

# CASE SUMMARY

## CASE SUMMARY

### Regular Agenda

PC HEARING DATE: May 14, 2025

BCC HEARING DATE: June 10, 2025

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**22-122945AM**

Regulation Amendments

CASE NAME: Regulation Amendments pertaining to Transportation and Access Standards

APPLICANT: Jefferson County

PURPOSE: **To amend Transportation and Access Standards pertaining to the:**

- **Transportation Design and Construction Manual**
- **Zoning Resolution Section 2 – General Provisions and Regulations**
- **Zoning Resolution Section 16 – Land Disturbance**
- **Land Development Regulation Section 15 – Circulation**
- **Storm Drainage Design and Technical Criteria – Chapter 10**

CASE MANAGER: Lindsey Wire, Engineering Supervisor

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**Applicant Team Presenters:**

Lindsey Wire, Engineering Supervisor, [lwire@jeffco.us](mailto:lwire@jeffco.us), 303.271.8717

Nathan Seymour, Civil Planning Engineer, [nseymour@jeffco.us](mailto:nseymour@jeffco.us), 303.271.8751

Christina Lane, Traffic Section Manager, [clane@jeffco.us](mailto:clane@jeffco.us), 303.271.8473

**Issues:**

- None

**Recommendations:**

- **Staff:** Recommends approval.
- **Planning Commission:** Recommends approval.

**Interested Parties:**

- Conifer and South Evergreen Community Committee

**Level of Community Interest:** Low

**Case Manager Information:** Phone: 303-271-8717 e-mail: [lwire@jeffco.us](mailto:lwire@jeffco.us)



# PLANNING COMMISSION RESOLUTION

It was moved by Commissioner **Messner** that the following Resolution be adopted:

BEFORE THE PLANNING COMMISSION  
COUNTY OF JEFFERSON  
STATE OF COLORADO

**May 14, 2025**

**RESOLUTION**

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**22-122945AM**

**Case Name:**

Regulation Amendments

Regulation Amendments pertaining to Transportation and Access Standards

**Applicant:**

Jefferson County

**Purpose:**

**To amend Transportation and Access Standards pertaining to the:**

- **Transportation Design and Construction Manual**
- **Zoning Resolution Section 2 – General Provisions and Regulations**
- **Zoning Resolution Section 16 – Land Disturbance**
- **Land Development Regulation Section 15 – Circulation**
- **Storm Drainage Design and Technical Criteria – Chapter 10**

**Case Manager:**

Lindsey Wire

The Jefferson County Planning Commission hereby recommends **APPROVAL**, of the above application, on the basis of the following facts:

1. That the factors upon which this decision is based include evidence and testimony and staff findings presented in this case.
2. The Planning Commission finds that:
  - A. The amendments to the regulations will establish clear, concise, and comprehensive documents that meet the needs of our community today.
  - B. The amendments to the regulations ensure consistency with current County regulations, state statutes, and applicable federal

standards.

- C. The amendments are in the best interest of the health, safety, and general welfare of the residents of Jefferson County.

Commissioner **Spencer** seconded the adoption of the foregoing Resolution, and upon a vote of the Planning Commission as follows:

Commissioner	<b>Rogers</b>	<b>aye</b>
Commissioner	<b>Spencer</b>	<b>aye</b>
Commissioner	<b>Becker</b>	<b>aye</b>
Commissioner	<b>Bolin</b>	<b>aye</b>
Commissioner	<b>Liles</b>	<b>aye</b>
Commissioner	<b>Messner</b>	<b>aye</b>
Commissioner	<b>LaRocque</b>	<b>aye</b>

The Resolution was adopted by **unanimous** vote of the Planning Commission of the County of Jefferson, State of Colorado.

I, Kimi Schillinger, Executive Secretary for the Jefferson County Planning Commission, do hereby certify that the foregoing is a true copy of a Resolution duly adopted by the Jefferson County Planning Commission at a regular hearing held in Jefferson County, Colorado, May 14, 2025.



Kimi Schillinger  
Executive Secretary

# STAFF REPORT

## STAFF REPORT

PC HEARING DATE: May 14, 2025

BCC HEARING DATE: June 10, 2025

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**22-122945AM**

Regulation Amendment

CASE NAME: Regulation Amendments pertaining to Transportation and Access Standards

APPLICANT: Jefferson County

LOCATION: Unincorporated Jefferson County

PURPOSE: **To amend Transportation and Access Standards pertaining to the:**

- **Transportation Design and Construction Manual**
- **Zoning Resolution Section 2 – General Provisions and Regulations**
- **Zoning Resolution Section 16 – Land Disturbance**
- **Land Development Regulation Section 15 – Circulation**
- **Storm Drainage Design and Technical Criteria – Chapter 10 (Streets/Roads)**

CASE MANAGER: Lindsey Wire, Engineering Supervisor

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### **BACKGROUND:**

Jefferson County Planning & Zoning is processing a Regulation Amendment (22-122945AM) pertaining to transportation and access standards of the Transportation Design and Construction Manual (TDCM), Zoning Resolution (ZR) Section 2 (General Provisions and Regulations) and Section 16 (Land Disturbance), Land Development Regulation (LDR) Section 15 (Circulation) and the Storm Drainage Design and Technical Criteria (SDD&TC) Chapter 10.

The proposed revisions are technical in nature and are necessary to provide clarity and align County requirements with industry standards. A major component of these proposed amendments is to remove the statement that the appropriate Fire Protection District may approve certain alternate standards. These updates define the process for how an applicant may request relief through the County from certain requirements previously approved by a Fire Protection District. If adopted, they will be carried forward and incorporated into the Unified Land Use Code (ULUC), as appropriate.

During the three referral periods, Staff received comments regarding the proposed changes to the regulations.

All the comments received during the referral periods have been incorporated into the Comment and Response Log attached to this Staff Report. Additionally, Staff reviewed the proposed regulation with the Regulation Advisory Panel (RAP) comprised of representatives from the following groups: Homeowner's Associations, Citizens, Land Use/Development Consultants, Business Owners/Real Estate Brokers, Engineers/Planners, Attorneys, Developers, and Special Districts. The RAP held two meetings to discuss the proposed amendments and were provided a referral.

These regulations have been through multiple referrals in order to best incorporate the comments received by citizens and agencies. Staff and the RAP are comfortable moving forward with the proposed regulatory amendments.

### **SUMMARY OF PROPOSED AMENDMENTS:**

The proposed amendments primarily encompass four parts of the County Regulations: 1) Transportation Design and Construction Manual (TDCM); 2) Zoning Resolution (ZR); 3) Land Development Regulation (LDR); and 4) Storm Drainage Design and Technical Criteria (SDD&TC). The details of each are described below.

1. Transportation Design and Construction Manual:
  - a. Chapter 3: Design and Technical Criteria
    - i. Update Standard Templates for Streets/Roads
    - ii. Align County requirements with the AASHTO Policy on Geometric Design of Highways & Streets.
    - iii. Update Section 3.7.1 to clarify intersection spacing requirements.
    - iv. Update Section 3.7.2 to provide additional clarity on Vision Clearance Triangle and Site Distance requirements.
    - v. Update Section 3.7.8 to:
      1. Remove the statement that the appropriate Fire Protection District may approve alternate standards.
      2. Define a new process for requesting relief of the requirements within this section, which must be approved by the County.
      3. Allow up to 15% grade for driveways and private roads provided specific requirements are met.
      4. Define minimum distance from a structure for a hammerhead turnaround.
      5. Define loading requirements for bridges and other structures.
      6. Clarify that the rules and regulations of the applicable Fire Protection District shall govern.
    - vi. Update Section 3.10 to add a reference to Colorado Department of Transportation criteria
  - b. Chapter 4: Pavement Design and Technical Criteria

- i. Update Section 4.2 to clarify that edge drains are required with the Construction Plans and may be omitted if final pavement design shows they are not necessary.
    - ii. Add Section 4.6.3.2 to specify when Stone Mastic Asphalt is required.
  - c. Chapter 5: Construction Specifications and Standards
    - i. Update Construction Specifications and Standards to meet industry standards.
  - d. Transportation Studies Appendix:
    - i. Relocate to Chapter 6 of the TDCM.
    - ii. Create four types: Trip Generation Memoranda, Transportation Analysis, Transportation Impact Studies, and Letter of Conformance with an Approved TIS.
    - iii. For each type, provide an example template.
  - e. Definitions:
    - i. Add a definition for All Weather Travel Surface
    - ii. Add definition for Dip of Natural Terrain
    - iii. Add definition for Sidewalk
    - iv. Add definition for Vulnerable Roadway User
- 2. Zoning Resolution:
  - a. Section 2 (General Provisions and Regulations)
    - i. Update Section 2.D.1.j.(4), to clarify how the physical standard of access will be evaluated for different Building Permit types (i.e., habitable vs non-habitable structures and additions).
  - b. Section 16 (Land Disturbance)
    - i. Clarify that land disturbance activities with or in advance of a building permit, with less than 0.5 acres of land disturbance where the applicant is requesting relief of a regulatory requirement requires a Grading Permit.
    - ii. Add the requirement that land disturbance associated with access to detached living space where either the access does not exist or has not previously been approved as access to living space requires a Notice of Intent Permit.
    - iii. Update the Notice of Intent process to allow modifications to previously accepted plans that do not conform to the Jefferson County Standards and Regulations for land disturbance permits to be processed as an Administrative Review rather than a Grading Permit.
- 3. Land Development Regulation:
  - a. Section 15 (Circulation):
    - i. Clarify that adjoining street improvements are required for all Arterial Streets/Roads.
    - ii. Remove the statement that the appropriate Fire Protection District may approve alternate standards for cul-de-sacs and clarify that any relief would be processed by Planning and Zoning.
- 4. Storm Drainage Design and Technical Criteria:
  - a. Chapter 10: Streets/Roads

- i. Remove the statement that the appropriate Fire Protection District may approve alternate standards for overtopping depth for the 100-year storm event that exceeds 12" and clarify that any relief would be processed by Planning and Zoning.

#### **HEARING PACKET DOCUMENTS:**

- Red-Marked copy of the Transportation Design and Construction Manual, Sections 2 and 16 of the Zoning Resolution, Section 15 of the Land Development Regulation and the Storm Drainage Design and Technical Criteria. Additions are in blue, deletions are in red, and moves are in green.
- A clean copy (changes accepted) of the Transportation Design and Construction Manual, Sections 2 and 16 of the Zoning Resolution, Section 15 of the Land Development Regulation and the Storm Drainage Design and Technical Criteria.
- Comment and Response Log
- Referral list

#### **REFERRAL PERIOD/PUBLIC NOTIFICATION AND OUTREACH:**

Notice of the proposed Amendments to the Transportation Design and Construction Manual, Storm Drainage Design and Technical Criteria, Zoning Resolution and the Land Development Regulation was provided when the case went out on referral and when the public hearings were scheduled.

There were three referral periods for this case. A formal draft of the proposed Amendments was sent to each applicable referral agency and organization registered with the County. This includes County departments and divisions, external agencies, neighboring local governments, registered HOA and Umbrella Groups, and the Regulation Advisory Panel (RAP) which is a panel of HOA representatives, citizens, land use/development consultants, business owners/real estate brokers, engineers/planners, attorneys, developers, and special districts. Please see the referral list for more information. All comments received have been incorporated into the Comment and Response Log associated with this Staff Report.

Additional citizen outreach was provided in the following ways:

- Direct email notification to all agencies, jurisdictions, community groups and citizens that may have a specific interest in these regulations.
- Email and/or text message to the Notify Me list serve for individuals interested in Regulation Updates.
- Meetings with the Regulation Advisory Panel (RAP).

The majority of the comments were submitted by citizens, community groups, other agencies/jurisdictions and engineering consultants. The following referral agencies had no comments or concerns: Arapahoe County, Jefferson County Building Safety, Jefferson County Planning Engineering, Jefferson County Public Health, Jefferson County Transportation and Engineering, South Metro Fire Rescue, City of Golden, Division of Water Resources, Douglas County, RTD, Bear Creek Water and Sanitation, and CORE.



The following summarizes comments received during the referrals. A full list of the questions and responses can be found in the comment response log:

- **Cities and Counties:** Staff received comments from both **Adams and Broomfield Counties** during the 1<sup>st</sup> referral. The comments from Adams County pertained to Municipal Separate Storm Sewer requirements as well as infiltration testing. These comments did not apply to these regulations, however they were incorporated into a separate update that was previously processed and approved. The comments from Broomfield included questions for the County regarding existing and proposed standards such as speed limits, Vision Clearance, Site Distance, Signal Warrants, and Driveway Spacing. Broomfield also provided questions regarding the new Trip Generation Memorandum and Transportation Analysis. A response to each question can be found in the 1st Referral Comment/Response Log.
- **Conifer and South Evergreen Community Committee (COSECC):** Staff received comments from COSECC pertaining to the updated standards within Chapter 3 of the Transportation Design and Construction Manual and the updates to Transportation Studies Appendix. Comments were provided during both the 1<sup>st</sup> and 2<sup>nd</sup> referrals of these regulation amendments. Staff responded following the 1<sup>st</sup> referral that we would work directly with the Fire Protection Districts to further define the standards for private streets/roads within Chapter 3. Staff also provided clarifying comments regarding the Transportation Studies section. Following the 2<sup>nd</sup> Referral, Staff received similar comments and in addition to comment responses, set up a meeting with the commentor, County Staff, Elk Creek Fire and Evergreen Fire to discuss the comments in further detail. Following the 3<sup>rd</sup> Referral, Staff received comments to the Transportation Studies Appendix only which were similar to those received during the 1<sup>st</sup> and 2<sup>nd</sup> Referrals. The comments indicated that the document was greatly improved from the original review and expressed the hope that Staff would continue to update this regulation over time as advancements are made in the Transportation field. Staff responded that future updates would be considered as necessary to meet industry standards.
- **Fire Protection Districts (Districts):** Staff received comments from **Elk Creek Fire, Evergreen Fire and Foothills Fire** during the 1<sup>st</sup> referral for these proposed amendments. The Districts provided general support for the proposed amendments with comments pertaining to turnaround standards, fire sprinkler system standards, building code references and the proposed relief process. Following the referral, Staff worked directly with the Districts to address these comments. **Evergreen Fire** provided follow up comments during the 2<sup>nd</sup> referral pertaining to private street/road grades and the private driveway template. Staff responded by updating the document to provide clarity. **Arvada Fire** provided comments during the 2<sup>nd</sup> referral pertaining to the standards of their District being more strict than the requirements of the County. Staff responded that this update allows the requirements of the applicable Fire Protection District to govern, if the same County requirement is less strict. No additional comments were provided from any of the Districts during the 3<sup>rd</sup> Referral.
- **Colorado Department of Transportation:** Staff received comments from the Colorado Department of Transportation during the 1<sup>st</sup> referral of these proposed amendments. The comments included questions regarding how the County determines when to require a road versus a street template and recommendations regarding utility construction in right-of-way. Staff responded that the County's roadway templates are meant to be utilized in conjunction with the County's Major Thoroughfare Plan (MTP). No additional comments

were provided during the subsequent referrals.

- **Jefferson County Horse Council:** The Jefferson County Horse Council provided comments during the 2<sup>nd</sup> referral for these proposed amendments. These comments pertained to access requirements for equestrian centers, safety concerns relating to vehicle/equestrian conflicts, and general access standards for equestrians. Staff updated the document to include a definition for vulnerable roadway users as those roadway users that are not protected by a vehicle or other shield while on a roadway and is at a greater risk for involvement in a serious injury or fatal crash. Said vulnerable roadway users were added to the Transportation Studies section of the TDCM for consideration of conflict points. In addition, in areas where equestrian use is high, staff will coordinate with the equestrian community to implement treatments in line with the Manual on Uniform Traffic Control Devices.
- **Internal Referral Responses:** During the 1<sup>st</sup> referral, Staff received internal comments from the **County Geologist and Jeffco Planning**. The County Geologist requested clarification that pavement design should include private and non-County maintained roads. During the 2<sup>nd</sup> referral **Jefferson County Open Space** provided general formatting comments and Road and Bridge requested the expansion or addition of language to Section 5.1.8.1 to include tracer wires to curb drains. Comments were addressed for all internal referral agencies and no further comments were provided.
- **Wildland Urban Interface Recommendations:** Concurrent to the processing of this case, Staff received recommendations from the Community Wildfire Planning Center. While this document was associated with a separate project, it included recommendations for the Transportation Design and Construction Manual pertaining to driveway and private street/road standards. Many of these recommendations were incorporated into the TDCM update; however, Staff did determine that some were outside the scope of these updates and would be better incorporated into the overall ULUC process.
- **Planning Commission:** A Planning Commission member provided comments during the 2<sup>nd</sup> referral of this project. The comments pertained to driveway and private street/road standards as well as sprinkler requirements for building permits. Staff responded that the proposed regulations were prepared in coordination with the Fire Protection Districts and that sprinkler requirements would apply to new start building permits or new habitable structures, not all building permits. In addition to comment responses, Staff set up a meeting with the commentor, County Staff, Elk Creek Fire and Evergreen Fire to discuss the comments in further detail. No additional comments were received during the 3<sup>rd</sup> Referral.
- **Ken Caryl Ranch:** During the 3<sup>rd</sup> referral, Ken-Caryl Ranch provided comments requesting that their specific street sign types be included in the County regulations. Staff responded that any metro district that presents custom neighborhood street signs to the County goes through a review process to ensure MUTCD compliance. Once they get County approval, a license agreement is entered into for the Metro District to maintain the signs.
- **Citizen Comments:** Staff received several citizen comments over the course of these regulation amendments. During the 1<sup>st</sup> referral, Staff received comments from a citizen stating that relief of the Standards within the Transportation Design and Construction Manual should not be allowed. Staff responded that there are instances where an existing standard within the County Regulations cannot be met, and it is necessary for an applicant to request relief. The relief requests may be approved if the applicant can demonstrate that alternate solutions or designs will not be detrimental to or contrary to the purpose of the regulation, and will be in harmony with the general purpose and intent of the provision

for which a waiver is sought, and that strict compliance with such provision would be impossible or impractical. Additional comments were provided from this citizen that pertained to a specific case. During the 2<sup>nd</sup> referral a citizen reached out to determine if these updates were a part of their outreach to CDOT and City of Lakewood for a crosswalk, light and turning lane into the Red Rocks Ranch development. Staff responded that this was a separate project. No further comments were provided from either citizen.

Staff has addressed all comments in the Comment and Response Log.

**PLANNING COMMISSION:**

Planning Commission Recommendation (Resolution dated May 14, 2025 attached):

Approval	
Approval with Conditions	X (7-0)
Denial	

The case was scheduled on the regular agenda of the Planning Commission hearing. There was one citizen who provided public testimony. Comments and questions during public testimony were regarding the Fire Protection District involvement in the new relief process for private streets/roads and driveways, fire sprinkler requirements during relief, the removal of the reference to the International Fire Code, the Administrative Review process, and the updated Horizontal Curve radius table not meeting the American Association of State Highway and Transportation Officials (AASHTO) requirements.

Regarding relief, Staff’s response confirmed that while the Fire Protection Districts would no longer be approving alternative standards for private streets/roads and driveways, the Districts would be a referral agency on any relief requests with their input contributing to Staff’s recommendation to the Director of Planning and Zoning. Staff also explained that Fire Sprinkler installation was included as a requirement for any relief requests since it would provide additional time for evacuation in the event of a fire as well as additional time for the applicable Fire District to respond. Regarding the International Fire Code, the reference still remains, however Staff removed the specific reference to the “2018” code and instead named the “applicable” International Fire Code in the document to avoid the need for future updates.

Regarding the Administrative Review process, Staff explained that currently, if changes occur during construction following the Notice of Intent land disturbance permit process that would warrant Staff review, a full Grading Permit is required. By instead requiring the Administrative Review process, Staff is still able to review the changes and send the documents on referral as necessary, while undergoing a more streamlined process for the applicant.

Regarding AASHTO standards, the Planning Commission asked Staff to review AASHTO standards for the Horizontal Curve radii. Based on this review, Staff has updated Chapter 3 to align with the Policy on Geometric Design of Highways & Streets.

The Planning Commission had comments regarding sign post bases to make sure that “or equivalent” is added following TELESPAR ® throughout the document. Staff responded that these changes would

be made, and after reviewing the text, "or equivalent" was added in two locations. After Staff responses, the Planning Commission recommended approval.

**FINDINGS/RECOMMENDATIONS:**

**Staff recommends that the Board of County Commissioners find that:**

- 1. The amendments to the regulations will establish clear, concise, and comprehensive documents that meet the needs of our community today.**
- 2. The amendments to the regulations ensure consistency with current County regulations, state statutes, and applicable federal standards.**
- 3. The amendments are in the best interest of the health, safety, and general welfare of the residents of Jefferson County.**

**And;**

**Staff recommends that the Board of County Commissioners approve Case No. 22-122945AM.**

**And;**

**Staff further recommends that Planning and Zoning Division be given the authority to revise the Transportation Design and Construction Manual, Land Development Regulation, Zoning Resolution, and Storm Drainage Design and Technical Criteria for the limited purposes of formatting the Regulations and correcting any typographical errors and any other non-substantive changes to the Regulations that Staff deems necessary prior to final publication of the Regulations.**

COMMENTS PREPARED BY:

*Lindsey Wire*

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Lindsey Wire  
Engineering Supervisor  
June 3, 2025

# NOTIFICATION SUMMARY

November 2, 2022

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#).

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Wednesday November 23, 2022.

Sincerely,

Planning and Zoning Staff

## Cities

DRT@littletongov.org;TownPlanner@columbinevalley.org;bowmartown@gmail.com;brenda@lakesidea  
musementpark.com;collinsb@bouldercolorado.gov;ashleym@bouldercolorado.gov;developmentservice  
s@denvergov.org;brad.eckert@denvergov.org;jmconne@cityofwestminster.us;jschartz@edgewaterco.  
com;kara@morrisonco.us;carrie@mccooldevelopment.com;lritchie@louisvilleco.gov;mgreer@tomv.org  
;pauric@lakewood.org;aarsch@lakewood.org;planner@bouldercounty.org;pfogg@bouldercounty.org;pl  
anning@cityofgolden.net;planningapps@broomfield.org;rsmetana@arvada.org;stevenw@superiorcolor  
ado.gov;wcharles@englewoodco.gov;zoning@ci.wheatridge.co.us;

## External Referral Contacts

CGS\_LUR@mines.edu;Emma.Brokl@colostate.edu;emma.brokl@colostate.edu;Kent.J.Christiansen@usp  
s.gov;krisss.j.summerfield@usps.gov;Jason.g.Eddleman@usps.gov;admin@evergreenchamber.org;afein  
stein@jcha.org;asummers@drcog.org;blake.angelo@colostate.edu;brad.eckert@denvergov.org;bradley  
.Sheehan@state.co.us;richard.solomon@state.co.us;bradley.sheehan@state.co.us;richard.solomon@st  
ate.co.us;ccufre@coloradoopenlands.org;cdattel@mines.edu;cdphe\_localreferral@state.co.us;  
todd.leopold@state.co.us;coloradoes@fws.gov;director@goconifer.com;engineering@rtd-  
denver.com;greg.ochis@state.co.us;inquiries@nist.gov;jbeck@blm.gov;jcd@jeffersoncd.com;jpphaadmi  
n@gmail.com;ken.mushinski@cotterusa.com;kiel.g.downing@usace.army.mil;lisa.heagley@usda.gov;na  
thanael.berry@usda.gov;lseeger@jeffcoedc.org;margaret.vigil@state.co.us;mark.lamb@state.co.us;mat  
t.martinez@state.co.us;oahp@state.co.us;sarah.brucker@state.co.us;joanna.williams@state.co.us;sub  
mittals@udfcd.org;tim\_connors@nps.gov;heather\_eggleson@nps.gov;Linda\_Moery@nps.gov;treed@j  
effco.k12.co.us;rhuxley@jeffco.k12.co.us;Matthew.Hanks@jeffco.k12.co.us;wrb@urbanfrontier.com;

## Internal Rare

[adoran@jeffco.us](mailto:adoran@jeffco.us); [cmarkel@co.jefferson.co.us](mailto:cmarkel@co.jefferson.co.us); [kcisowsk@jeffco.us](mailto:kcisowsk@jeffco.us); [dbeauvai@co.jefferson.co.us](mailto:dbeauvai@co.jefferson.co.us); [dconway@jeffco.us](mailto:dconway@jeffco.us); [esander@jeffco.us](mailto:esander@jeffco.us); [kdouglas@jeffco.us](mailto:kdouglas@jeffco.us); [hguthierl@jeffco.us](mailto:hguthierl@jeffco.us); [hrgrieb@jeffco.us](mailto:hrgrieb@jeffco.us); [kwshephard@jeffco.us](mailto:kwshephard@jeffco.us); [elroberts@jeffco.us](mailto:elroberts@jeffco.us); [jshrader@jeffco.us](mailto:jshrader@jeffco.us); [kstewart@co.jefferson.co.us](mailto:kstewart@co.jefferson.co.us); [mdanner@jeffco.us](mailto:mdanner@jeffco.us); [apanza@jeffco.us](mailto:apanza@jeffco.us); [mschuste@jeffco.us](mailto:mschuste@jeffco.us); [rklopf@jeffco.us](mailto:rklopf@jeffco.us); [rbishop@flyrmma.com](mailto:rbishop@flyrmma.com); [bmillier@flyrmma.com](mailto:bmillier@flyrmma.com); [panslow@co.jefferson.co.us](mailto:panslow@co.jefferson.co.us); [rtemmer@q.com](mailto:rtemmer@q.com); [sswain@jeffco.us](mailto:sswain@jeffco.us); [steve.chestnut@jeffcolibrary.org](mailto:steve.chestnut@jeffcolibrary.org); [tkauffma@jeffco.us](mailto:tkauffma@jeffco.us); [pweber@jeffco.us](mailto:pweber@jeffco.us);

## Internal Referral Contacts

[arohwer@jeffco.us](mailto:arohwer@jeffco.us); [srowe@jeffco.us](mailto:srowe@jeffco.us); [kdean@jeffco.us](mailto:kdean@jeffco.us); [mharalds@jeffco.us](mailto:mharalds@jeffco.us); [jpvigil@co.jefferson.co.us](mailto:jpvigil@co.jefferson.co.us); [mdamjano@co.jefferson.co.us](mailto:mdamjano@co.jefferson.co.us); [kperea@co.jefferson.co.us](mailto:kperea@co.jefferson.co.us); [mweiden@co.jefferson.co.us](mailto:mweiden@co.jefferson.co.us); [mbaldwin@co.jefferson.co.us](mailto:mbaldwin@co.jefferson.co.us); [bhasten@jeffco.us](mailto:bhasten@jeffco.us); [fselvosk@co.jefferson.co.us](mailto:fselvosk@co.jefferson.co.us); [kbryson@jeffco.us](mailto:kbryson@jeffco.us); [hguthierl@jeffco.us](mailto:hguthierl@jeffco.us); [khangaman@jeffco.us](mailto:khangaman@jeffco.us); [kjordan@co.jefferson.co.us](mailto:kjordan@co.jefferson.co.us); [ltownsen@co.jefferson.co.us](mailto:ltownsen@co.jefferson.co.us); [mvanatta@co.jefferson.co.us](mailto:mvanatta@co.jefferson.co.us); [rfox@co.jefferson.co.us](mailto:rfox@co.jefferson.co.us); [mschuste@jeffco.us](mailto:mschuste@jeffco.us); [rklopf@jeffco.us](mailto:rklopf@jeffco.us); [nyork@jeffco.us](mailto:nyork@jeffco.us); [estoner@co.jefferson.co.us](mailto:estoner@co.jefferson.co.us); [poconnel@jeffco.us](mailto:poconnel@jeffco.us); [publichealthelanduse@jeffco.us](mailto:publichealthelanduse@jeffco.us); [tjones@jeffco.us](mailto:tjones@jeffco.us); [rkirkega@jeffco.us](mailto:rkirkega@jeffco.us);

## Irrigation Companies

[eve@farmersres.com](mailto:eve@farmersres.com); [fhl.gm.mike@gmail.com](mailto:fhl.gm.mike@gmail.com); [generalmanager@churchditch.org](mailto:generalmanager@churchditch.org); [jerry.foster@denverwater.org](mailto:jerry.foster@denverwater.org); [jim.ferentchak@wwwheeler.com](mailto:jim.ferentchak@wwwheeler.com); [johnreiber@msn.com](mailto:johnreiber@msn.com); [liddy.armijo@molsoncoors.com](mailto:liddy.armijo@molsoncoors.com); [mike.ater.org](mailto:mike.ater.org);

[wright@archden.org](mailto:wright@archden.org); [minifarm2@aol.com](mailto:minifarm2@aol.com); [neal.santangelo@molsoncoors.com](mailto:neal.santangelo@molsoncoors.com); [scot.hatcher@molsoncoors.com](mailto:scot.hatcher@molsoncoors.com); [peter.adrc@gmail.com](mailto:peter.adrc@gmail.com); [ssarrow@pinehurstcountryclub.com](mailto:ssarrow@pinehurstcountryclub.com); [theander@mseapc.com](mailto:theander@mseapc.com);

### **Metro Districts**

[management@fhmd.net](mailto:management@fhmd.net); [abeckman@sdmsi.com](mailto:abeckman@sdmsi.com); [traciw@kcranch.org](mailto:traciw@kcranch.org); [gmcgowan9052@aol.com](mailto:gmcgowan9052@aol.com); [dolphindance1@aol.com](mailto:dolphindance1@aol.com); [Lisa.johnson@claconnect.com](mailto:Lisa.johnson@claconnect.com); [Jill.Neuffer@cliftonlarsonallen.com](mailto:Jill.Neuffer@cliftonlarsonallen.com); [SALLEN@WBAPC.COM](mailto:SALLEN@WBAPC.COM); [abeckman@sdmsi.com](mailto:abeckman@sdmsi.com); [afinn@sdmsi.com](mailto:afinn@sdmsi.com); [afrisbie@wbapc.com](mailto:afrisbie@wbapc.com); [angela@teleos-services.com](mailto:angela@teleos-services.com); [anna.jones@claconnect.com](mailto:anna.jones@claconnect.com); [barnett@timberlinedc.com](mailto:barnett@timberlinedc.com); [levy@timberlinedc.com](mailto:levy@timberlinedc.com); [cmamlmgren@pleasantviewmetro.com](mailto:cmamlmgren@pleasantviewmetro.com); [twaller@pleasantviewmetro.org](mailto:twaller@pleasantviewmetro.org); [cnoon@crsofcolorado.com](mailto:cnoon@crsofcolorado.com); [cschauder@evergreenmetrodistrict.com](mailto:cschauder@evergreenmetrodistrict.com); [dave@peakdistrictmanagementllc.com](mailto:dave@peakdistrictmanagementllc.com); [cindy.jenkins@cliftonlarsonallen.com](mailto:cindy.jenkins@cliftonlarsonallen.com); [dchenoweth@evergreenmetro.org](mailto:dchenoweth@evergreenmetro.org); [zloftis@evergreenmetro.org](mailto:zloftis@evergreenmetro.org); [jstawski@evergreenmetro.org](mailto:jstawski@evergreenmetro.org); [dolphindance1@aol.com](mailto:dolphindance1@aol.com); [eds@gginb.com](mailto:eds@gginb.com); [ewhite@highlandsranch.org](mailto:ewhite@highlandsranch.org); [firm@wbapc.com](mailto:firm@wbapc.com); [jhenry@specialdistrictlaw.com](mailto:jhenry@specialdistrictlaw.com); [jtanaka@wbapc.com](mailto:jtanaka@wbapc.com); [kseter@svwpc.com](mailto:kseter@svwpc.com); [ljacoby@sdmsi.com](mailto:ljacoby@sdmsi.com); [ljohnson@sdmsi.com](mailto:ljohnson@sdmsi.com); [mbecher@specialdistrictlaw.com](mailto:mbecher@specialdistrictlaw.com); [mmcgeady@mcgeadysisneros.com](mailto:mmcgeady@mcgeadysisneros.com); [mmruphy@wbapc.com](mailto:mmruphy@wbapc.com); [nicholas.carlson@claconnect.com](mailto:nicholas.carlson@claconnect.com); [anna.jones@claconnect.com](mailto:anna.jones@claconnect.com); [andrew.williams@claconnect.com](mailto:andrew.williams@claconnect.com); [office@meadowbrookwaterdistrict.com](mailto:office@meadowbrookwaterdistrict.com); [rkron@spencerfane.com](mailto:rkron@spencerfane.com); [sblair@crsofcolorado.com](mailto:sblair@crsofcolorado.com); [tgeorge@spencerfane.com](mailto:tgeorge@spencerfane.com); [wendi.klein@claconnect.com](mailto:wendi.klein@claconnect.com);

### **Park and Rec Districts**

[Brad.eckert@denvergov.org](mailto:Brad.eckert@denvergov.org); [David.Peak@cliftonlarsonallen.com](mailto:David.Peak@cliftonlarsonallen.com); [PlanningSupport@ssprd.org](mailto:PlanningSupport@ssprd.org); [RosWil@lakewood.org](mailto:RosWil@lakewood.org); [johpal@lakewood.org](mailto:johpal@lakewood.org); [ablackmore@prospectdistrict.org](mailto:ablackmore@prospectdistrict.org); [mhanson@prospectdistrict.org](mailto:mhanson@prospectdistrict.org); [brett@ckrd.org](mailto:brett@ckrd.org); [insley@fhprd.org](mailto:insley@fhprd.org); [seank@fhprd.org](mailto:seank@fhprd.org); [richeller@fhprd.org](mailto:richeller@fhprd.org); [jmanwaring@ci.wheatridge.co.us](mailto:jmanwaring@ci.wheatridge.co.us); [kwsargent@msn.com](mailto:kwsargent@msn.com); [htableman@co.clear-creek.co.us](mailto:htableman@co.clear-creek.co.us); [ncooper@eprd.co](mailto:ncooper@eprd.co); [cvanderveen@eprd.co](mailto:cvanderveen@eprd.co); [nemrdpool@gmail.com](mailto:nemrdpool@gmail.com); [nikki.mccabe@denvergov.org](mailto:nikki.mccabe@denvergov.org); [Nikki.VanRavenswaay@DenverGov.org](mailto:Nikki.VanRavenswaay@DenverGov.org); [pamartinez@edgewaterco.com](mailto:pamartinez@edgewaterco.com); [rheanar@apexprd.org](mailto:rheanar@apexprd.org); [stecar@lakewood.org](mailto:stecar@lakewood.org); [biljew@lakewood.org](mailto:biljew@lakewood.org); [tom@beaverranch.org](mailto:tom@beaverranch.org); [traciw@kcranch.org](mailto:traciw@kcranch.org); [weecreekers@gmail.com](mailto:weecreekers@gmail.com);

### **Regulation Notifications**

[Brennanjr@aol.com](mailto:Brennanjr@aol.com); [Jenslines@gmail.com](mailto:Jenslines@gmail.com); [John@Hermanussen.net](mailto:John@Hermanussen.net); [MarkBenallo@aol.com](mailto:MarkBenallo@aol.com); [Pittingerkaren@hotmail.com](mailto:Pittingerkaren@hotmail.com); [admin@arrowheadmanor.com](mailto:admin@arrowheadmanor.com); [algnemes@comcast.net](mailto:algnemes@comcast.net); [ashleyctoole@gmail.com](mailto:ashleyctoole@gmail.com); [carl@horecky.com](mailto:carl@horecky.com); [board@bfarmshoa.org](mailto:board@bfarmshoa.org); [bradengine@aol.com](mailto:bradengine@aol.com); [cfliberatore@gmail.com](mailto:cfliberatore@gmail.com); [chcastleman@comcast.net](mailto:chcastleman@comcast.net); [claymeason@yahoo.com](mailto:claymeason@yahoo.com); [deb@carneylaw.net](mailto:deb@carneylaw.net); [dreedfineline@aol.com](mailto:dreedfineline@aol.com); [evergreenhighlands@gmail.com](mailto:evergreenhighlands@gmail.com); [fsa333@aol.com](mailto:fsa333@aol.com); [gkollman@cityofwestminster.us](mailto:gkollman@cityofwestminster.us); [hanseninc@gmail.com](mailto:hanseninc@gmail.com); [jeffrey\\_orlowski@nps.gov](mailto:jeffrey_orlowski@nps.gov); [kathy@kchoa.com](mailto:kathy@kchoa.com); [kathy@kchoa.com](mailto:kathy@kchoa.com); [kristy@epiphanydesigngroup.com](mailto:kristy@epiphanydesigngroup.com); [lam@calibre.us.com](mailto:lam@calibre.us.com); [laneengr@comcast.net](mailto:laneengr@comcast.net); [mhanson@prospectdistrict.org](mailto:mhanson@prospectdistrict.org); [mkbtoy@yahoo.com](mailto:mkbtoy@yahoo.com); [mlrichardson@apc.us.com](mailto:mlrichardson@apc.us.com); [neil3@q.com](mailto:neil3@q.com); [nicolemoves@gmail.com](mailto:nicolemoves@gmail.com); [pk surv@aol.com](mailto:pk surv@aol.com); [rmheine1@msn.com](mailto:rmheine1@msn.com); [rmve2@comcast.net](mailto:rmve2@comcast.net); [rumurphy@gmail.com](mailto:rumurphy@gmail.com); [satruj\\_437@hotmail.com](mailto:satruj_437@hotmail.com); [shannon@milehighoutdoor.com](mailto:shannon@milehighoutdoor.com); [skigolden@yahoo.com](mailto:skigolden@yahoo.com); [tciancy911@aol.com](mailto:tciancy911@aol.com); [team@planwest.com](mailto:team@planwest.com); [tegcoalcreek@gmail.com](mailto:tegcoalcreek@gmail.com); [treidski@hotmail.com](mailto:treidski@hotmail.com);

### **Regulation Advisory Panel**

[1812eagle@gmail.com](mailto:1812eagle@gmail.com); [al@pcsgroupco.com](mailto:al@pcsgroupco.com); [childreth@foxrothschild.com](mailto:childreth@foxrothschild.com); [dean@evstudio.com](mailto:dean@evstudio.com); [deb@carneylaw.net](mailto:deb@carneylaw.net); [meredethward@msn.com](mailto:meredethward@msn.com); [dmsmn5@aol.com](mailto:dmsmn5@aol.com); [douglassengineering1@gmail.com](mailto:douglassengineering1@gmail.com); [esther.kettering@cushwake.com](mailto:esther.kettering@cushwake.com); [ethan@baselinecorp.com](mailto:ethan@baselinecorp.com); [jeanne@chadwickplanning.com](mailto:jeanne@chadwickplanning.com);



[jking@evergreenfirerescue.com](mailto:jking@evergreenfirerescue.com); [jveres0@gmail.com](mailto:jveres0@gmail.com); [kbrooks@westmetrofire.org](mailto:kbrooks@westmetrofire.org);  
[mhanson@prospectdistrict.org](mailto:mhanson@prospectdistrict.org); [mlrichardson@apc.us.com](mailto:mlrichardson@apc.us.com); [phorn@martinmartin.com](mailto:phorn@martinmartin.com);  
[wrb@urbanfrontier.com](mailto:wrb@urbanfrontier.com); [ynotbev@aol.com](mailto:ynotbev@aol.com); [rrush@evergreenfirerescue.com](mailto:rrush@evergreenfirerescue.com); [chris@ballprop.com](mailto:chris@ballprop.com);

### **Water and Sanitation Districts**

[Gary.booth@denverwater.org](mailto:Gary.booth@denverwater.org); [Amy.turney@denverwater.org](mailto:Amy.turney@denverwater.org); [PVWSD.David@comcast.net](mailto:PVWSD.David@comcast.net); [pvwsd@comcast.net](mailto:pvwsd@comcast.net); [aj@publicalliancellc.com](mailto:aj@publicalliancellc.com); [asd@applewoodsan.org](mailto:asd@applewoodsan.org); [dick@rjlawpc.com](mailto:dick@rjlawpc.com); [barbara@roxwater.org](mailto:barbara@roxwater.org);  
[mike@roxwater.org](mailto:mike@roxwater.org); [barry@wrwdistrict.com](mailto:barry@wrwdistrict.com); [bearcreekwater@bearcreekwater.org](mailto:bearcreekwater@bearcreekwater.org); [barney.fix@merrick.com](mailto:barney.fix@merrick.com); [janwalker@bearcreekwater.org](mailto:janwalker@bearcreekwater.org); [berkeleywater@gmail.com](mailto:berkeleywater@gmail.com); [blavoie@highlandsranch.org](mailto:blavoie@highlandsranch.org); [calane@plattecanyon.org](mailto:calane@plattecanyon.org); [tpcocozzella@plattecanyon.org](mailto:tpcocozzella@plattecanyon.org); [cbrownell@geneseewater.com](mailto:cbrownell@geneseewater.com); [cschauder@evergreenmetrodistrict.com](mailto:cschauder@evergreenmetrodistrict.com); [culp@culp.ws](mailto:culp@culp.ws); [reid.dewalt@state.co.us](mailto:reid.dewalt@state.co.us); [engineering@cmwc.net](mailto:engineering@cmwc.net); [info@bcwaterms.org](mailto:info@bcwaterms.org); [info@bennettbearcreekfarmsdistrict.com](mailto:info@bennettbearcreekfarmsdistrict.com); [info@lookoutmountainwaterdistrict.org](mailto:info@lookoutmountainwaterdistrict.org); [will.raatz@w2eng.com](mailto:will.raatz@w2eng.com); [jcs@jsimonson.com](mailto:jcs@jsimonson.com); [kgunderson@broomfield.org](mailto:kgunderson@broomfield.org); [ljohnson@sdmsi.com](mailto:ljohnson@sdmsi.com); [manager@greenmountainwater.org](mailto:manager@greenmountainwater.org); [manager@lakehurstwater.org](mailto:manager@lakehurstwater.org); [sdaldegan@lakehurstwater.org](mailto:sdaldegan@lakehurstwater.org); [mstaheli@cordesco.com](mailto:mstaheli@cordesco.com); [mwsd@qwestoffice.net](mailto:mwsd@qwestoffice.net); [mwsd@qwestoffice.net](mailto:mwsd@qwestoffice.net); [nicki@jsimonson.com](mailto:nicki@jsimonson.com); [nickie@nmholderfinancial.com](mailto:nickie@nmholderfinancial.com); [norm@hch2o.com](mailto:norm@hch2o.com); [rlewis@rockymtnoptions.com](mailto:rlewis@rockymtnoptions.com); [office@indianhillswater.com](mailto:office@indianhillswater.com); [office@meadowbrookwaterdistrict.com](mailto:office@meadowbrookwaterdistrict.com); [office@willowbrookwater.org](mailto:office@willowbrookwater.org); [steve@purringtoncivil.com](mailto:steve@purringtoncivil.com); [philrvsd@comcast.net](mailto:philrvsd@comcast.net); [rcox@fruitdale.net](mailto:rcox@fruitdale.net); [gmariano@fruitdale.net](mailto:gmariano@fruitdale.net); [bwillis@martinmartin.com](mailto:bwillis@martinmartin.com); [sbeck@sdmsi.com](mailto:sbeck@sdmsi.com); [bwillis@martinmartin.com](mailto:bwillis@martinmartin.com); [aganda@martinmartin.com](mailto:aganda@martinmartin.com); [sgrooter@cityofwestminster.us](mailto:sgrooter@cityofwestminster.us); [stevejhil@earthlink.net](mailto:stevejhil@earthlink.net); [tanderson@kcwater.org](mailto:tanderson@kcwater.org); [timl@bancroftclover.com](mailto:timl@bancroftclover.com); [Barney.fix@merrick.com](mailto:Barney.fix@merrick.com); [tjbenton80425@aol.com](mailto:tjbenton80425@aol.com); [v.waterdist\\_kathy@comcast.net](mailto:v.waterdist_kathy@comcast.net); [wendy@ntmwater.org](mailto:wendy@ntmwater.org); [bart@ntmwater.org](mailto:bart@ntmwater.org);

### **Utilities**

[platreferral@unitedpower.com](mailto:platreferral@unitedpower.com); [donna.L.George@xcelenergy.com](mailto:donna.L.George@xcelenergy.com); [bkaufman@irea.coop](mailto:bkaufman@irea.coop); [jgutierrez@summitutilitiesinc.com](mailto:jgutierrez@summitutilitiesinc.com); [kayla\\_jones3@comcast.com](mailto:kayla_jones3@comcast.com); [platreview@lumen.com](mailto:platreview@lumen.com);

### **Counties**

[Planreferralrequest@douglas.co.us](mailto:Planreferralrequest@douglas.co.us); [developmentsubmittals@adcogov.org](mailto:developmentsubmittals@adcogov.org); [clarue@adcogov.org](mailto:clarue@adcogov.org); [frollenhagen@co.clear-creek.co.us](mailto:frollenhagen@co.clear-creek.co.us); [ruschmyer@co.clear-creek.co.us](mailto:ruschmyer@co.clear-creek.co.us); [jdeagan@parkco.us](mailto:jdeagan@parkco.us); [msmith@parkco.us](mailto:msmith@parkco.us); [planner@bouldercounty.org](mailto:planner@bouldercounty.org); [pfogg@bouldercounty.org](mailto:pfogg@bouldercounty.org); [planningapps@broomfield.org](mailto:planningapps@broomfield.org); [referrals@arapahoegov.com](mailto:referrals@arapahoegov.com); [tpetersen@co.gilpin.co.us](mailto:tpetersen@co.gilpin.co.us); [rrears@co.gilpin.co.us](mailto:rrears@co.gilpin.co.us);

### **Fire Protection Districts**

[GPedigo@cityofwestminster.us](mailto:GPedigo@cityofwestminster.us); [JSTRICKER@cityofgolden.net](mailto:JSTRICKER@cityofgolden.net); [sparker@cityofgolden.net](mailto:sparker@cityofgolden.net); [bill.lucatuorto@yahoo.com](mailto:bill.lucatuorto@yahoo.com); [chief1@highlandrescue.org](mailto:chief1@highlandrescue.org); [admin@highlandrescue.org](mailto:admin@highlandrescue.org); [chief@IHFR.org](mailto:chief@IHFR.org); [cmalmgren@pleasantviewfire.com](mailto:cmalmgren@pleasantviewfire.com); [ddifeo@RMTD.net](mailto:ddifeo@RMTD.net); [general@coalcreekcanyonfd.org](mailto:general@coalcreekcanyonfd.org); [dharkwell@msn.com](mailto:dharkwell@msn.com); [gjudge@wispetel.net](mailto:gjudge@wispetel.net); [jbrennan@westmetrofire.org](mailto:jbrennan@westmetrofire.org); [jpuffett@geneseefire.org](mailto:jpuffett@geneseefire.org); [mfinocchio@edgewaterco.com](mailto:mfinocchio@edgewaterco.com); [nffpd@hotmail.com](mailto:nffpd@hotmail.com); [randongrimes@foothillsfire.org](mailto:randongrimes@foothillsfire.org); [chief1@highlandrescue.org](mailto:chief1@highlandrescue.org); [admin@highlandrescue.org](mailto:admin@highlandrescue.org); [referrals@southmetro.org](mailto:referrals@southmetro.org); [ripatenco@fairmountfire.org](mailto:ripatenco@fairmountfire.org); [rrush@evergreenfirerescue.com](mailto:rrush@evergreenfirerescue.com); [sgosselin@northmetrofire.org](mailto:sgosselin@northmetrofire.org); [fireprevention@northmetrofire.org](mailto:fireprevention@northmetrofire.org); [sshirlaw@icfpd.net](mailto:sshirlaw@icfpd.net); [tlucero@icfpd.net](mailto:tlucero@icfpd.net); [steven.parker@arvadafireco.gov](mailto:steven.parker@arvadafireco.gov); [steven.parker@arvadafireco.gov](mailto:steven.parker@arvadafireco.gov); [scott.plumer@arvadafireco.gov](mailto:scott.plumer@arvadafireco.gov);

### **HOA I:**

anita@springsteenlaw.com; suefenn@q.com; shane@cchoapros.com;  
david.kirschner@advancehoa.com; cbolla@associacolorado.com; nhoffstaetter@associacolorado.com;  
rebecca.raebel@associacolorado.com; rburke@msiho.com; cici@acmhoa.com;  
Geneseebeth@yahoo.com; caronrealtyinc@att.net; kimteschke@me.com;  
wsuch@homesteadmgmt.com; virginia@withcpmg.com; jon@kchoa.com;  
kathy.christensen@kchoa.com; service@ciramail.com; jon@kchoa.com; kathy@kchoa.com;  
Kevin.Christensen@kchoa.com; snowbird1zang@gmail.com ; cindydalvarez@yahoo.com;  
erich52@gmail.com; jl30661@hotmail.com; hoa.suncreek@gmail.com;  
lguardado@ehammersmith.com; clientservices@ehammersmith.com; tlaron@servicepluscm.com;  
ddemarc@coloradomanagement.com; jon@kchoa.com; kathy@kchoa.com; katie@cmsincorp.net;  
Admin@cmsincorp.net; marciawlarson@gmail.com; mkfrick@gmail.com; jon.ingersoll66@gmail.com;  
davebshaver@gmail.com; sargent.keith.g@gmail.com; the.rileys@hotmail.com;  
bellparkestateshoa26001@gmail.com; melissa@mbf1.com; steve@denverjewelers.com;  
kathypmc@hotmail.com; mrspicoli@me.com; valerieamburn@gmail.com; johnlay9@gmail.com;  
scott.c.henricks@gmail.com; geerdes.sonia@gmail.com; jack@terratech.us; jetellman@gmail.com;  
applewoodlanehoa@gmail.com; robertanderson123@comcast.net; lkaiser@ehammersmith.com;  
nancyfelix@msn.com; ken\_bland@yahoo.com; bruce.rosenlund@gmail.com;  
kevin.christensen@kchoa.com; Kathy@kchoa.com; savedinosaurridge@gmail.com;  
savedinosaurridge@gmail.com; eric\_m\_brown@yahoo.com; patti@vistamgmt.com;  
patti@vistamgmt.com; rgstutz@earthlink.net; candice@kchoa.com; kathy.christensen@kchoa.com;  
christina@cmsincorp.net; admin@cmsincorp.net; daralynn.butler@gmail.com; garthbutler1@msn.com;  
lindaziccardi@yahoo.com; jtimmerman@rkmi.com; rjcs@att.net; 1812eagle@gmail.com;  
solterrapresident@gmail.com; solterratreasurer@gmail.com; cici@acmhoa.com; lspies@msiho.com;  
btate@msiho.com; lspies@msiho.com; btate@msiho.com; dona@acmhoa.com;  
jayna@acmhoa.com; lspies@msiho.com; btate@msiho.com; lspies@msiho.com;  
btate@msiho.com; lspies@msiho.com; btate@msiho.com; misty.thurman@advancehoa.com;  
jrademacher@associacolorado.com; agusa@hoamco.com; sally@carruthproperties.com;  
dennis@carruthproperties.com; ashley.gonzales@kchoa.com; Kathy@kchoa.com;  
customerservice@associacolorado.com; scorn@associacolorado.com; gzuppa@associacolorado.com;  
ashbaughe@gmail.com; jimamos.s1002@msn.com; ricbechter@comcast.net; chip.brunk@gmail.com;  
klast@comcast.net; ivigil@bluehawkmgmt.net; cbroach@bluehawkmgmt.net;  
heatherfurger@gmail.com; wallack44@gmail.com; lhll@tmmccares.com; springhill\_hoa@hotmail.com;  
jamespringhill@outlook.com; hiwanhills@gmail.com; hiwanhills@gmail.com;  
lauren.gerbholz@advancehoa.com; ddeley@earthlink.net; btate@msiho.com; bjhanse2@gmail.com;  
luannkswim@gmail.com; marianne.ortiz@live.com; miransl56@aol.com; ken@kenbrumelle.com;  
timshangraw@emsidenver.com; cogreatstuff@gmail.com; hilltopshop@aol.com; deb@carneylaw.net;  
schemel@q.com; twaltemath@aol.com; ray@cohopejeffco.com; wrmoorej@msn.com;  
diane@cohopejeffco.com; columbinehills80128@gmail.com; mydelibob@yahoo.com;  
candice.jackson@kchoa.com; kathy@kchoa.com; info@ckha.org; pasperj@comcast.net;  
dennismontaguecasey@msn.com; cksehoa@gmail.com; normandavis5344@gmail.com;  
cksehoa@gmail.com; gsteward54@gmail.com; cksiihoatreasurer@gmail.com;  
pres.sodalakes@gmail.com; treas.sodalakes@gmail.com; steigen@msiho.com; cwcatalk@gmail.com;  
rk.simonsen@att.net; tony.carmeli@gmail.com; calebaughj@me.com; wbdietz@yahoo.com;  
larry.hayes1604@gmail.com; triplex1953@gmail.com; tina@kchoa.com; kathy.christensen@kchoa.com;

kmkulasza@comcast.net; evergreenhighlands@gmail.com; secretary@emha.us; president@emha.us; caronrealtyinc@att.net; dnjbecker@msn.com; suzy@geneseefoundation.org; cgarlasco@gmail.com; danagrhoa@outlook.com; bgeddes191@aol.com; daveo71@yahoo.com; info@springranchpoa.org; ltworthvmd@gmail.com; jybkh1919@gmail.com;

## HOA II:

spencer.s.hamilton@gmail.com; lgydvosb@msn.com; president@hiwan.com; presidentislandathiwanhoa@gmail.com; vpislandathiwanhoa@gmail.com; vince@rozmiarek.com; franevers@centurylink.net; etomandjudy@centurylink.net; briany@kcranch.org; alhintz@aol.com; gjshin@msn.com; treasurer@kittredgeco.org; president@kittredgeco.org; Burke\_n\_mel@comcast.net; villarecca@comcast.net; suevgibbs@aol.com; bbnevins@yahoo.com; nancysommer@msn.com; scott.troyer87@hotmail.com; garydmckay@comcast.net; neia.president@gmail.com; kwgreenman@yahoo.com; angela@kchoa.com; cbndit@aol.com; alanbhendrix@yahoo.com; ted@merriamlaw.com; pebelanger@glassdesignresources.com; kathschroeder@msn.com; shellymeans@hotmail.com; tinamarie@pmidenvermetro.com; jmamusciano7@comcast.net; meredithaward@msn.com; ashleyjohnston730@gmail.com; greenyvett@gmail.com; jayna@acmhoa.com; diana@acmhoa.com; cici@acmhoa.com; colleen@acmhoa.com; marti44@aol.com; Alisa.Nixon@kchoa.com; tandyjones@gmail.com; djc@al-tar.com; cathy@skylinedenver.com; terri@skylinedenver.com; sthomas@homesteadmgmt.com; krliesveld@homesteadmgmt.com; barbmack@comcast.net; earthdesignslsc@aol.com; dhastings@lcmpm.com; mark@donelsonarchitecture.com; slmowatt@hotmail.com; sean.vanberschot@prosono.com; valleyhi@valleyhi.org; dls.beat.stanfurd@gmail.com; brennandanp@gmail.com; mpoolet@gmail.com; brandymaze@hotmail.com; spindelcarolyn@yahoo.com; ricdane@aol.com; steigen@msiho.com; btate@msiho.com; janepro@comcast.net; phil@phhco.com; lilpeat73@yahoo.com; norm.dunn@outlook.com; 5953toscano@comcast.net; Jack@cmsincorp.net; Admin@cmsincorp.net; lhill@tmccares.com; STEigen@msiho.com; btate@msiho.com; meredith@kchoa.com; andyreed62@gmail.com; tvhoapresident@gmail.com; steved@laudercompany.com; neil@nblank.com; president@hiwanhomeowners.org; donb34@comcast.net; lcw0901@comcast.net; chan@chpollock.com; mcrocker@evergreenbookkeepers.com; switulski72@gmail.com; hageninsurance@hotmail.com; bkbennett2001@yahoo.com; danielswelchester@gmail.com; manyeyes49@hotmail.com; clpimm@aol.com; christina@cmsincorp.net; newwestproperty@gmail.com; pgumbas@aol.com; secretary@orchardhoa.org; president@orchardhoa.org; westranchgate@qwestoffice.net; bob@ogdonventures.com; tkauffung@hotmail.com; wburdan119@aol.com; alan@hardsavellc.com; sally@carruthproperties.com; dennis@carruthproperties.com; rsimms@rsimmspc.com; bernie@imark-co.com; lspies@msiho.com; btate@msiho.com; qatpartner@aol.com; estates@flood-works.com; mnowell@cchoapros.com; info@wsosoa.org; northmaster@wsosoa.org; artopia4751@gmail.com; watts@acmhoa.com; frutr@q.com; delrump@aol.com; terryanderson2@comcast.net; telebark@myedl.com; jbholmes25@yahoo.com; jhnichols50@msn.com; dduckman@msn.com; melinda@realworldsolutions.us; cinocco@sbcglobal.net; Katie@cmsincorp.net; admin@cmsincorp.net; akelly@crsofcolorado.com; wraffaelli@icloud.com; froandpoka@msn.com; daviddesch@comcast.net; jscott@firstrounders.com; enoyes@mbpros.net; kelly@vistamgmt.com; cici@acmhoa.com; lindaropes@comcast.net; vgchild@comcast.net; edeegail@yahoo.com; donaldgparker@gmail.com;

mrichardson@4shoa.com; mrichardson@4shoa.com; schmidtjam@comcast.net;  
codychristman@ymail.com; huebels@aol.com; cgrush1996@yahoo.com; greg.reiman@comcast.net;  
lhill@tmmccares.com; frontdesk@tmmccares.com; Kathy@kchoa.com; jahind2@yahoo.com;  
galles.eric@gmail.com; elkfallspoapres@gmail.com; elkfallspoa@gmail.com;  
suzannestmartin@gmail.com; yeagerfam33@hotmail.com; mmillage@tmmccares.com;  
mpeck@tmmccares.com; denise@5150cm.com; tchudy@tmmccares.com; tom@preferredleasing.net;  
communitycare@ehammersmith.com; kh15811@yahoo.com; n.keppen@msiho.com;  
jboy@netscape.com; bwaryanka@gmail.com; waynepaugh@gmail.com; alisa.nixon@kchoa.com;  
tvlaberge@gmail.com; cglaberge@gmail.com; whittend@comcast.net; mjduran1@live.com;  
fdmuldoon@comcast.net; plefever@grantranch.org; lspies@msiho.com; rburke@msiho.com;

### HOA III:

tina.white@kchoa.com; nnoll3@yahoo.com; asybesma@austin.rr.com; sean@mmhoaservices.com;  
tdorth@msiho.com; tstephens@msiho.com; lkaiser@ehammersmith.com;  
will.bottoms@dinoridge.org; deb@carneylaw.net; joanobert@yahoo.com; tina@kchoa.com;  
kevin@kchoa.com; kathy.christensen@kchoa.com; alisa.nixon@kchoa.com;  
kevin.christensen@kchoa.com; gail@MSCCM.com; mgonring@msn.com; debellis3@comcast.net;  
candice@kchoa.com; candice@kchoa.com; kathy.christensen@kchoa.com; tina@kchoa.com;  
kathy.christensen@kchoa.com; twtyrrell@live.com; bobandhollyking@msn.com; Mkharts@gmail.com;  
rwhite2@farmersagent.com; jon@kchoa.com; kathy.christensen@kchoa.com; meredith@kchoa.com;  
kathy.christensen@kchoa.com; meredith.thayer@kchoa.com; kathy.christensen@kchoa.com;  
mosiela@f@gmail.com; rwmboard@gmail.com; john@ehammersmith.com;  
contact@evergreenlegacyfund.org; dean@evstudio.com; jon@kchoa.com;  
kathy.christensen@kchoa.com; donaldsno@msn.com; derrhitt@yahoo.com;  
cmorgan@homesteadmgmt.com; ronbrittanyoaks@gmail.com; info@welca-hoa.com;  
amyskinner53@comcast.net; clechris1@msn.com; cherylllovechchio@yahoo.com; lsk1041@gmail.com;  
jdjohannsen@cs.com; billrobie@prodigy.net; paradisehillsboard@gmail.com;  
craig.southorn@mortenson.com; cici@acmhoa.com; colleen@acmhoa.com; admin@cmsincorp.net;  
tomdarr@yahoo.com; cdeehring@mac.com; emasterson@aol.com; jenny@advancehoa.com;  
admin@milehighmg.com; jeantate@enviro-support.com; mthanson@earthlink.net;  
drpoa.president@gmail.com; drpoa.secretary2020@gmail.com; lbcjrquarters@hotmail.com;  
hobsonstaxes@msn.com; rmve2@comcast.net; PamSellsColoradoHomes@gmail.com;  
tortiz@associacolorado.com; leila@smashmarketing.com; barbrunfree@gmail.com;  
vdr825@yahoo.com; brandonrigo@hotmail.com; ejskagen@hotmail.com; yjludwig@msn.com;  
djlbeck@gmail.com; mbramlett@associacolorado.com; customerservice@associacolorado.com;  
virginia@withcpmg.com; jen@maximummgt.com; john@lakehurstwest5.com;  
kathy.christensen@kchoa.com; Bill@cmsincorp.net; patiohoapresident@gmail.com;  
steigen@msiho.com; btate@msiho.com; angela@kchoa.com; kathy.christensen@kchoa.com;  
angela@kchoa.com; angela@kchoa.com; brandy.hughes@kchoa.com; clientservices@kchoa.com;  
jon@kchoa.com; mpoolet@gmail.com; jklitz@comcast.net; christina@cmsincorp.net;  
admin@cmsincorp.net; services@skylinedenver.com; cathy@skylinedenver.com; jack@cmsincorp.net;  
admin@cmsincorp.net; candice.jackson@kchoa.com; d.dienstfrei@praisechurch.org;  
Bill@cmsincorp.net; Admin@cmsincorp.net; js164world@live.com; denniscassell@gmail.com;  
jimmy.roy@earthlink.net; 1812eagle@gmail.com; KevinLundquist@gmail.com;

clare.lundquist@gmail.com; manager@zeatoproperty.com; liquid1018@gmail.com;  
MAPLEVALLEYARVADA@GMAIL.COM; Tory.Korthuis@fbc.org; marcia.holly@advancehoa.com;  
mbhboard@gmail.com; support@mmhoaservices.com; mwfneighborhood@gmail.com;  
LEGlassburn@aol.com; clientservices@kchoa.com; lsprain@msn.com; mcurtiss@comcast.net;  
pbkaygi@gmail.com; wsufans@wispertel.net; peacefulhillsco@gmail.com; tbkleban@msn.com;  
Delygl@msn.com; Meganrcastle@gmail.com; watts@acmhoa.com; danette@acmhoa.com;  
conawaybc@gmail.com; conawaydiane@gmail.com; dave@regionalsalescompany.com;  
Mikeandkeith@yahoo.com; bill@dmdbuilders.com; admin@cmsincorp.net; christina@cmsincorp.net;  
admin@cmsincorp.net; amanda@cmsincorp.net; admin@cmsincorp.net; christina@cmsincorp.net;  
admin@cmsincorp.net; christina@cmsincorp.net; admin@cmsincorp.net; christina@cmsincorp.net;  
admin@cmsincorp.net; amanda@cmsincorp.net; admin@cmsincorp.net; pripko@sdmsi.com;  
rwilliams@sdmsi.com; batwood5@comcast.net; nicole.hemmer@gmail.com;  
garry4maverick@centurylink.net; bassbros@msn.com; paul.d.schaffnit@lmco.com;  
ltsperry@comcast.net; robie.abraham@gmail.com; scott.bristol@scmcolorado.com;  
pp925847@yahoo.com; dave@gcpaint.com; cragmontneighbors@gmail.com;  
mtnparadise@comcast.net; tomjunker51@gmail.com; trappersglenhoa@gmail.com;

#### **BCC**

commish1@jeffco.us; commish2@jeffco.us; [commish3@jeffco.us](mailto:commish3@jeffco.us)

#### **BOA**

[eiblumer@msn.com](mailto:eiblumer@msn.com); [efordces@comcast.net](mailto:efordces@comcast.net); [j.a.jehn@jehnengineering.com](mailto:j.a.jehn@jehnengineering.com); [p\\_warb@msn.com](mailto:p_warb@msn.com);  
[kipkolkmeier@gmail.com](mailto:kipkolkmeier@gmail.com); [gregromberg@comcast.net](mailto:gregromberg@comcast.net); [powersquare@comcast.net](mailto:powersquare@comcast.net)

#### **PC**

alemmer@arch-syn.com; brianbecker.pe@gmail.com; davidduncn@gmail.com;  
jjost@jostenergyllaw.com; jmeyer3808@gmail.com; tprogers@gcgcre.com; t.o.owens@gmail.com;  
wendy@wendyspencercfp.com; [lucid720@gmail.com](mailto:lucid720@gmail.com)

[Planning&Zoning-All@co.jefferson.co.us](mailto:Planning&Zoning-All@co.jefferson.co.us)

#### **Interested Citizens**

P & J Olson <[wsufans@wispertel.net](mailto:wsufans@wispertel.net)>

## Lindsey Wire

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**From:** P&Z Admin  
**Sent:** Thursday, April 24, 2025 2:34 PM  
**To:** PZ-Regulation-Revisions  
**Subject:** Regulation Amendment Case 22-122945AM - Regulation Amendments pertaining to Transportation and Access Standards - Public Hearing Notification  
**Attachments:** 01 Summary of Proposed Regulation Updates 21125.pdf

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

Final Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#).

**Public Hearings for these proposed amendments have been scheduled for the following dates:**

- **Planning Commission Hearing - May 14<sup>th</sup>, 2025 at 6:15 PM**
- **Board of County Commissioners Hearing - June 10<sup>th</sup>, 2025 at 9 AM**

If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Thank you,

### Planning & Zoning

Jefferson County Planning and Zoning  
100 Jefferson County Parkway, Suite 3550  
Golden, CO 80419  
o (303) 271-8700  
[www.https://planning.jeffco.us/](https://planning.jeffco.us/)

Help us shape the future of Jefferson County by visiting the Together Jeffco website!  
Click the image below to visit our website: <https://togetherjeffco.com>



We encourage scheduling an appointment to see staff during our office hours Monday - Thursday. Please schedule [appointments](#) and submit [applications](#) online. Go to [planning.jeffco.us](https://planning.jeffco.us) for more information.  
RE: 22-122945AM\_HOA I

## City

DRT@littletongov.org;TownPlanner@columbinevalley.org;aneverdahl@morrisonco.us;cchristensen@morrisonco.us;bowmartown@gmail.com;brenda@lakesideamusementpark.com;collinsb@bouldercolorado.gov;ashleym@bouldercolorado.gov;developmentservices@denvergov.org;brad.eckert@denvergov.org;jmcconne@cityofwestminster.us;acastro@safebuilt.com;lritchie@louisvilleco.gov;mgreer@tomv.org;pauric@lakewood.org;shadej@lakewood.org;Tonbis@lakewood.org;planner@bouldercounty.org;pfgg@bouldercounty.org;planning@cityofgolden.net;planning@superiorcolorado.gov;planningapps@broomfield.org;rsmetana@arvada.org;wcharles@englewoodco.gov;zoning@ci.wheatridge.co.us;

## County

[Planreferralrequest@douglas.co.us](mailto:Planreferralrequest@douglas.co.us); [developmentsubmittals@adcogov.org](mailto:developmentsubmittals@adcogov.org); [clarue@adcogov.org](mailto:clarue@adcogov.org); [gmcallister@clearcreekcounty.us](mailto:gmcallister@clearcreekcounty.us); [cruschmyer@co.clearcreek.co.us](mailto:cruschmyer@co.clearcreek.co.us); [ideagan@parkco.us](mailto:ideagan@parkco.us); [msmith@parkco.us](mailto:msmith@parkco.us); [planner@bouldercounty.org](mailto:planner@bouldercounty.org); [pfgg@bouldercounty.org](mailto:pfgg@bouldercounty.org); [planningapps@broomfield.org](mailto:planningapps@broomfield.org); [referrals@arapahoegov.com](mailto:referrals@arapahoegov.com); [rrears@co.gilpin.co.us](mailto:rrears@co.gilpin.co.us); [rrears@co.gilpin.co.us](mailto:rrears@co.gilpin.co.us);

## External Referral Contacts

[CGS\\_LUR@mines.edu](mailto:CGS_LUR@mines.edu); [loana.comanicu@state.co.us](mailto:loana.comanicu@state.co.us); [Kent.J.Christiansen@usps.gov](mailto:Kent.J.Christiansen@usps.gov); [krissy.j.summerfield@usps.gov](mailto:krissy.j.summerfield@usps.gov); [Jason.g.Eddleman@usps.gov](mailto:Jason.g.Eddleman@usps.gov); [admin@evergreenchamber.org](mailto:admin@evergreenchamber.org); [afeinstein@jcha.org](mailto:afeinstein@jcha.org); [asummers@drcog.org](mailto:asummers@drcog.org); [ben.hammar@state.co.us](mailto:ben.hammar@state.co.us); [brad.eckert@denvergov.org](mailto:brad.eckert@denvergov.org); [ccufre@coloradoopenlands.org](mailto:ccufre@coloradoopenlands.org); [cdotr1access\\_groupE@state.co.us](mailto:cdotr1access_groupE@state.co.us); [cdphe\\_localreferral@state.co.us](mailto:cdphe_localreferral@state.co.us); [coloradoes@fws.gov](mailto:coloradoes@fws.gov); [director@goconife.r.com](mailto:director@goconife.r.com); [eliot.hoyt@state.co.us](mailto:eliot.hoyt@state.co.us); [engineering@rtd-denver.com](mailto:engineering@rtd-denver.com); [erhample@jeffco.us](mailto:erhample@jeffco.us); [Karla.Melgar\\_Velis@colostate.edu](mailto:Karla.Melgar_Velis@colostate.edu); [inquiries@nist.gov](mailto:inquiries@nist.gov); [jbeck@blm.gov](mailto:jbeck@blm.gov); [jcd@jeffersoncd.com](mailto:jcd@jeffersoncd.com); [john.white@colostate.edu](mailto:john.white@colostate.edu); [jpphaadmin@gmail.com](mailto:jpphaadmin@gmail.com); [ken.mushinski@cotterusa.com](mailto:ken.mushinski@cotterusa.com); [kiel.g.downing@usace.army.mil](mailto:kiel.g.downing@usace.army.mil); [lisa.heagley@usda.gov](mailto:lisa.heagley@usda.gov); [nathanael.berry@usda.gov](mailto:nathanael.berry@usda.gov); [lseeger@jeffcoedc.org](mailto:lseeger@jeffcoedc.org); [margaret.vigil@state.co.us](mailto:margaret.vigil@state.co.us); [mark.lamb@state.co.us](mailto:mark.lamb@state.co.us); [matt.martinez@state.co.us](mailto:matt.martinez@state.co.us); [oahp@state.co.us](mailto:oahp@state.co.us); [submittals@mhfd.org](mailto:submittals@mhfd.org); [tim\\_connors@nps.gov](mailto:tim_connors@nps.gov); [heather\\_eggleson@nps.gov](mailto:heather_eggleson@nps.gov); [Linda\\_Moery@nps.gov](mailto:Linda_Moery@nps.gov); [todd.leopold@state.co.us](mailto:todd.leopold@state.co.us); [treed@jeffco.k12.co.us](mailto:treed@jeffco.k12.co.us); [rhuxley@jeffco.k12.co.us](mailto:rhuxley@jeffco.k12.co.us); [Matthew.Hanks@jeffco.k12.co.us](mailto:Matthew.Hanks@jeffco.k12.co.us); [wrbb@urbanfrontier.com](mailto:wrbb@urbanfrontier.com);

## Fire Districts

[GPedigo@cityofwestminster.us](mailto:GPedigo@cityofwestminster.us); [bill.lucatuorto@yahoo.com](mailto:bill.lucatuorto@yahoo.com); [chief1@highlandrescue.org](mailto:chief1@highlandrescue.org); [admin@highlandrescue.org](mailto:admin@highlandrescue.org); [chief@IHFR.org](mailto:chief@IHFR.org); [cmalmgren@pleasantviewfire.com](mailto:cmalmgren@pleasantviewfire.com); [twall@pleasantviewmetro.org](mailto:twall@pleasantviewmetro.org); [fireprevention@evergreenfirerescue.com](mailto:fireprevention@evergreenfirerescue.com); [general@coalcreekcanyonfd.org](mailto:general@coalcreekcanyonfd.org); [chief@coalcreekcanyonfd.org](mailto:chief@coalcreekcanyonfd.org); [gjudge@wispertel.net](mailto:gjudge@wispertel.net); [jbrennan@westmetrofire.org](mailto:jbrennan@westmetrofire.org); [jgoorman@westmetrofire.org](mailto:jgoorman@westmetrofire.org); [jeffvelasco@foothillsfire.org](mailto:jeffvelasco@foothillsfire.org); [chief1@highlandrescue.org](mailto:chief1@highlandrescue.org); [admin@highlandrescue.org](mailto:admin@highlandrescue.org); [jpuffett@geneseeffire.org](mailto:jpuffett@geneseeffire.org); [kbenson@goldengatefire.org](mailto:kbenson@goldengatefire.org); [nffpd@hotmail.com](mailto:nffpd@hotmail.com); [rrush@elkcreekfire.org](mailto:rrush@elkcreekfire.org); [referrals@southmetro.org](mailto:referrals@southmetro.org); [rrush@elkcreekfire.org](mailto:rrush@elkcreekfire.org); [sgosselin@northmetrofire.org](mailto:sgosselin@northmetrofire.org); [fireprevention@northmetrofire.org](mailto:fireprevention@northmetrofire.org); [sjones@cityofgolden.net](mailto:sjones@cityofgolden.net); [jpriestly@cityofgolden.net](mailto:jpriestly@cityofgolden.net); [sshirlaw@icfpd.net](mailto:sshirlaw@icfpd.net); [steven.parker@arvadafireco.gov](mailto:steven.parker@arvadafireco.gov); [scott.plumer@arvadafireco.gov](mailto:scott.plumer@arvadafireco.gov)

## HOA

lclemens5858@gmail.com; femathes@gmail.com; jford@4x4concrete.com; debbieeford@outlook.com  
; BOARD@CEHOA.NET; scottjkeen@gmail.com; nstroeher@hotmail.com;  
president@thevistasevergreen.com; vp@thevistasevergreen.com; danette@acmhoa.com;  
christian@acmhoa.com; caronrealtyinc@att.net; sherry.mcdowell1@icloud.com;  
customercare@havencm.com; nkelly@havencm.com; tpadilla@acmhoa.com;  
deercreekmesa@gmail.com; jvlaw@jjvlaw.digitalspacemail8.net; Dpettigrew@msiho.com;  
sgna.lakewood@gmail.com; sgna.lakewood@gmail.com; customercare@havencm.com;  
nkelly@havencm.com; dbehrent@tmmccares.com; customercare@havencm.com;  
nkelly@havencm.com; belanger.laura@gmail.com; ricbechter@comcast.net; chip.brunck@gmail.com;  
lehoaboard@gmail.com; lehoaboard@gmail.com; mttop@aol.com; klast@comcast.net;  
cbroach@bluehawkmgmt.net; cbroach@bluehawkmgmt.net; heatherfurger@gmail.com;  
lhill@tmmccares.com; springhill\_hoa@hotmail.com; jamespringhill@outlook.com;  
hiwanhills@gmail.com; hiwanhills@gmail.com; lauren.gerbholz@advancehoa.com;  
ddeley@earthlink.net; rhansen@msiho.com; bjhanse2@gmail.com; d-braden@comcast.net;  
marianne.ortiz@live.com; mirans156@aol.com; ken@kenbrumelle.com; timshangraw@emsidenver.com;  
hilltopshop@aol.com; hilltopshop@aol.com; ContactUs@CAREJeffco.org; schemel@q.com;  
twaltemath@aol.com; wrmoorej@msn.com; diane@cohopejeffco.com;  
columbinehills80128@gmail.com; mydelibob@yahoo.com; candice.jackson@kchoa.com;  
kathy@kchoa.com; atwisselman@msn.com; knollscolumbinehoa@gmail.com ;  
SJHantelman@gmail.com; andylisamcclure@earthlink.net; pasperj@comcast.net; cksehoa@gmail.com;  
cksemem2@gmail.com; pres.sodalakes@gmail.com; treas.sodalakes@gmail.com;  
steigen@msiho.com; cwcatalk@gmail.com; rk.simonsen@att.net; regrimm@yahoo.com;  
dosborn@q.com; wbdietz@yahoo.com; larry.hayes1604@gmail.com; tripley1953@gmail.com;  
tina@kchoa.com; kathy.christensen@kchoa.com; kmkulasza@comcast.net;  
evergreenhighlands@gmail.com; secretary@emha.us; president@emha.us; caronrealtyinc@att.net;  
johnellisevergreen@gmail.com; briank@geneseefoundation.org; traci@geneseefoundation.org;  
manager@grhoa.com; assistant@grhoa.com; akovinchick@msiho.com; ltworthvmd@gmail.com;  
nikstevens@outlook.com; thepreservehoaboard@gmail.com; thepreservehoaboard@gmail.com;  
hilldalepinespres@gmail.com; sthumbard3@gmail.com; lgydvosb@msn.com; president@hiwan.com;  
presidentislandathiwanhoa@gmail.com; vpislandathiwanhoa@gmail.com;  
mike.patterson@indianhillsco.org; ray.todd@indianhillsco.org; franevers18@gmail.com;  
michelehoet@gmail.com; briany@kcranch.org; sandral@kcranch.org ; alhintz@aol.com;  
gjshin@msn.com; president@kittredgeco.org; treasurer@kittredgeco.org; Burke\_n\_mel@comcast.net;  
srw151@hotmail.com; chelsea.paige.lawrence@gmail.com; nancysommer@msn.com;  
qpnbrown3@hotmail.com; scott.troyer87@hotmail.com; garydmckay@comcast.net;  
neia.president@gmail.com; kwgreenman@yahoo.com; cbndit@aol.com; alanbhendrix@yahoo.com;  
hrwasko@hotmail.com; panoramaestateshoa@gmail.com; shellymeans@hotmail.com;  
fred.kress@cbrealty.com; Sahlilaw@gmail.com; meredithaward@msn.com;  
ashleyjohnston730@gmail.com; greenyvett@gmail.com; diana@acmhoa.com; cici@acmhoa.com;  
marti44@aol.com; brittany.bazan@kchoa.com; cathy@skylinedenver.com; services@skylinedenver.com;  
sthomas@homesteadmgmt.com; krliessveld@homesteadmgmt.com; barbmac@comcast.net;  
earthdesignslsc@aol.com; dhastings@lcmpm.com; mark@donelsonarchitecture.com;  
tvsfhoa@gmail.com; cjstrickler@conduitresources.com ; dls.beat.stanford@gmail.com;  
chuck\_newby@me.com; mpoolet@gmail.com; Barbara.Weiss@ucdenver.edu;



spindelcarolyn@yahoo.com; ricdane@aol.com; steigen@msiho.com; btate@msiho.com;  
mike@windyholdings.com; lilpeat73@yahoo.com; norm.dunn@outlook.com;  
5953toscano@comcast.net; abrin@tmmccares.com; lhill@tmmccares.com; STEigen@msiho.com;  
btate@msiho.com; meredith@kchoa.com; andyreed62@gmail.com; tvhoapresident@gmail.com;

neil@nblank.com; communications@hiwanhomeowners.org; lcw0901@comcast.net;  
angela.mays@yahoo.com; gretchen@stubenvoll.net; switulski72@gmail.com; Stephen@bisque.com;  
legries@gmail.com; danielswelchester@gmail.com; jongoldman@comcast.net; clpimm@aol.com;  
christina@cmsincorp.net; newwestproperty@gmail.com; pgumbas@aol.com; joby.schaffer@gmail.com;  
tjraub@hotmail.com; westranchgate@qwestoffice.net; bob@ogdonventures.com;  
tkauffung@hotmail.com; wburdan119@aol.com; alan@hardsavellc.com; sally@carruthproperties.com;  
dennis@carruthproperties.com; rsimms@rsimmspc.com;  
MattWilliamsCottonwoodWestHOA@gmail.com; bernie@arvadamall.com; lspies@msiho.com;  
btate@msiho.com; qatpartner@aol.com; estates@flood-works.com; mnowell@cchoapros.com;  
info@wsosoa.org; artopia4751@gmail.com; watts@acmhoa.com; frutr@q.com;  
admin@AMAcolorado.com; shirleyofconifer@gmail.com; christy.seabourne@gmail.com;  
jbholmes25@yahoo.com; jhnichols50@msn.com; dduckman@msn.com;  
melinda@realworldsolutions.us; bhybinette@gmail.com; Katie@cmsincorp.net;  
adrianna@cmsincorp.net; akelly@crsofcolorado.com; president@ridgepointhoa.org; treasurer-  
vp@ridgepointhoa.org; daviddesch@comcast.net; jscott@firstrounders.com; enoyes@mbpros.net;  
MillerK@keystonepacific.com; cici@acmhoa.com; lindaropes@comcast.net; cskeelan@gmail.com;  
edeegail@yahoo.com; donalddgarker@gmail.com; bmcMahon@4shoa.com; mhall@4shoa.com;  
schmidtjam@comcast.net; codychristman@ymail.com; huebels@aol.com; sparks.mary@icloud.com;  
fzustak@comcast.net; lhill@tmmccares.com; dpeck@tmmccares.com; Kathy@kchoa.com;  
jahind2@yahoo.com; galles.eric@gmail.com; elkfallspoapres@gmail.com; elkfallspoavp@gmail.com;  
suzannestmartin@gmail.com; yeagerfam33@hotmail.com; mmillage@tmmccares.com;  
mpeck@tmmccares.com; denise@5150cm.com; tchudy@tmmccares.com; tom@preferredleasing.net;  
aperin@ehammersmith.com; kh15811@yahoo.com; n.keppen@msiho.com; jboy@netscape.com;  
bwaryanka@gmail.com; waynepaugh@gmail.com; alisa.nixon@kchoa.com; tvlaberge@gmail.com;  
zakwessel@gmail.com; whittend@comcast.net; mjduran1@live.com; fdmuldoon@comcast.net;  
plefever@grantranch.org; lspies@msiho.com; rburke@msiho.com; rramelow@msiho.com;  
customercare@havencm.com; nkelly@havencm.com; tina.white@kchoa.com; nnoll3@yahoo.com;  
asybesma@austin.rr.com; sean@mmhoaservices.com; tdorth@msiho.com; tstephens@msiho.com;  
lkaiser@ehammersmith.com; will.bottoms@dinoridge.org; deb@carneylaw.net;  
joanobert@yahoo.com; tina@kchoa.com; kevin@kchoa.com; kathy.christensen@kchoa.com;  
brandy.hughes@kchoa.com; kevin.christensen@kchoa.com; gailclark3415@gmail.com;  
mgonring@msn.com; debellis3@comcast.net; kathy.christensen@kchoa.com;  
kathy.christensen@kchoa.com; tina@kchoa.com; kathy.christensen@kchoa.com; jrobert@mines.edu;  
sean\_steeves@hotmail.com; rwhite2@farmersagent.com; jon@kchoa.com;  
kathy.christensen@kchoa.com; meredith@kchoa.com; kathy.christensen@kchoa.com;  
meredith.thayer@kchoa.com; kathy.christensen@kchoa.com; mosielaff@gmail.com;  
rwmboard@gmail.com; john@ehammersmith.com; contact@evergreenlegacyfund.org;  
dean@evstudio.com; jon@kchoa.com; kathy.christensen@kchoa.com; donaldsno@msn.com;  
derrhitt@yahoo.com; CLAsani@homesteadmgmt.com; info@welca-hoa.com; zquicky@msn.com;  
clechris1@msn.com; nortonha2693487@gmail.com; shannon.loizzo@realmanage.com;

billrobie@prodigy.net; harnagels@aol.com; presidentofphhoa@gmail.com; cici@acmhoa.com;  
amber@cmsincorp.net; ileana@cmsincorp.net; tomdarr@yahoo.com; cdeehring@mac.com;  
jenny@advancehoa.com; admin@milehighmg.com; jeantate@enviro-support.com;  
mthanson@earthlink.net; drpoa.secretary2020@gmail.com; drpoa.vicepresident@gmail.com;  
lbcjrquarters@hotmail.com; hobsonstaxes@msn.com; rmve2@comcast.net; janet@janetlane.net;  
achromy@gmail.com; dawn.bates@advancehoa.com; tgebess@gmail.com; barbrunfree@gmail.com;  
vdr825@yahoo.com; brandonrigo@hotmail.com; ejksagen@hotmail.com; yjludwig@msn.com;  
djlbeck@gmail.com;

virginia@withcpmg.com; jen@maximummgt.com; john@lakehurstwest5.com;  
kathy.christensen@kchoa.com; anita@springsteenlaw.com; suefenn@q.com; shane@cchoapros.com;  
david.kirschner@advancehoa.com; cbolla@associacolorado.com; nhoffstaetter@associacolorado.com;  
rebecca.raebel@associacolorado.com; rburke@msiho.com; cici@acmhoa.com;  
Geneseebeth@yahoo.com; caronrealtyinc@att.net; kimteschke@me.com;  
wsuch@homesteadmgmt.com; virginia@withcpmg.com; jon@kchoa.com;  
kathy.christensen@kchoa.com; service@ciramail.com; jon@kchoa.com; kathy@kchoa.com;  
Kevin.Christensen@kchoa.com; snowbird1zang@gmail.com; Michael.Brennan@kchoa.com;  
rljones05@yahoo.com; erich52@gmail.com; jl30661@hotmail.com; hoa.suncreek@gmail.com;  
lguardado@ehammersmith.com; clientservices@ehammersmith.com; tlaron@servicepluscm.com;  
ddemarcas@coloradomanagement.com; jon@kchoa.com; kathy@kchoa.com;  
marcia.holly@advancehoa.com; Cheryl.aphoa@gmail.com; barrie.fiedler@gmail.com;  
mkfrick@gmail.com; jon.ingersoll66@gmail.com; osgoodhartness@gmail.com;  
sargent.keith.g@gmail.com; the.rileys@hotmail.com; bellparkestateshoa26001@gmail.com;  
bellparkestateshoa26001@gmail.com; steve@denverjewelers.com; kathypmc@hotmail.com;  
mrspicoli@me.com; valerieamburn@gmail.com; johnlay9@gmail.com; scott.c.henricks@gmail.com;  
geerdes.sonia@gmail.com; rjspies18@gmail.com; janhcrosby@gmail.com;  
applewoodlanehoa@gmail.com; robertanderson123@comcast.net; lkaiser@ehammersmith.com;  
nancyfelix@msn.com; ken\_bland@yahoo.com; bruce.rosenlund@gmail.com;  
kevin.christensen@kchoa.com; Kathy@kchoa.com; savedinosaurridge@gmail.com;  
eric\_m\_brown@yahoo.com; PSego@keystonepacific.com; PSego@keystonepacific.com;  
rgstutz@earthlink.net; cathy@skylinedenver.com; services@skylinedenver.com;  
christina@cmsincorp.net; admin@cmsincorp.net; daralynn.butler@gmail.com; garthbutler1@msn.com;  
lindaziccardi@yahoo.com; rjcs@att.net; 1812eagle@gmail.com; solterrapresident@gmail.com;  
solterratreasurer@gmail.com; cici@acmhoa.com; lspies@msiho.com; landrews@msiho.com;  
lspies@msiho.com; landrews@msiho.com; Danette@acmhoa.com; Christian@acmhoa.com;  
lspies@msiho.com; btate@msiho.com; lspies@msiho.com; btate@msiho.com;  
lspies@msiho.com; btate@msiho.com; misty.thurman@advancehoa.com;  
jrademacher@associacolorado.com; agusa@hoamco.com; shaffergreens@gmail.com;  
jstorchevoy@emporiaenergy.com; clayton.russell@kchoa.com; clayton.russell@kchoa.com;  
customerservice@associacolorado.com; scorn@associacolorado.com; gzuppa@associacolorado.com;  
jen@cmsincorp.net; adriana@cmsincorp.net; steigen@msiho.com; btate@msiho.com;  
angela@kchoa.com; kathy.christensen@kchoa.com; angela@kchoa.com; angela@kchoa.com;  
brandy.hughes@kchoa.com; clientservices@kchoa.com; jon@kchoa.com; mpoolet@gmail.com;  
jeantate@enviro-support.com; christina@cmsincorp.net; admin@cmsincorp.net;  
services@skylinedenver.com; cathy@skylinedenver.com; jack@cmsincorp.net; morgan@cmsincorp.net;

candice.jackson@kchoa.com; admin@cmsincorp.net; Admin@cmsincorp.net; js164world@live.com; griesteven@msn.com; jimmy.roy@earthlink.net; 1812eagle@gmail.com; KevinLundquist@gmail.com; clare.lundquist@gmail.com; danette@acmhoa.com; christian@acmhoa.com; MAPLEVALLEYARVADA@GMAIL.COM; Tory.Korthuis@fbc.org; mbhboard@gmail.com; ColUSA81@gmail.com; artopia4751@gmail.com; mwfneighborhood@gmail.com; LEGlassburn@aol.com; clientservices@kchoa.com; lsprain@msn.com; mcurtiss@comcast.net; pbkaygi@gmail.com; peacefulhillsco@gmail.com; coug@2lazycats.com; tbkleban@msn.com; Delygl@msn.com; Meganrcastle@gmail.com; watts@acmhoa.com; danette@acmhoa.com; eadesdb@gmail.com; belinda.oakley@gmail.com; dave@regionalsalescompany.com; joha9148@colorado.edu; shanedon11@yahoo.com; christina@cmsincorp.net; admin@cmsincorp.net; christina@cmsincorp.net; admin@cmsincorp.net; amanda@cmsincorp.net; admin@cmsincorp.net; christina@cmsincorp.net; morgan@cmsincorp.net; christina@cmsincorp.net; admin@cmsincorp.net;

#### PC, BOA

ashley@junipermountainhouse.com; brianbecker.pe@gmail.com; davidduncn@gmail.com>; drew.bolin@gmail.com; johnameessner@gmail.com; kelcdunne@gmail.com; stacyliles@gmail.com; tprogers@gcgcre.com; wendy@wendyspencercfp.com; gjohnson2126@gmail.com; jeff@clinedesigngroup.com; kporter2003@comcast.net; lmcgahee@mac.com; p\_warb@msn.com; lester737@gmail.com; tom@bariarchitecture.com;

#### Internal Referral

[adoran@jeffco.us](mailto:adoran@jeffco.us); [cmarkel@jeffco.us](mailto:cmarkel@jeffco.us); [kcisowsk@jeffco.us](mailto:kcisowsk@jeffco.us); [dbeauvai@co.jefferson.co.us](mailto:dbeauvai@co.jefferson.co.us); [dconway@jeffco.us](mailto:dconway@jeffco.us); [elroberts@jeffco.us](mailto:elroberts@jeffco.us); [mtrubenstein@jeffco.us](mailto:mtrubenstein@jeffco.us); [esander@jeffco.us](mailto:esander@jeffco.us); [kdouglas@jeffco.us](mailto:kdouglas@jeffco.us); [jshraider@jeffco.us](mailto:jshraider@jeffco.us); [knewman@jeffco.us](mailto:knewman@jeffco.us); [hgutherl@jeffco.us](mailto:hgutherl@jeffco.us); [mdanner@jeffco.us](mailto:mdanner@jeffco.us); [apanza@jeffco.us](mailto:apanza@jeffco.us); [mschuste@jeffco.us](mailto:mschuste@jeffco.us); [jcohen@jeffco.us](mailto:jcohen@jeffco.us); [rbishop@flyrmma.com](mailto:rbishop@flyrmma.com); [bmiller@flyrmma.com](mailto:bmiller@flyrmma.com); [panslow@co.jefferson.co.us](mailto:panslow@co.jefferson.co.us); [rtemmer@jeffco.us](mailto:rtemmer@jeffco.us); [sswain@jeffco.us](mailto:sswain@jeffco.us); [steve.chestnut@jeffcolibrary.org](mailto:steve.chestnut@jeffcolibrary.org); [tkauffma@jeffco.us](mailto:tkauffma@jeffco.us); [pweber@jeffco.us](mailto:pweber@jeffco.us); [kparker@co.jefferson.co.us](mailto:kparker@co.jefferson.co.us)

[arohwer@jeffco.us](mailto:arohwer@jeffco.us); [jrwright@co.jefferson.co.us](mailto:jrwright@co.jefferson.co.us); [kdean@jeffco.us](mailto:kdean@jeffco.us); [catencio@jeffco.us](mailto:catencio@jeffco.us); [khagaman@jeffco.us](mailto:khagaman@jeffco.us); [mdamjano@jeffco.us](mailto:mdamjano@jeffco.us); [catencio@jeffco.us](mailto:catencio@jeffco.us); [mweiden@co.jefferson.co.us](mailto:mweiden@co.jefferson.co.us); [mbaldwin@jeffco.us](mailto:mbaldwin@jeffco.us); [ekrause@jeffco.us](mailto:ekrause@jeffco.us); [estoner@jeffco.us](mailto:estoner@jeffco.us); [hgutherl@jeffco.us](mailto:hgutherl@jeffco.us); [rclark@jeffco.us](mailto:rclark@jeffco.us); [khagaman@jeffco.us](mailto:khagaman@jeffco.us); [kjordan@jeffco.us](mailto:kjordan@jeffco.us); [ltownsen@co.jefferson.co.us](mailto:ltownsen@co.jefferson.co.us); [mvanatta@co.jefferson.co.us](mailto:mvanatta@co.jefferson.co.us); [mschuste@jeffco.us](mailto:mschuste@jeffco.us); [jcohen@jeffco.us](mailto:jcohen@jeffco.us); [poconnel@jeffco.us](mailto:poconnel@jeffco.us); [publichealthelanduse@jeffco.us](mailto:publichealthelanduse@jeffco.us); [tjones@jeffco.us](mailto:tjones@jeffco.us); [russheckle@jeffco.us](mailto:russheckle@jeffco.us); [terbert@jeffco.us](mailto:terbert@jeffco.us); [stmaurer@jeffco.us](mailto:stmaurer@jeffco.us); [kbryson@jeffco.us](mailto:kbryson@jeffco.us);

#### Irrigation Companies

[bmiddleton@broomfield.org](mailto:bmiddleton@broomfield.org); [eve@farmersres.com](mailto:eve@farmersres.com); [fhl.gm.mike@gmail.com](mailto:fhl.gm.mike@gmail.com); [generalmanager@churchditch.org](mailto:generalmanager@churchditch.org); [jim.ferentchak@www.wheeler.com](mailto:jim.ferentchak@www.wheeler.com); [johnreiber@msn.com](mailto:johnreiber@msn.com); [jrobbins@pinehurstcountryclub.com](mailto:jrobbins@pinehurstcountryclub.com); [norm@hch2o.com](mailto:norm@hch2o.com); [liddy.armijo@molsoncoors.com](mailto:liddy.armijo@molsoncoors.com); [mike.wright@archden.org](mailto:mike.wright@archden.org); [minifarm2@aol.com](mailto:minifarm2@aol.com); [neal.santangelo@molsoncoors.com](mailto:neal.santangelo@molsoncoors.com); [peter.adrc@gmail.com](mailto:peter.adrc@gmail.com); [projects@farmersres.com](mailto:projects@farmersres.com); [ssarrow@pinehurstcountryclub.com](mailto:ssarrow@pinehurstcountryclub.com); [theander@mseapc.com](mailto:theander@mseapc.com);

#### Metro Districts

management@fhmd.net;dsolin@sdmsi.com;victoriad@kcranch.org;gmcgowan9052@aol.com;dolphindance1@aol.com;Lisa.johnson@claconnect.com;SALLEN@WBAPC.COM;afinn@sdmsi.com;afrisbie@wbapc.com;angela@teleos-services.com;anna.jones@claconnect.com;barnett@timberlinedc.com;cmalmgren@pleasantviewfire.com;twaller@pleasantviewmetro.org;dave@peakdistrictmanagementllc.com;cindy.jenkins@cliftonlarsonallen.com;dolphindance1@aol.com;dsolin@sdmsi.com;eeds@gginb.com;ewhite@highlandsranch.org;firm@wbapc.com;gbaum@urbanfrontier.com;jhenry@specialdistrictlaw.com;jtanaka@wbapc.com;kseter@svwpc.com;ljohnson@sdmsi.com;mbecher@specialdistrictlaw.com;mmcgeady@mcgeadysisneros.com;mmruffy@wbapc.com;nicholas.carlson@claconnect.com;anna.jones@claconnect.com;andrew.williams@claconnect.com;office@meadowbrookwaterdistrict.com;rbilek@crsocolorado.com;rkron@spencerfane.com;sbeck@sdmsi.com;sblair@crsocolorado.com;tgeorge@spencerfane.com;triggle@evergreenmetro.org;

#### Park and Recreation Districts

Brad.eckert@denvergov.org;David.Peak@cliftonlarsonallen.com;PlanningSupport@ssprd.org;RosWil@lakewood.org;johpal@lakewood.org;brett@ckrd.org;insley@fhprd.org;seank@fhprd.org;richeller@fhprd.org;jeffg@apexprd.org;jmanwaring@ci.wheatridge.co.us;kparker@prospectdistrict.org;victoria@enthusd.com;kwsargent@msn.com;mevens@eprd.co;cvanderveen@eprd.co;mtableman@co.clear-creek.co.us;nemrdpool@gmail.com;nikki.mccabe@denvergov.org;Nikki.VanRavenswaay@DenverGov.org;pamartinez@edgewaterco.com;stecar@lakewood.org;biljew@lakewood.org;tom@beaverranch.org;traciw@kcranch.org;weecreekers@gmail.com;

#### Regulation Review Committee

[ethan@baselinecorp.com](mailto:ethan@baselinecorp.com); [jveres0@gmail.com](mailto:jveres0@gmail.com); [atrietley@ventanacap.com](mailto:atrietley@ventanacap.com); [jtidmore@jeffcoedc.org](mailto:jtidmore@jeffcoedc.org); [bill@actualp.com](mailto:bill@actualp.com); [Josh@mcgdenver.com](mailto:Josh@mcgdenver.com); [rrush@elkcreekfire.org](mailto:rrush@elkcreekfire.org); [arogers@mullereng.com](mailto:arogers@mullereng.com); [mlrichardson@apc.us.com](mailto:mlrichardson@apc.us.com); [clane@jeffco.us](mailto:clane@jeffco.us); [DHamilton@foxrothschild.com](mailto:DHamilton@foxrothschild.com); [JEddy@martinmartin.com](mailto:JEddy@martinmartin.com); [ynotbev2@gmail.com](mailto:ynotbev2@gmail.com); [dean@evstudio.com](mailto:dean@evstudio.com); [chris@ballprop.com](mailto:chris@ballprop.com); deb@carneylaw.net

Brennanjr@aol.com;Jenslines@gmail.com;John@Hermanussen.net;MarkBenallo@aol.com;Pittingerkaren\_@hotmail.com;admin@arrowheadmanor.com;algnemes@comcast.net;ashleyctoole@gmail.com;carl@horecky.com;board@bfarmshoa.org;bradengine@aol.com;cfliberatore@gmail.com;chcastleman@comcast.net;claymeason@yahoo.com;deb@carneylaw.net;dreedfineline@aol.com;evergreenhighlands@gmail.com;fsa333@aol.com;gkollman@cityofwestminster.us;hanseninc@gmail.com;jeffrey\_orlowski@nps.gov;kathy@kchoa.com;kathy@kchoa.com.;kristy@epiphanydesigngroup.com;lam@calibre.us.com;laneengr@comcast.net;mhanson@prospectdistrict.org;mkbtoy@yahoo.com;mlrichardson@apc.us.com;neil3@q.com;nicolemoves@gmail.com;pksurv@aol.com;rmheine1@msn.com;rmve2@comcast.net;satrui\_437@hotmail.com;shannon@milehighoutdoor.com;skigolden@yahoo.com;john@hermanussen.net;tclancy911@aol.com;team@planwest.com;tegcoalcreek@gmail.com;treidski@hotmail.com;

1812eagle@gmail.com;al@pcsgroupco.com;childreth@foxrothschild.com;dean@evstudio.com;deb@carneylaw.net;dmsmn5@aol.com;douglassengineering1@gmail.com;esther.kettering@cushwake.com;ethan@baselinecorp.com;jeanne@chadwickplanning.com;jking@evergreenfirerescue.com;jveres0@gmail.com;kbrooks@westmetrofire.org;mhanson@prospectdistrict.org;mlrichardson@apc.us.com;phorn@martinmartin.com;wrb@urbanfrontier.com;ynotbev@aol.com;

## Utilities

platreferral@unitedpower.com;ReferralsXcelDistribution@xcelenergy.com;Alfonzo\_Martinez@cable.com  
cast.com;bkaufman@irea.coop;jgutierrez@summitutilitiesinc.com;platreview@lumen.com;

## Water and Sanitation Districts

[Gary.booth@denverwater.org](mailto:Gary.booth@denverwater.org); [Amy.turney@denverwater.org](mailto:Amy.turney@denverwater.org); [aj@publicalliancellc.com](mailto:aj@publicalliancellc.com); [asd@applewoodsan.org](mailto:asd@applewoodsan.org); [barbara@roxwater.org](mailto:barbara@roxwater.org); [mike@roxwater.org](mailto:mike@roxwater.org); [barry@wrwdistrict.com](mailto:barry@wrwdistrict.com); [bearcreekwater@bearcreekwater.org](mailto:bearcreekwater@bearcreekwater.org); [barney.fix@merrick.com](mailto:barney.fix@merrick.com); [janwalker@bearcreekwater.org](mailto:janwalker@bearcreekwater.org); [berkeleywater@gmail.com](mailto:berkeleywater@gmail.com); [blavoie@highlandsranch.org](mailto:blavoie@highlandsranch.org); [calane@plattecanyon.org](mailto:calane@plattecanyon.org); [cbrownell@geneseewater.com](mailto:cbrownell@geneseewater.com); [culp@culp.ws](mailto:culp@culp.ws); [reid.dewalt@state.co.us](mailto:reid.dewalt@state.co.us); [dgarcia@sdmsi.com](mailto:dgarcia@sdmsi.com); [engineering@cmwc.net](mailto:engineering@cmwc.net); [info@bennettbearcreekfarmsdistrict.com](mailto:info@bennettbearcreekfarmsdistrict.com); [info@lookoutmountainwaterdistrict.org](mailto:info@lookoutmountainwaterdistrict.org); [will.raatz@w2eng.com](mailto:will.raatz@w2eng.com); [jcs@jsimonson.com](mailto:jcs@jsimonson.com); [jstawski@evergreenmetro.org](mailto:jstawski@evergreenmetro.org);

[recept@evergreenmetro.org](mailto:recept@evergreenmetro.org); [kgunderson@broomfield.org](mailto:kgunderson@broomfield.org); [ljohnson@sdmsi.com](mailto:ljohnson@sdmsi.com); [lvullo@kcwater.org](mailto:lvullo@kcwater.org); [manager@greenmountainwater.org](mailto:manager@greenmountainwater.org); [manager@lakehurstwater.org](mailto:manager@lakehurstwater.org); [sdaldegan@lakehurstwater.org](mailto:sdaldegan@lakehurstwater.org); [mstaheli@cordesco.com](mailto:mstaheli@cordesco.com); [mwsd@mtwaterandsan.com](mailto:mwsd@mtwaterandsan.com); [mwsd@qwestoffice.net](mailto:mwsd@qwestoffice.net); [nicki@jsimonson.com](mailto:nicki@jsimonson.com); [nickie@nmholderfinancial.com](mailto:nickie@nmholderfinancial.com); [norm@hch2o.com](mailto:norm@hch2o.com); [rlewis@rockymtnoptions.com](mailto:rlewis@rockymtnoptions.com); [office@meadowbrookwaterdistrict.com](mailto:office@meadowbrookwaterdistrict.com); [office@willowbrookwater.org](mailto:office@willowbrookwater.org); [steve@purringtoncivil.com](mailto:steve@purringtoncivil.com); [philrvwsd@comcast.net](mailto:philrvwsd@comcast.net); [pvwsd@pvwsdistrict.org](mailto:pvwsd@pvwsdistrict.org); [nickm@publicalliancellc.com](mailto:nickm@publicalliancellc.com); [rclayshulte@earthlink.net](mailto:rclayshulte@earthlink.net); [rcox@fruitdale.net](mailto:rcox@fruitdale.net); [gmariano@fruitdale.net](mailto:gmariano@fruitdale.net); [bwillis@martinmartin.com](mailto:bwillis@martinmartin.com); [sbeck@sdmsi.com](mailto:sbeck@sdmsi.com); [sgrooter@cityofwestminster.us](mailto:sgrooter@cityofwestminster.us); [stevejhille@earthlink.net](mailto:stevejhille@earthlink.net); [timl@bancroftclover.com](mailto:timl@bancroftclover.com); [Barney.fix@merrick.com](mailto:Barney.fix@merrick.com); [tjbenton80425@aol.com](mailto:tjbenton80425@aol.com); [triggle@evergreenmetro.org](mailto:triggle@evergreenmetro.org); [v.waterdist\\_kathy@comcast.net](mailto:v.waterdist_kathy@comcast.net); [wendy@ntmwater.org](mailto:wendy@ntmwater.org); [bart@ntmwater.org](mailto:bart@ntmwater.org);

[Planning&Zoning-All@co.jefferson.co.us](mailto:Planning&Zoning-All@co.jefferson.co.us)

## Interested Citizens

P & J Olson <[wsufans@wispertel.net](mailto:wsufans@wispertel.net)>

## Engineers

[drew@insightengineering.org](mailto:drew@insightengineering.org); [douglassengineering1@gmail.com](mailto:douglassengineering1@gmail.com); [chris@purringtoncivil.com](mailto:chris@purringtoncivil.com); [jennifer@285engineering.com](mailto:jennifer@285engineering.com); [john@insightengineering.org](mailto:john@insightengineering.org); [tfrazier@redland.com](mailto:tfrazier@redland.com);

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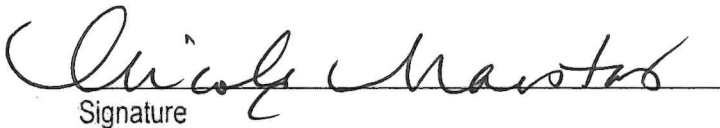
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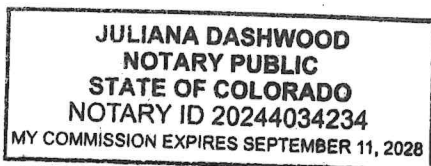
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3. The notice that is attached hereto  
is a true copy, published in Your Hub  
for West Jeffco (including the counties  
of Jefferson, Arapahoe, Arvada, Denver, Lakewood, Gilpin,  
Clear Creek, and Westminster) on the following date(s):

May 22, 2025

  
Signature

Subscribed and sworn to before me this  
23 day of May, 2025.

  
Notary Public



(SEAL)

NOTICE OF PUBLIC HEARINGS FOR SPECIAL USE

NOTICE IS HEREBY GIVEN that the Board of County Commissioners of the County of Jefferson, State of Colorado will hold a hybrid (in-person and online virtual) public hearing on a proposed rezoning of certain property within Jefferson County, Colorado. The public hearing will be held at the Jefferson County Administration and Courts Facility, Hearing Room 1, at 100 Jefferson County Parkway, Golden, Colorado, on June 10, 2025 at 9:00 a.m. with the virtual hearing link being available on the County's website at <https://www.jeffco.us/meetings>.

FURTHER NOTICE IS HEREBY GIVEN that said public hearings may be continued from time to time without further notice.

Said proposed rezoning is Case No. 24-133066RZ/South Golden Road / Mt. Vernon Mixed-Use ODP Amendment, which proposes to rezone from Planned Development (PD) to a new Planned Development to amend the existing South Golden Road / Mt. Vernon Mixed-Use Official Development Plan zone district boundary which allows a mixed-use project with ground-floor retail and up to 200 multi-family residential dwelling units above, and to preserve the Rock Rest Lodge.

Said property is located at: 16121 W 10th Ave, 16129 W 10th Ave, 16005 Mt Vernon Rd, and 16100 S Golden Rd, Golden, which contains approximately 5.87 acres.

BE IT ALSO KNOWN that the text and/or maps relating to the above referenced rezoning and any text and/or maps so certified by the Jefferson County Planning Commission may be examined by contacting the Jefferson County Planning and Zoning Division during any working day. You can reach Planning & Zoning at 303-271-8700 or [pzweb@jeffco.us](mailto:pzweb@jeffco.us).

BOARD OF COUNTY COMMISSIONERS  
COUNTY OF JEFFERSON  
STATE OF COLORADO

Published May 22, 2025

/s/ Lesley Dahlkemper, Chairman

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# **PROPOSED REGULATIONS – CLEAN COPIES**

# **TRANSPORTATION DESIGN AND CONSTRUCTION MANUAL – CLEAN COPY**



# Jefferson County

# Transportation Design & Construction

# Manual

JEFFERSON COUNTY, COLORADO PLANNING AND ZONING DIVISION

## *Revision Dates*

*The Transportation Design & Construction Manual, formerly known as Roadway Design & Construction Manual, adopted by the Board of County Commissioners of Jefferson County, Colorado on March 21, 1995, has since been amended on the following dates:*

*December 5, 1995*

*May 12, 1998*

*March 23, 1999*

*October 1, 2002*

*July 1, 2003*

*November 25, 2003*

*December 5, 2006*

*May 20, 2008*

*October 13, 2009*

*November 24, 2015*

*July 17, 2018*

*December 17, 2019*

*XX-XX-XX*

Jefferson County Planning and Zoning Division

100 Jefferson County Parkway, Suite 3550, Golden, Colorado 80419

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## ***Chapter I***

# **General Provisions**

## **1.1. Short Title**

These regulations together with all future amendments shall be known as the “Jefferson County Transportation Design and Construction Manual” (hereafter called MANUAL) as referenced in the Jefferson County Land Development Regulation (hereafter called LDR) and the Jefferson County Zoning Resolution (hereafter called ZR).

## **1.2. Jurisdiction**

The requirements of this MANUAL shall apply to all subdividers, developers or other landowners, their employees, agents or contractors designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations. The foregoing design and construction of transportation systems are subject to review and approval by the County pursuant to any County regulation or requirement.

## **1.3. Purpose and Effect**

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads. All land development or any other proposed construction submitted for approval under the provisions of the LDR and/or ZR as applicable, shall include adequate transportation system analysis and appropriate transportation system design. Such analysis and design shall conform to the criteria set forth herein. Technical criteria not specifically addressed in this MANUAL shall follow the provisions of the American Association of State Highway and Transportation Officials (AASHTO) “A Policy of Geometric Design of Highways and Streets”, as amended; the Colorado Department of Transportation (CDOT) Design Standards, as amended; and the Manual on Uniform Traffic Control Devices (MUTCD), as amended.

## **1.4. Enactment Authority**

The LDR has been adopted pursuant to the authority conferred within: Article 28 of Title 30 (County Planning); Article 2 of Title 43 (State, County, and City Highway Systems); Article 20 of Title 29 (Land Use Control and Conservation); and other applicable sections of the Colorado Revised Statutes, as amended.

This MANUAL is adopted by resolution of the Board of County Commissioners, as the authority provided by which the County promulgates the LDR.

Transportation Design and Construction Manual – Amended XX-XX-XX

### **1.5. Amendment and Revisions**

These criteria may be amended as new technology is developed and/or if experience gained in the use of this MANUAL indicates a need for revision. Amendments and revisions will be made by resolution of the Board of County Commissioners.

### **1.6. Enforcement Responsibility**

It shall be the obligation of the Board of County Commissioners acting through the Department of Development and Transportation to enforce the provisions of this MANUAL.

### **1.7. Review and Approval**

The County will review all submittals for compliance with this MANUAL. An approval by the County does not relieve the owner, engineer, or designer from responsibility of ensuring that the calculations, plans, specifications and construction are in compliance with the MANUAL and accepted engineering practices.

### **1.8. Interpretation**

In interpretation and application of the provisions of the MANUAL, the following shall govern:

1.8.1. The provisions shall be regarded as the minimum requirements for the protection of public health, safety, comfort, convenience, prosperity, and welfare of the residents of the County.

1.8.2. Whenever a provision of this MANUAL and any other provision of the LDR or any provision in any law, ordinance, resolution, rule, or regulation of any kind, contains any restriction covering any of the same subject matter, whichever restrictions are more restrictive or impose higher standards of requirements shall govern.

1.8.3. This Jefferson County Transportation Design and Construction Manual was adopted by the Board of County Commissioners on March 21, 1995. Any amendments to this MANUAL shall be immediately effective upon its adoption by the Board of County Commissioners. All applications shall be subject to the provisions of this MANUAL that are in effect at the time of the formal application submittal, unless otherwise specified by the Board of County Commissioners resolution.

### **1.9. Relationship to Other Standards**

If the State or Federal Government imposes stricter criteria, standards, or requirements, these shall be incorporated into the County's requirement after due process and public hearings needed to modify the County's regulations and standards.

## ***Chapter 2***

# **Construction Drawing Requirements**

### **2.1. General Requirements**

Construction drawings must be submitted in Portable Document Format (PDF) unless otherwise approved for hard copy submittal, to scale, shall be a complete package, which includes all details and documentation necessary for the construction of the proposed improvements. The plans shall be prepared by, or under the direction of a professional engineer, registered in the State of Colorado, and qualified in the field of civil engineering.

The final set of plans (hard copy) for each drawing shall be 24" x 36", unless otherwise approved by the County, and shall contain a title block, sheet number, scale, north arrow, and date.

The developer's engineer shall comply with Colorado Revised Statute 9-1.5-101 through 9-1.5-108 "Excavation Requirements" when the nature of work proposed (1) will involve a contract with Jefferson County (this shall include, but not be limited to binding agreements such as permits and Subdivision Improvement Agreements); (2) will involve primarily Horizontal Construction and not the construction of buildings; (3) will involve excavation that exceeds two (2) feet in depth and that is a contiguous 1,000 square feet, or involve Utility

Boring; and (4) requires the design services of a licensed professional engineer. Existing and Proposed Subsurface Utilities shall be identified on the design plans in accordance with ASCE 38 Standards. For more information please reference the Colorado Revised Statutes and Federal Highway Administration websites.

## **2.2. Cover Sheet**

A cover sheet shall be provided with each submittal which contains the following:

1. A vicinity map at a minimum scale of 1" - 2000' which shows the location and name of all arterial streets/roads within one mile of the proposed development and all streets/roads within the proposed development.
2. A legend, scale, and north arrow.
3. General notes.
4. Index of sheets.
5. Seal, signature, and date of the professional engineer responsible for plan preparation.
6. A permanent benchmark description and location based on USGS datum. At least one permanent benchmark must be established within each subdivision or filing thereof, located on public property.

If a cover sheet is not provided, the above information shall be included on the first sheet of the submittal.

## **2.3. Plan**

The plan view shall include but not be limited to, the following:

1. The scale shall be a minimum of one (1) inch to fifty (50) feet and shown on the plan.
2. Locations and dimensions of existing and proposed improvements, property lines, easements, and Right-of-Way. Plan view limits shall extend 100 linear feet before the Point of Beginning, and 100 linear feet after the Construction End. Each Point of Beginning and Construction End shall be clearly labeled and identified with stationing.
3. Names of streets/roads.
4. Survey line ties to section or quarter corners.
5. Survey lines and centerline stationing. Stationing shall be equated to flowline stationing at horizontal radius curves, cul-de-sacs, and other departures from normal roadway cross sections.
6. Centerline stations for all intersecting roadways and commercial driveways.
7. Existing and proposed street/road improvements (sidewalk, curb, gutter, pavement limits, bridges, culverts, inlets, manholes, asphalt core sample locations, guardrails, curb ramps, etc.). Existing improvements shall be clearly depicted by a dashed line; proposed improvements shall be depicted by a solid line and or greyscale or hatching. Plans shall include existing and proposed limits for asphalt pavement, including areas of milling and overlaying, as well as new asphalt placement. All items shall have a corresponding legend.
8. Curve layout including radius, degree of curve, deflection angle, length of curve, point of curvature, and point of tangency.
9. Elevations and station shall be noted for all curb returns, points of curvature, points of tangency, and high or low points of all vertical curves. The existing and proposed percent cross slope shall be repeated on the plan sheets at select points. Include elevations and cross slopes, existing and proposed, for all lanes of intersection improvements, regardless if construction is planned for opposing streets.
10. Rate of super elevation.
11. Typical template(s) for streets/roads.

12. Match lines and consecutive sheet numbers.
13. Key map.
14. A minimum of one (1) permanent bench mark, based on United States Geological Survey's datum, fully described, within each subdivision or filing thereof.
15. Existing and proposed utilities and structures, including but not limited to: water, fire hydrants, sanitary sewer, storm sewer, telephone, gas, electric, cable television, fiber optic. Existing utility pothole information shall be organized on a separate plan sheet to identify location, depth, utility type, pipe size and material, conflicts with proposed improvements, and other information obtained during subsurface investigation. Subsurface investigation shall include new laterals or service connections to existing main lines and be clearly shown on separate plan sheets. \*
16. Stations and critical elevations of all utility and drainage appurtenances. \*
17. Construction phasing. \*
18. Major Collector and/or Arterial intersection design at a scale of one (1) inch to twenty (20) feet. \*
19. Traffic signal design at a scale of one (1) inch to twenty (20) feet. \*
20. Signing and Striping Plan.
20. Noise attenuation measures/details. \*
21. Trails. \*
22. Sediment and erosion control measures/details. \*
23. Landscaping. \*

\*May be included on separate plan sheets.

## **2.4. Profile**

The profile shall include, but not be limited to the following:

1. The scale shall be a minimum of one (1) inch to five (5) feet for street profiles and a minimum of one (1) inch to ten (10) feet for road profiles, and be shown on the plan.
2. Existing (dashed line) and proposed (solid line) grades.
3. Continuous centerline stationing for the entire portion of the existing and proposed roadway shown in the plan. Clearly label centerline stationing for all intersecting roadways and commercial driveways.
4. All design elevations shall be centerline, flowline, back of curb, or lip of gutter.
5. Vertical curve data including length of curve, P.V.C., P.V.T., P.V.I., beginning and end grades. All vertical curves shall be symmetrical.
6. Curb return profiles at a horizontal scale of 1" = 10' and vertical scale of 1" = 1'.
7. All existing curbs, gutters, sidewalks, culverts or storm sewers, ditches and irrigation structures and asphalt adjacent to the proposed design, as well as the same such features that are 100 linear feet before the Point of Beginning and continue for 100 linear feet beyond the Construction End. Basis for existing grades shall be as-built elevations at intervals not to exceed fifty (50) feet. All existing grades, locations and alignments shall be field surveyed by a licensed Professional Land Surveyor for design of the proposed improvements. Previously approved designs are not an acceptable means of establishing existing grades.
8. Separate flowline or top of curb profiles shall be provided for all proposed curb and gutter, including for design of cul-de-sacs and any other departure from a 2% street/road cross slope. In addition, cross-sections at intervals not to exceed 50 feet are required if a departure from a normal cross-slope is proposed.
9. Existing and proposed utilities. \*

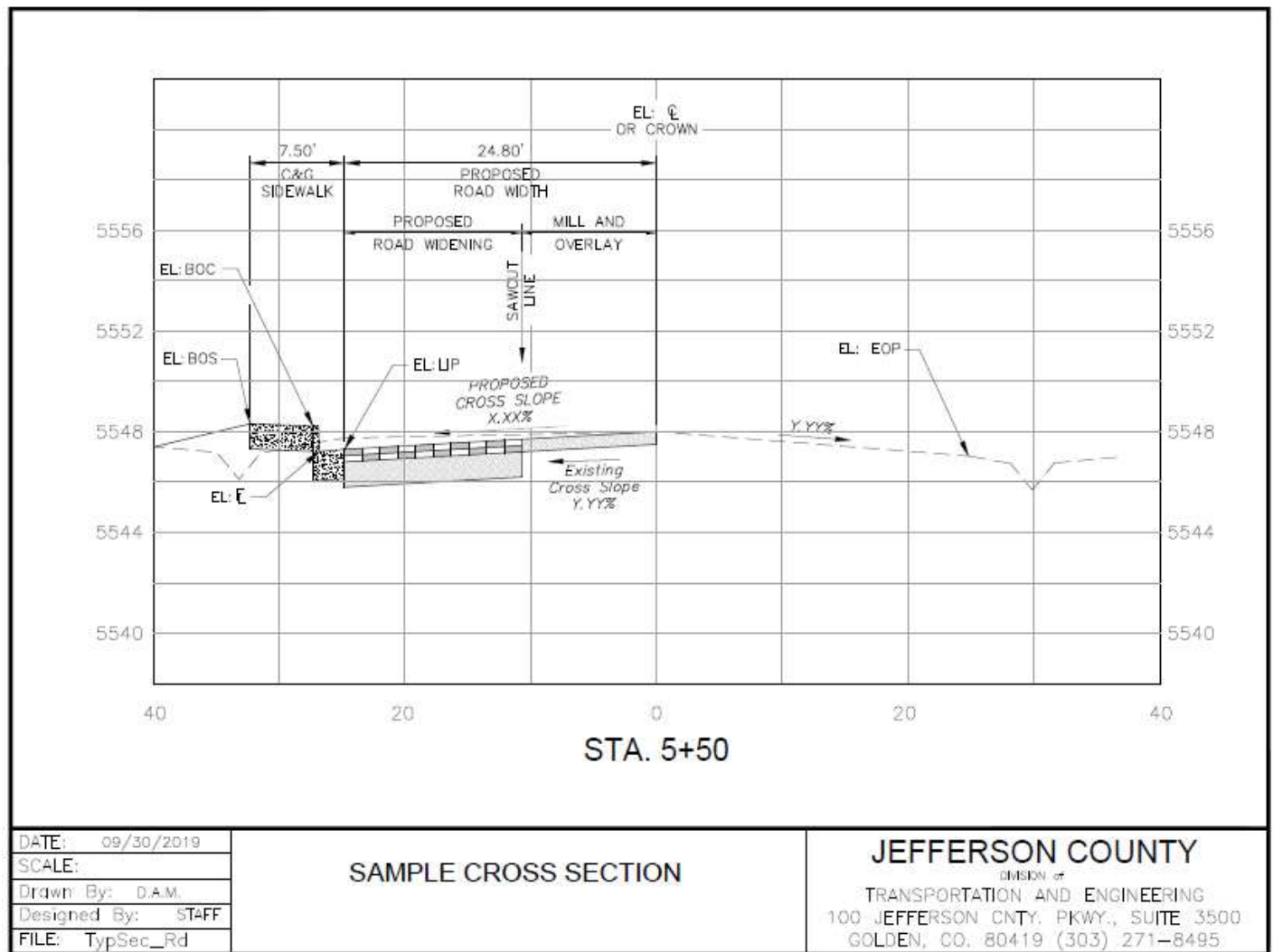
\*May be included on separate plan sheets.

## **2.5. Cross Sections**

1. On widening or matching projects, or as required by the Jefferson County Planning & Zoning, cross sections of the proposed new construction and existing improvements within the Right-of-Way shall be provided at survey stationing at a maximum of fifty foot intervals and at locations of cross culverts. The scale shall correspond to that used on the plan and profile.
2. Cross sections shall identify both the existing or matching percent cross slope of the roadway, as well as percent proposed cross slope.
3. Cross sections shall identify the elevation at the point of match for widening projects for each station interval.
4. Cross sections shall identify the proposed new road segment in gray scale or other hatching.
5. Cross sections shall identify the proposed pavement treatment or alterations, such as mill and overlay of the match point; as well as the proposed new pavement section and respective lifts asphalt.
6. Core samples shall be collected from the existing roadway prior to construction to determine the existing asphalt depth and condition. Such cores shall not exceed 4-inches in diameter and shall be collected at the centerline of the existing road, as well as edge of existing asphalt. The existing depth of asphalt shall be represented on the cross sections.
7. Proposed widening shall avoid cross sections with gross inverts or peaks at the match point. Normal roadway cross sections shall follow AASHTO design criteria that limit the minimum cross slope to 1.5% and maximum cross slope to 3.0%. Cross slope grade change shall not exceed +/- 0.5% as measured every 50 linear feet along the station intervals. There shall be no change in existing cross slope greater than +/- 1.0% from the match point to the proposed edge of asphalt, or the flow line or the lip of the gutter pan.

Refer to Figure 2-1 "Sample Cross Section" below:

Figure 2-1 - Sample Cross Section



## 2.6. Details

Jefferson County or CDOT standard details shall be referenced as applicable. Where these standards cannot be used, a separate detail sheet shall be provided with an explanation detailing why these standard details are not being used.

## 2.7. Standard Notes

The following general notes shall appear on the cover sheet or the first sheet of the plans for all street/road construction plan packages.

1. A Construction Permit from Transportation and Engineering is required prior to commencing work within County Right-of-Way.
2. Any work within State Right-of-Way will require a State Construction Permit.
3. The contractor shall notify Transportation and Engineering at least 24 hours prior to starting construction within the Right-of-Way.
4. The contractor shall provide all signs, barricades, flaggers, lights, or other devices necessary for safe construction traffic control in accordance with the current edition of the MUTCD and as modified by the Colorado Supplement to the MUTCD. A construction traffic control plan shall be submitted to and approved by Transportation and Engineering prior to the issuance of any construction permit for



work within County Right-of-Way.

5. The contractor shall contact the Utility Notification Center of Colorado at least 48 hours prior to construction.
6. Construction specification: Current edition of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, special provisions and revisions thereto, and as amended by Chapter 5 of this MANUAL.
7. The subgrade material shall be scarified or removed to a depth required by Jefferson County per information obtained from laboratory tests and/or as required in the Pavement Design Report. Additives or approved material may be required if the native material is unsatisfactory. The subgrade shall be compacted to a minimum density and moisture content range of 2 percent below optimum to 2 percent above as determined in accordance with AASHTO designation T180 or T99 and in accordance with the Standard Specifications Section 203.07.
8. Class 6 aggregate base course for shoulders shall be placed and compacted 95 percent modified Proctor Test (AASHTO T180) after placement of asphalt.
9. Existing asphalt pavement shall be straight sawcut or blade-cut when adjoining with new asphalt pavement. SS-1 tack coat shall be applied to all surfaces.
10. Structural section, including subbase and asphalt, shall be constructed according to the Final Pavement design that has been prepared by the developer's engineer, and approved by Transportation and Engineering according to Chapter 4 of this MANUAL. Existing structural section at the match point shall comply with the minimum Full Depth Asphalt thickness identified in Table 4.3 "Minimum Pavement Sections" of this MANUAL for the respective road classification, regardless of the original thickness of asphalt and / or sub-base.

The following notes shall appear in addition to the above for all street construction, as applicable:

1. Concrete may be placed by machine methods if all finish lines are within 1/8" + tolerance of the lines shown on the plans. The flowline must be free draining and comply with this MANUAL.
2. One half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.
3. The contractor is advised to first obtain inspection of forms by Transportation and Engineering before placing concrete curb, gutter, sidewalk, inlets, and/or other concrete drainage structures.

### *Chapter 3*

## **Design and Technical Criteria**

### **3.1. General**

This section sets forth the minimum design and technical criteria to be used in the preparation of all public and private street/road construction plans. All street/road design shall be in accordance with the current edition of AASHTO Geometric Design of Highways and Streets, unless modified herein.

For this regulation, streets shall be used in the Plains and roads shall be used in the Mountains, except as indicated below:

- 3.1.1 Roads may be allowed in the Plains in locations with slopes greater than 15%, subject to approval by Planning and Zoning.
- 3.1.2 Streets may be required in the following Mountains locations as directed by Planning and Zoning: 1) Areas where urban development is projected based on Community Plans designations, 2) Areas where curb and gutter would be needed to mitigate drainage impacts.

## **3.2. Street/Road Types**

3.2.1 Public Streets/Roads: Streets or roads that are owned and maintained by the City, County or State for public use.

3.2.2 Private Streets/Roads: Streets or roads that are owned, maintained, or restricted for the use by a person, group of people, or non-governmental entity.

3.2.3 Non-Maintained Streets/Roads in County ROW: Streets or roads that are owned by the County for public use, but are not constructed to a County public standard and are not County maintained.

## **3.3. Functional Classification**

Jefferson County has adopted a Major Thoroughfare Plan based on traffic volumes, existing and/or zoned land use, and anticipated growth. The Major Thoroughfare Plan designates streets/roads as freeway, parkway, principal arterial, minor arterial, major collector, or collector.

3.3.1. Freeway: A freeway serves major regional traffic movements and carries the highest traffic volume of all classifications. A freeway is planned to have four to six through lanes and may have frontage roads. The movement of traffic takes precedence over access. Access is fully controlled and is allowed only to other freeways or to arterials by grade separated interchanges. Opposing movements on a freeway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes. A freeway may be developed as a parkway with at-grade intersections as a first phase. Freeways are typically in State jurisdiction.

Design Speed: Special Design Required

3.3.2. Parkway: A parkway serves major regional traffic movements and carries high traffic volumes. A parkway is planned to have four to six through lanes. The movement of traffic takes precedence over access. Access is fully controlled and allowed only to major collector classifications or higher. Grade separation at major intersections is preferred over traffic signals. Opposing movements on a parkway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 40 - 50 MPH

3.3.3. Arterial.

3.3.3.1. Principal Arterial: A principal arterial serves major regional traffic movements and carries high traffic volumes. A principal arterial is planned to have four to six through lanes in the Plains and four through lanes in the Mountains. The movement of traffic takes precedence over access. Access is controlled and allowed to collectors and higher class facilities is preferred, but some restricted access to major developments may be allowed. Opposing movements are usually separated by a raised, depressed, or painted median. Pedestrians and bicycle traffic may be carried on detached walks and trails unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 35 - 45 MPH

3.3.3.2. Minor Arterial: A minor arterial serves intracommunity traffic and carries moderate traffic volumes. Minor arterials are planned to have four lanes in the Plains. In the Mountains, minor arterials are planned to have two lanes, plus turn lanes and passing or climbing lanes where warranted. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally separated by a raised, depressed, or painted median in the Plains. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40 MPH

3.3.4. Major Collector: A major collector serves intracommunity traffic and carries moderate traffic volumes. Major collectors are planned to have two lanes, plus turn lanes where warranted, in the Plains and the Mountains. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally

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separated by a median/turn lane. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40MPH

3.3.5. Collector: A collector serves neighborhood traffic movements over short distances, generally accessing arterials and major collectors. A collector has two lanes, plus turn lanes where warranted, in the Plains and two lanes in the Mountains. Access takes precedence over the movement of traffic. Reasonable access for streets is allowed except for private residential driveways. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 25 - 30 MPH

3.3.5. Local: A local street or road serves neighborhood traffic over very short distances to higher class roadways. A local street or road has two travel lanes. It is always paved in the Plains and usually paved in the Mountains. Access to adjacent land is its primary purpose. All types of access are allowed. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 15 - 25 MPH

### 3.4. Standard Templates

The following templates reflect the minimum section for each street/road classification and for cul-de-sacs. Any additional requirements including, but not limited to, acceleration/deceleration lanes and left turn lanes are not shown.

Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
1	Principal Arterial Street	Greater than 25,000	130'
2	Minor Arterial Street	15,000 to 25,000	100'
3	Major Collector Street	8,000 to 15,000	84'
4	Collector Street (36' FL to FL) with Attached Sidewalks	1,000 to 8,000	50'
5	Collector Street (36' FL to FL) with Detached Sidewalks	1,000 to 8,000	37' + 20' minimum easement for sidewalks, maintenance and traffic signs
6	Local Street (34' FL to FL) with Attached Sidewalks	Less than 1,000	50'
7	Local Street (34' FL to FL) with Detached Sidewalks	Less than 1,000	35' + 20' minimum easement for sidewalks, maintenance and traffic signs
8	Local Street (28' FL to FL) with Attached Sidewalks	Less than 350	45'
9	Local Street (28' FL to FL) with Detached Sidewalks	Less than 350	30' + 18' minimum easement for sidewalks, maintenance and traffic signs

Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
10	Minor Arterial Road	Greater than 8,000	70'
11	Major Collector Road	2,000 to 8,000	50', 60' for turn lanes
12	Collector Road	1,000 to 2,000	50'
13	Local Road	Less than 1,000	50'
14	Street Cul-de-sac – Option 1 Street Cul-de-sac – Option 2 Street Cul-de-sac – Option 3		90' 100' 112'
15	Partial Cul-de-sac for Local Streets		45'
16	Offset Cul-de-sac for Local Streets – Option 1 Offset Cul-de-sac for Local Streets – Option 2 Offset Cul-de-sac for Local Streets – Option 3		90' 100' 112'
17	Cul-de-sac for Local Roads		90'
Driveway, private street/road templates and Non-maintained streets/roads in County ROW templates (see section 3.7.8) *			
18a	Driveway		14'- 16'
18b	Private Road		14'-24'
18c	Private Street with Curb and Gutter		14'-24'
18d	Private Street with Streetside Ditch		14'-24'
19	Pull Out for Private Road		
20	Hammerhead Turnaround for Driveway/Private Road		varies
21	Hammerhead Turnaround for Private Street		varies

\* The "non-maintained streets/roads in County ROW" templates can only be used if the following provisions apply:

1. The County is not holding a guarantee for a previous development process that would require the construction of a County public standard street/road in the ROW.
2. The County does not wish to have the street/road constructed to a County public standard.
3. The street/road is not identified on the Jefferson County Major Thoroughfare Plan.

## 3.5. Horizontal Alignment

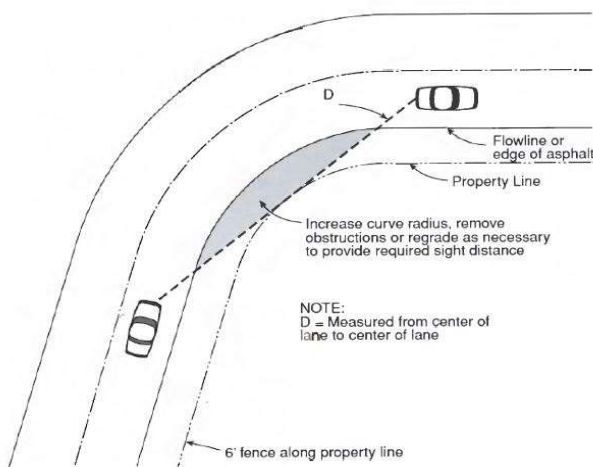
3.5.1. Horizontal Curves: The design of roadway curves should be based on an appropriate relationship between design speed and curvature and on their joint relationships with superelevation (roadway banking) and side friction. Although these relationships stem from the laws of mechanics, the actual values for use in design depend on practical limits and factors determined more or less

empirically, and the most recent edition of AASHTO Policy on Geometric Design of Highway & Streets (the Green Book) Chapter 3 should be referenced for designing appropriate horizontal curves.

**3.5.2. Super Elevation:** Super elevation is required for curves on all principal and minor arterial streets/roads and selected collector streets/roads. Minimum horizontal curve radius, rate of super elevation, and lengths of tangent runout and super elevation runoff shall be in accordance with the recommendations of the current edition of AASHTO Policy on Geometric Design of Highways and Streets.

Super elevation shall not be used on local streets, but may be used on local roads.

**3.5.3. Sight Distance:** Horizontal alignment must provide at least the minimum stopping sight distance for the design speed at all points. This includes visibility at intersections, as well as around curves and roadside encroachments. Where an object off the traveled surface restricts sight distance, the minimum radius of curvature is determined by the stopping sight distance. A likely obstruction may be a bridge abutment, retaining wall, cut slope, landscaping, or side or corner of a building. In considering sight distance, it shall be assumed a 6'-0" fence (as measured from finished grade) exists along all property lines except in the sight distance triangles required at all intersections. Minimum stopping sight distance (measured from the centerline of the inside lane) shall follow AASHTO Policy on Geometric Design of Highways & Streets (The Green Book) Chapter 3.



## 3.6. Vertical Alignment

**3.6.1. Grades:** The minimum grade for all new streets and roads is 2%, except within a sag. A minimum flowline grade of 1.5% shall be maintained around all full and partial cul-de-sac bulbs, except within a sag. Planning and Zoning may approve grades as low as 1% if existing conditions make it infeasible to construct a minimum of 1.5%. The maximum grade for all public streets is 6.0% and for public roads is 8.0%. The maximum grade for public roads may be increased to 10% where the dip of the natural terrain bears between South 60° East and South 45° West.

**3.6.2. Intersection Grades:** The maximum grade at intersections shall

be in accordance with the following figure and table. Grades and lengths apply to the street/road controlled by a stop sign. At signalized and uncontrolled intersections, grades and lengths apply to all legs of the intersection.

	Through Street / Road		
Intersection Street/Road	Local	Collector	Major Collector/Arterial
Local	50' @ 4%	100' @ 4%	100' @ 4%
Collector	-	100' @ 3%	200' @ 2%
Major Collector/Arterial	-	-	200' @ 2%

**3.6.3. Changing Grades.** Continuous grade changes shall not be permitted. The use of grade breaks in lieu of vertical curves is discouraged; however, if a grade break is necessary and the algebraic difference in grade (A) does not exceed four-tenths (0.40) of a percent along the street/road, the grade break will be permitted.

The maximum grade break allowed at the point of tangency at a curb return for local and collector streets shall be two (2) percent and a maximum of one (1) percent for arterial streets.

3.6.4. Vertical Curves. All vertical curves shall be symmetrical. A vertical curve shall be used when the algebraic difference in grade (A) equals or is greater than four-tenths (0.40) of a percent. The minimum grade within a sag (sump) vertical curve is five-tenths (0.50) of a percent. All vertical curves shall be labeled, in the profile with curve length (L) and K value ( $= L/A$ ). Vertical Curve requirements shall apply to all public and private streets, roads and driveways. The minimum K values for crest and sag vertical curves shall be in accordance with the current edition of AASHTO Policy on Geometric Design of Highways & Streets (The Green Book) Chapter 3.

### 3.6.5. Connection with Existing Streets/Roads

3.6.5.1. Connection with existing roadways shall be smooth transitions conforming to normal vertical curve criteria (see Section 3.6.4. of these standards) if the algebraic difference in grade (A) between the existing and proposed grade exceeds four-tenths (0.40) of a percent. When a vertical curve is used to make this transition, it shall be fully accomplished prior to the connection with the existing improvement, and comply with the grade requirements at intersection approaches.

3.6.5.2. Existing grade shall be shown for at least three hundred (300) feet with field verified as-builts showing stations and elevations at twenty-five (25) foot intervals. In the case of connection with an existing intersection, these as-builts are to be shown within a three hundred (300) foot radius of the intersection. This information will be included in the plan and profile that show the proposed roadway.

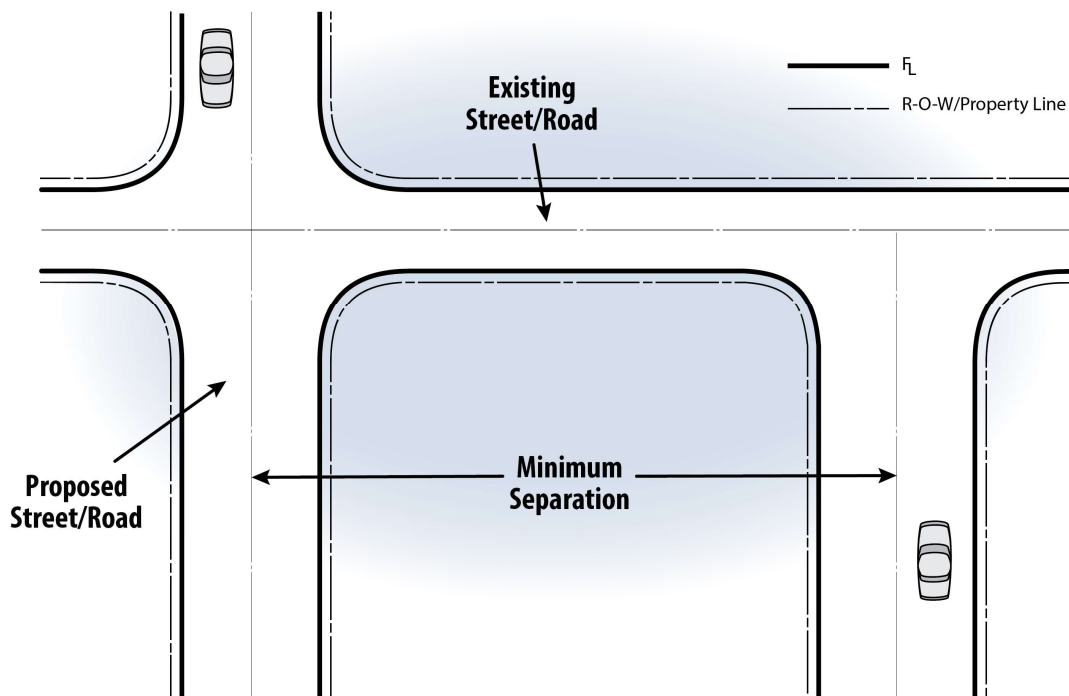
3.6.5.3. Previously approved designs for the existing improvement are not an acceptable means of establishing existing grades; however, they are to be referenced on the construction plan where they occur.

3.6.5.4. The basis of the as-built elevations shall be the same as the design elevations (both flowline or top of curb, etc.) unless otherwise approved by Planning and Zoning.

## 3.7. Intersection Spacing, Vision Clearance Triangle and Sight Distance for Streets, Roads and Driveways

3.7.1. Intersection Spacing: Spacing of intersections (measured centerline to centerline) shall be in accordance with the following table and the graphic below:

Proposed Street/Road: Existing Street/Road	Minimum Separation (feet)
Local: Local or Collector	175
Local: Arterial or Major Collector	500
Collector: Collector	230
Collector: Major Collector	660
Collector: Arterial or higher	1000
Major Collector: Major Collector	1000
Major Collector: Arterial or higher	1320
Arterial: Arterial or higher	5,280'

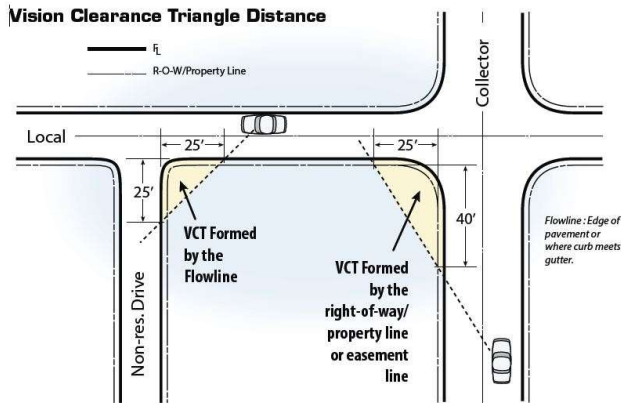


3.7.2. Vision Clearance Triangle: The table below shows where a vision clearance triangle must be provided.

Required	Not Required
Street/Road Intersections	Intersection of internal drive isles in non-residential*
Intersections of non-residential driveways with streets/roads	Multi-family and townhome developments*
Intersections of multifamily and/or townhome residential drive isles with streets/roads	
Intersections of street/roads and railroad Right-of-Way	

\*Layout of these types of developments should not impede a driver's ability to see on-coming vehicles and pedestrians at intersections

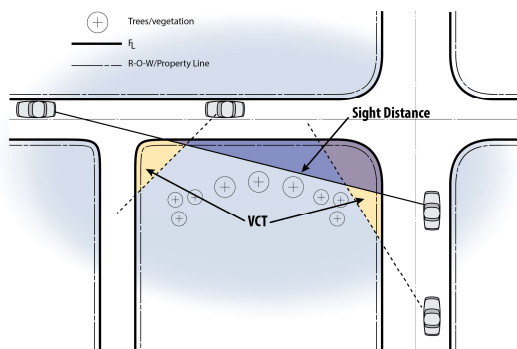
As illustrated below, the vision clearance triangle must provide an unobstructed view across the triangle formed by the Right-of-Way/property line or easement line adjacent to a street or road as illustrated. The vision clearance triangle may also be formed by the flowline adjacent to a street or road as illustrated below subject to approval by Planning and Zoning. The approval of the vision clearance triangle formed by a flowline is predicated on a fully built-out street or road and existing Right-of-Way that exceeds the Right-of-Way requirements in the Land Development Regulation. Within the area of the triangle, there shall be no fence, wall, landscaping, structure or other obstruction to view more than forty-two (42) inches in height (measured from the flowline or edge of pavement on the street/road surface). The allowable height of forty-two (42) inches is determined by measuring from the flowline or edge of pavement, as applicable. For example, the grade on a lot within the triangle is 12" higher than the flow line of a gutter, the allowable height of landscaping would be 30" on the property.



Street/Road Classification	Required Distance from Intersection
Non-residential drive	25'
Local	25'
Collector	40'
Major Collector/Arterial/Parkway	55'
Railroad Right-of-Way	55'

Note that if there is any conflict between this provision (3.7.2) and the Sight Distance provision (3.7.2.1) of this MANUAL, the Sight Distance provision shall take precedence. Note that if a physical median exists or is proposed at an access point restricting or eliminating a conflict point, the Vision Clearance Triangle requirements will not apply where no conflict points exist. See graphic below for a comparison between Sight Distance and the Vision Clearance Triangle.

#### Comparison between Sight Distance and the Vision Clearance Triangle



3.7.2.1. Sight Distance: At any street/road intersections or multifamily residential, commercial and industrial site driveways, an unobstructed view as defined above must be provided across the area formed by the flowline or edge of pavement on one street/road and the flowline or edge of pavement of the intersecting street/road (or edge of driveway) and lines (labeled d1 or d2 on the Sight Distance figure) connecting them at ten (10) feet from their point of intersection. This area will be used to ensure that drivers of vehicles exiting from the stopped approach have the minimum required sight distance available. Minimum Sight Distance requirements for all

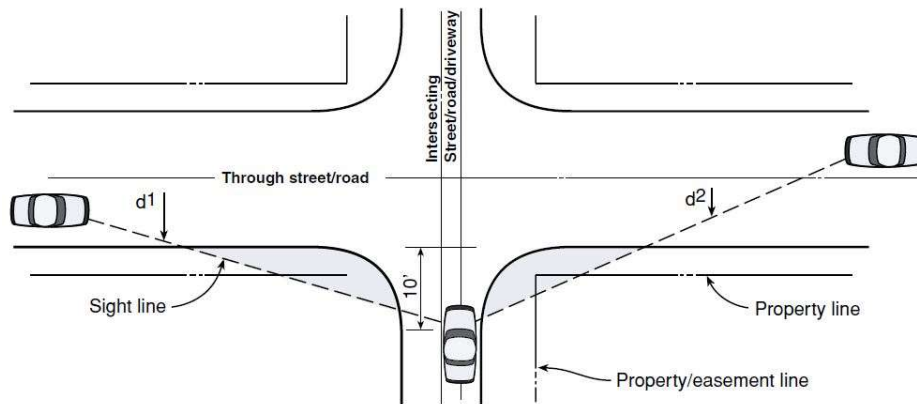


intersection types must follow the provisions covered in the current edition of AASHTO Policy on Geometric Design of Highways & Streets (The Green Book) Chapter 9.

### Minimum Sight Distance Requirements

*d1 Left sight distance measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the outside lane.*

*d2 Right sight distance measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the median lane.*



1. Requirements assume that the vehicle is stopped on the proposed public or private street/road or driveway.
2. Requirements are based on a 3.5-foot driver eye height in the stopped vehicle and a 4.25-foot height of the approaching vehicle.
3. The operating speed of the approaching vehicle is assumed to be the posted speed limit.
4. Truck traffic (WB30 or larger) entering onto streets/roads requires longer sight distances and the current edition of AASHTO Policy on Geometric Design of Highway & Streets Chapter 9 shall be referenced for the appropriate adjustment. Any proposed public or private street/road or driveway regularly used by truck traffic will require this analysis.
5. When the criteria for sight distances cannot be met, the County may deny the access, prohibit left turns by vehicles entering the street/road or require speed change lanes.

#### 3.7.3. Right Turn Lanes

3.7.3.1. Right Turn Acceleration Lanes: Right turn acceleration lanes may be required based on an approved transportation study. Right turn acceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning.

3.7.3.2. Right Turn Deceleration Lanes: Right turn deceleration lanes are required at arterial and major collector street/road intersections and at driveways on arterial streets/ roads as needed based on required transportation study/analysis. Transportation study/analysis shall address storage, as applicable. Right turn deceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning.

3.7.3.3. If the proposed street/road intersection or driveway is within two different speed zones, the criteria for the higher speed zone apply.

3.7.3.4. Where there are three or more through lanes in the direction of travel, right turn acceleration and deceleration lanes will be required only when determined necessary by Planning and Zoning due to high traffic volume or other site specific safety considerations.

3.7.3.5. Taper and lane lengths shall be in accordance with the following criteria after an engineering analysis shows conditions without any extenuating factors or alternative needs. All taper length and lane length alterations must be in accordance with the provisions set forth in the Transportation Design and Construction Manual – Amended XX-XX-XX

forward by the latest editions of the current edition of AASHTO Policy on Geometric Design of Highways & Streets and the Manual on Uniform Traffic Control Devices.

#### Deceleration Right Turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length* (Taper Length + Lane Length)
25	80'	120'	200'
30	100'	150'	250'
35	120'	190'	310'
40	140'	230'	370'
45	160'	280'	440'
50	180'	320'	500'

*\*At signalized intersections, where storage is needed for right-turning vehicles, additional length shall be provided to accommodate the average number of vehicles anticipated.*

#### Acceleration Right turn Lanes

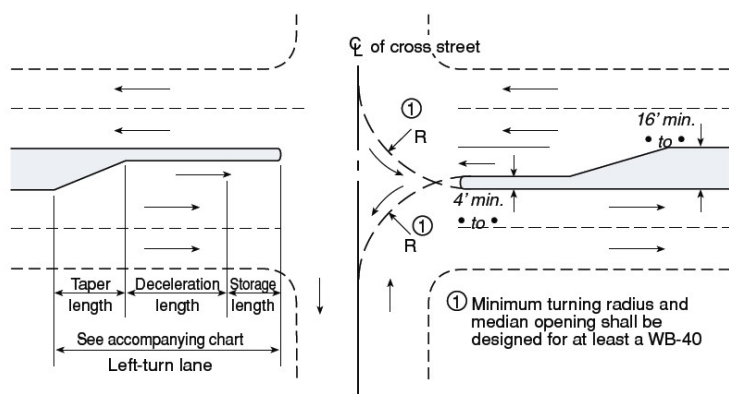
Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length (Taper Length + Lane Length)
30	120'	190'	310'
35	120'	270'	390'
40	180'	380'	560'
45	180'	550'	730'
50	240'	760'	1000'

3.7.3.6. A continuous accel/decel lane may be required if the acceleration lane for one access and the deceleration lane for another access overlap or are in close proximity to each other.

3.7.3.7. The minimum pavement width for acceleration and deceleration lanes shall be eleven (11) feet, excluding gutter pan or shoulder.

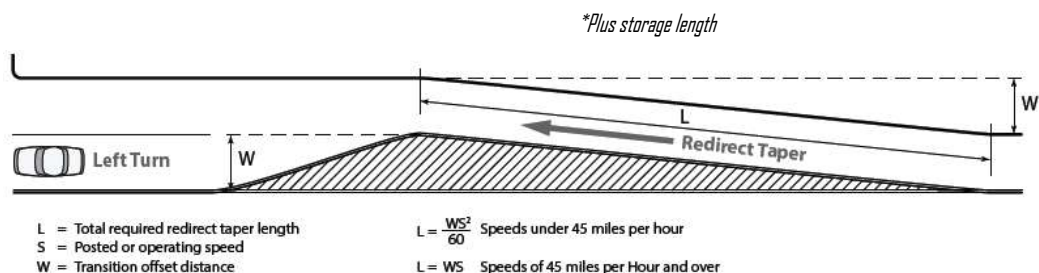
3.7.3.8. Grade correction factors are required where street/road grades are steeper than three (3) percent.

3.7.4. Left-Turn Lanes: Left-turn lanes are required at all arterial and major collector street/road intersections and at driveways on major collector/arterial streets/roads. Design of left-turn lanes shall be in accordance with the following criteria.



### Left-Turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Decel Length	Total Length
30	100'	150'	*250'
40	140'	230'	*370'
45	160'	280'	*440'
50	180'	320'	*500'



3.7.4.1. Storage Lengths: Storage lengths for signalized and unsignalized intersections shall be determined by an approved transportation analysis or transportation study, as applicable.

3.7.4.2. Median Design: Other left-turn median designs such as reverse curve taper, offset approach nose and double left-turn lanes must be approved by Planning and Zoning and shall conform to AASHTO standards.

### 3.7.5. Curb Returns

3.7.5.1. The table below provides the minimum street/road intersection radii measured to flowline or edge of pavement where no curb and gutter is required.

#### Curb Return Radii (R) To Flowline

Intersecting Street	Principal Arterial	Minor Arterial	Major Collector	Collector	Local
Principal Arterial	Special Design*	Special Design*	40'	40'	30'
Minor Arterial	Special Design*	Special Design*	30'	30'	25'
Major Collector	40'	30'	30'	30'	25'
Collector	40'	30'	30'	25'	20'
Local	30'	25'	25'	20'	20'/15'

*\*Special Design should provide consideration for right turn channelization.*

3.7.5.1.1. At driveway locations where curb returns are used, the minimum radii allowed on arterials and major collectors shall be twenty-five (25) feet.

3.7.5.1.2. At driveway or private access locations where there is no curb and gutter, the minimum radii (measured to edge of pavement) allowed on arterials and major collectors shall be twenty-five (25).

3.7.5.2. The minimum elevation difference (fall) around curb returns (PCR to PCR) for flow along the curb line shall be as follows:

Radius	Minimum Fall
15'	0.3'
20'	0.4'
25'	0.5'
All Others	1.27% of length from PCR to PCR

3.7.5.3. The maximum fall around curb returns shall be equal to the steepest grade coming into or out of the return multiplied by the return length, + 0.2 feet.

3.7.5.4. Curb Return Profiles: Curb return profiles are required for radii equal to or greater than thirty (30) feet within the public Right-of-Way. A midpoint elevation along the arc length of the curb return shall be shown in plan view for radii equal to or greater than twenty-five (25) feet. Curb return design shall be set in accordance with the following design procedure. General standards for flowline control and profiles within the curb returns shall be as follows:

3.7.5.4.1. The point of tangency at each curb return shall be determined by the projected tangent grade beginning at the point of intersection (P.I.) of the flowlines.

3.7.5.4.2. The arc length and external distance of the curb return shall be computed and indicated on the drawing.

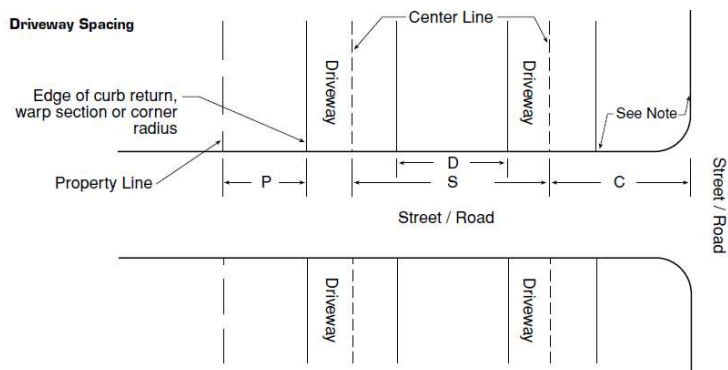
3.7.5.4.3. Show the corresponding flowline (or top of curb) grade for each roadway beyond the P.C.R.

3.7.5.4.4. Design of the curb return flowline shall be such that the maximum cross slope between the midpoint of the curve and the PICR (external distance) does not exceed +5 percent. Grade breaks at the PCR's will not exceed two (2) percent for local and collector streets and one (1) percent for arterials. The flowline design of the curb return will be accomplished within the return without affecting street grades beyond the PCR. Maximum vertical curves will equal the arc length of the curb return. The elevation and location of the high or low point within the return, if applicable, is to be called out in the profile.

3.7.5.4.5. Scale for the curb return profile is 1" = 10' horizontally and 1" = 1' vertically. See Section 2.4.6.

### 3.7.6. Driveway Spacing

Opposing and adjacent driveway locations shall be in accordance with the following figure and table. The minimum spacing shall be increased as necessary to accommodate left turn storage bays. Offset of opposing driveway locations is not required if driveways are physically constrained to right-in, right-out.



NOTE: Flowline of curb/gutter or edge of asphalt if curb/gutter does not exist or edge of shoulder if asphalt does not exist.

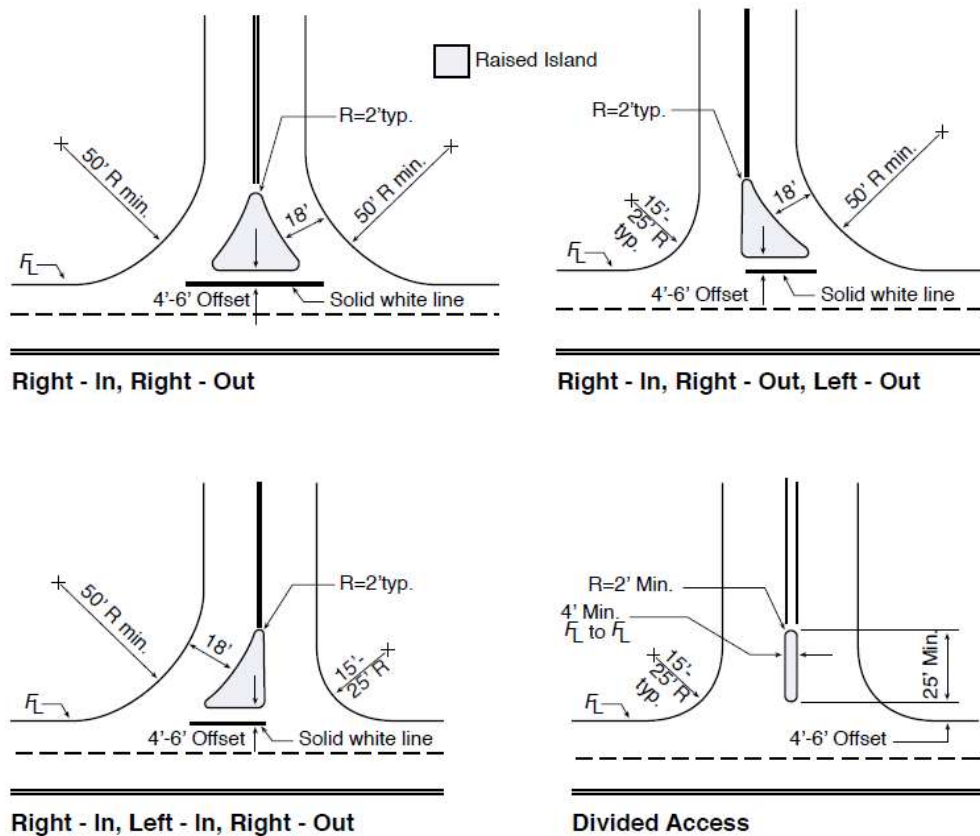
	Figure Reference	Distance
Residential Driveways		
From property lines	P	0'
From streets/roads	C	30'
Between driveways		
On local streets/roads	D	10'
On collector streets/roads	S	80'***
On major collector/arterial streets/roads	S	325'
Non-Residential Driveways on Locals/Collectors		
From property lines	P	0'
From major collectors/arterial streets/roads	C	300' *
From collector streets/roads	C	200' *
From local streets/roads	C	125'
Between driveways		
30 MPH design speed	S	180'
35 MPH design speed	S	200'
Non-Residential Driveways on Major Collectors/Arterials/Parkways		
From property lines	P	0'
From streets/roads	C	500' **
Between driveways		
40 MPH design speed	S	275'
45 MPH design speed	S	325'

\* The C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. The minimum distance shall be no less than 150 feet.

\*\* If the proposed driveway is restricted to right turn movements or if it is not aligned with an existing or planned left turn lane, the C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. If signalization is proposed, the minimum C distance shall be increased to 660 feet.

\*\*\*May be reduced for circular driveways or driveways with a standard hammerhead turnaround If approved by Planning and Zoning.

3.7.7. Channelizing Islands The following figures illustrate the minimum design for channelizing islands for site accesses with various turn movement restrictions.



3.7.7.1. Non-rigid post mounted delineators are required on raised islands.

3.7.7.2. Curb ramps four (4) feet wide, with a maximum slope of 12:1, are required and shall be shown on the plans.

3.7.8. Non-Maintained Roads in County Right-of-Way, Driveways, and Private Street/Road Standards.

**3.7.8.1. Driveways serving one dwelling unit shall meet the following standards (Template 18a):**

*Exception: If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.4. do not apply.*

3.7.8.1.1. Curve Radius: Minimum horizontal curve radius of 30 feet at centerline or as required by the applicable fire protection district.

3.7.8.1.2. Width: A total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side in accordance with Template 18a.

If the length of the driveway in the Mountains exceeds 500 feet, and is a total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side, then pullouts shall be required at 200-foot intervals in accordance with Template 19. Due to site constraints, this 200-foot interval could be modified by 50 feet in either direction. Alternatively, if pullouts are not desired, a total width of 16 ft, including a 12-foot all-weather travel surface and two-foot shoulders on either side is required.

3.7.8.1.3. Grade: Maximum grade of ten (10) percent on straight sections. Maximum grade of eight (8) percent for curves with radius of less than or equal to 50 feet at centerline.

*Exception: In the Mountains, a maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100) feet is allowed provided the appropriate fire sprinkler systems are installed per the National Fire Protection Association (NFPA) 13D or International Residential Code (IRC) P2904 - Standards for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes. There may be more than one section up to 15% provided they are separated by a distance of 1000 feet.* This Transportation Design and Construction Manual – Amended XX-XX-XX

*spacing may be reduced to 300 feet provided a pullout in accordance with this Manual is provided in a break between sections. This pullout is required regardless of the road width.*

3.7.8.1.4. Turnaround: If the length of the driveway exceeds 150 feet, a hammerhead turnaround shall be provided in accordance with Template 20. The centerline of the turnaround shall be located a minimum distance away from the structure. The minimum distance equals 1.5 times the height of the structure. Building height is measured as the distance between the average point between grade and the average point of the roof.

**3.7.8.2. Private streets/roads serving more than one dwelling unit and non-maintained streets/roads in county Right of Way shall meet the following standards (Templates 18b, 18c, and 18d):**

3.7.8.2.1. Curve Radius: Minimum horizontal curve radius of 30 feet at centerline or as required by the applicable fire protection district.

3.7.8.2.2. Width (For a street/road serving up to 15 dwelling units): A total width of 20 feet, including a 16-foot all-weather travel surface and two-foot shoulders on either side in accordance with Templates 18b, 18c or 18d. Alternatively, if a total width of 16 feet, including a 12-foot travel surface and two-foot shoulders on either side is proposed, then pullouts at 200 foot intervals in accordance with Template 19 are required. Due to site constraints, this 200 foot interval could be modified by 50 feet in either direction.

3.7.8.2.2.1. Width (For a street/road serving 16 or more dwelling units or one or more non-residential units): A total width of 24 feet, including an 18-foot paved surface (plains) or all-weather surface (mountains) and three-foot shoulders on either side is required in accordance with Templates 18b, 18c, or 18d.

3.7.8.2.3. Grade: Maximum grade of ten percent on straight sections. Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West. Maximum grade of eight percent for curves with radius of less than or equal to 50 feet at centerline.

**3.7.8.3. Non-Compliant Driveways/Private Streets/Roads:**

If the proposed or existing driveway or private street/road cannot meet the requirements of this section, the following shall be submitted to Planning and Zoning through a relief request:

1) A signed and stamped letter/statement by a qualified Colorado-registered professional engineer indicating:

- The existing and/or proposed conditions,
- The conditions that do not meet requirements, and documentation of why the requirements cannot be met,
- Any offsite improvements that can and will be completed,
- That the existing or proposed driveway or private street/road will be able to serve the residence under normal and expected conditions and that the existing and/or proposed design is satisfactory,
- That the material and method of work offered adequately meets the intent of this section and the minimum prescriptive requirements of the applicable International Fire Code (IFC) 104.9, and
- This statement shall include a detailed explanation of how an emergency apparatus within the appropriate fire protection district will be able to serve the residence under normal and expected conditions. This analysis may include auto-turn or turning radius templates. Such statement shall bear the professional engineer's seal, signature and date.

2) Plan and profile showing the existing conditions and proposed design, and

3) A written statement from the property owner that a fire sprinkler system will be installed per National Fire Protection Association (NFPA) 13D or International Residential Code (IRC) P2904 at the time of Building Permit.

4) Affidavit, signed by the property owner and recorded with the County stating that the property owner acknowledges that the driveway or street/road as proposed does not meet the requirements of the Transportation Design and Construction Manual and as a result, emergency services may be impacted. This form shall be provided by the County.

These submittal documents will be required to be reviewed and approved by Planning and Zoning prior to issuance of a building permit. Planning and Zoning may consult directly with the appropriate fire protection district when evaluating driveways or private streets/roads which cannot meet the requirements of this section.

Prior to closeout of the land disturbance permit, as-built drawings are required.

Note: This section applies to on or offsite private driveways/streets/roads on private land and within non-maintained County Right-of-Way or platted Right-of-Way. This shall not apply to County maintained Right-of-Way.

3.7.8.4. Driveway approaches and private road intersections with public roads must comply with Standard 8 - Driveway and Private Road Approaches onto Roads.

3.7.8.5. Cattle guards shall conform to the current edition of the CDOT M&S Standard Plans and approved by the appropriate fire protection district.

3.7.8.6. All gates and entry-way structures shall be approved by the appropriate fire protection district.

3.7.8.7. All streets in the Plains are required to be paved.

3.7.8.8. All rules and regulations of the applicable fire protection district shall govern unless less restrictive than the requirements of this Manual.

3.7.8.9 All culverts, bridges and other conveying structures shall meet loading requirements for the heaviest fire apparatus potentially serving the residence(s). Maximum capacity of any bridge or culvert with a span larger than 4 feet shall be posted on signs at both approaches for through roads and at the entrance for cul-de-sacs.

### **3.8. Drainage**

All storm drainage systems shall be designed in accordance with Jefferson County Storm Drainage Design and Technical Criteria (JCSDDTC). Safe and efficient conveyance of traffic is the primary function of streets/roads; therefore, design of the storm drainage function shall not exceed the limits (such as gutter capacity and street overtopping) set forth in the JCSDDTC. All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T", in accordance with Jefferson County Land Development Regulation Section 33.

3.8.1. Crosspans: Crosspans are not permitted across collector or arterial streets, nor are they allowed on streets with existing storm sewer systems. Crosspans may be used parallel to collector or arterial streets to convey storm runoff across local streets.

3.8.2. Inlets: Inlets shall be located to intercept gutter flow at the point gutter capacity is exceeded by the storm runoff (see Chapter 9 of the JCSDDTC for gutter capacity). Inlets shall also be installed to intercept cross-pavement flows at points of transition in superelevation. Due to the presence of curb ramps at intersections, inlets are not allowed within the curb return, but shall be located at the tangent points of the curb return.

3.8.3. Cross Slope: Except at intersections, or where superelevation is required, streets/roads shall be level from top of curb to top of curb (or flowline to flowline) and shall have a two (2) percent crown. At or within 150' of an intersection, the maximum elevation difference between flowlines is that dictated by the intersection grade (Section 3.5.2.) and the actual distance between flowlines.

3.8.3.1. Parabolic or curved crowns are not allowed. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street.

3.8.3.2. Carrying the crown at a side street into the through street is permitted only when drainage considerations warrant such a design.

3.8.3.3. The rate of change in pavement cross slope, when warping side streets at intersections, shall not exceed one (1) percent every



twenty-five (25) feet horizontally on local streets/roads, one (1) percent every thirty-seven and one-half (37.5) feet horizontally on collector streets/roads, or one (1) percent every fifty-six and one-half (56.5) feet horizontally on arterial streets/roads.

3.8.4. Temporary Erosion Control: Temporary erosion control is required along and at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc., in accordance with the Jefferson County Zoning Resolution, Section 15.

3.8.5. Cross Culverts: Cross culverts shall be installed at locations where roads cross natural drainageways and/or where changes in road grade are greater than two (2) percent. The culvert slope shall match as nearly as possible that of the existing topography, but shall in no case be less than one (1.0) percent. Cross culverts for roads shall be spaced a maximum of five hundred (500) feet apart.

### **3.9. Traffic Control**

3.9.1. Construction Traffic Control: Traffic safety in construction zones should be an integral element of every project from planning through design and construction. Pedestrian, as well as vehicular traffic, should be considered in the design of a traffic control plan. A traffic control plan shall be submitted to and approved by Transportation and Engineering prior to issuance of a construction permit.

Design of all traffic control plans shall be in accordance with Part VI of the Manual on Uniform Traffic Control Devices, Standards for Work Zone Traffic Control. All necessary signs, pavement markings, barricades, etc. shall be shown on the plan.

3.9.2. Traffic Signals: Traffic signals shall be installed at street/road intersections or site accesses identified as meeting warrants in the traffic study submitted for a proposed development. If the proposed signal location is within twelve hundred (1,200) feet of any adjacent signal, a two-way progression analysis shall be included in the traffic study.

Design of all traffic signals shall be in accordance with the Manual on Uniform Traffic Control Devices and the Colorado Department of Transportation Standards and Specifications. Traffic signal plans shall be submitted to and approved by Planning and Zoning.

Traffic signal poles shall not be installed within sidewalks or curb ramps.

3.9.3. Signing and Striping: Plans are required for signing/ striping of new streets/roads and re-signing/stripping of existing streets/roads necessitated by development. All signing/stripping plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and shall be submitted as part of the construction plans.

3.9.3.1. The signing plan shall:

1. Show the general longitudinal location of each existing and proposed sign (by side of street/road and station).
2. Specify the sign legend and sign type (from the MUTCD).
3. Specify the sign size.
4. Include a typical detail of installation dimensions (height, distance from curb or edge of pavement).
5. Include a detail of post and base dimensions and installation plan (showing any wedges or sleeves, depth below surface, any materials used).
6. Specify the blank gauge and material of the sign(s).
7. Note the reflectorization provided.

3.9.3.2. The striping plan shall show:

1. Striping material (paint, thermoplastic, preformed tape, etc.).
2. Color designation and line width.
3. Lane width.
4. Proposed and existing lane striping including skip interval.
5. Typical treatments for accel/decel lanes, turning lanes, bike lanes and crosswalks.

3.9.3.1. Stop signs shall be placed at intersections in accordance with the MUTCD, unless otherwise approved by the Director of Planning and Zoning.

3.9.3.2. All street/road name signs shall be in accordance with the current edition of DRCOG “Guidelines for the Design and Placement of Street Signs in the Denver Region”.

### **3.10. Miscellaneous**

3.10.1. Guardrail: In locations where guardrail is required, as determined by Planning and Zoning, design shall be in accordance with the Colorado Department of Transportation Standards and Specifications. Determination of guardrail requirements shall be based on Colorado Department of Transportation Roadway Design Guide, Chapter 20 and other applicable CDOT criteria. Guardrail locations shall be shown on the construction plans.

3.10.2. Noise Attenuation: In locations where arterial streets/roads are adjacent to existing or planned residential areas, fencing and/or other noise attenuation measures are required. These measures may include, but are not limited to, earth beams, landscaping, walls, or a combination.

3.10.3. Street Lighting: Street lights shall be provided at all parkway/arterial/major collector street/road intersections. In addition, street lights shall be provided at all locations where multifamily residential, commercial or industrial site driveways intersect parkway/arterial/major collector streets/roads. Street lights shall be designed in accordance with the most recent ANTI/ICES Roadway Lighting Standards and installed in accordance with Public Service Company of Colorado standards. Light poles shall not be installed within sidewalks or curb ramps.

3.10.4. Roundabouts: Roundabouts may be constructed subject to an approved traffic study. Roundabouts shall be designed in accordance with the current edition of the Federal Highways Administration Publication, Roundabouts: An Informational Guide, and approved by Transportation and Engineering and the appropriate fire protection district. Roundabouts shall also conform to CDOT Roadway Design Guide Chapter 19.

3.10.5. Bridges: Bridges shall be designed in accordance with CDOT Bridge Manuals, the CDOT Roadway Design Guide Chapter 15 and approved by Transportation and Engineering and the appropriate fire protection district.

3.10.6. Curb Extensions (mid-block and corner) and Pedestrian Refuge Islands: Curb extensions and pedestrian refuge islands shall be designed in accordance with the current version of the Federal Highway Administration Bicycle and Pedestrian Report, the CDOT Roadway Design Guide Chapters 12 and 14 and approved by Transportation and Engineering and the appropriate fire protection district.

## ***Chapter 4***

# **Pavement Design and Technical Criteria**

### **4.1. General**

This section sets forth the minimum criteria and design procedures for public street/roadway pavements. Recommended design methodologies for asphalt are addressed and essentially follow the Colorado Department of Transportation (CDOT) and the Asphalt Institute methodology. Some standardization of criteria has been made in design procedures. Other design methodologies may be presented for comparison to the current County design method. For private streets and non-maintained streets/roads in County Right-of-Way these same design methodologies are required.

## 4.2. Pavement Design Report Submittal

4.2.1 Preliminary Pavement Design: A Preliminary Pavement Design shall be used for estimating purposes only to determine the financial security "Exhibit A" associated with development projects. Three standardized Preliminary Pavement Designs corresponding to three zones of unique geotechnical characteristics within Jefferson County are presented in Construction Standards 22-24. Construction Standard 25 shows each of the three zones. Zone 1 corresponds with materials associated with fractured crystalline rock in the higher elevation foothills and mountains. Zone 2 addresses highly expansive clay and claystone material within the Designated Dipping Bedrock Area. The template for this zone includes edge drains for public and private streets. The inclusion of edge drains should be evaluated as a part of the preliminary and final pavement design and edge drain design and details shall be provided with the Street Construction Plans. Final pavement design modifications presented by the applicant, including changes to or elimination of edge drains, may be allowed as determined appropriate by Transportation and Engineering for public streets and Planning and Zoning for private streets. The evaluation of the edge drains in the pavement design and approval of an alternative standard shall be made based on data provided by the Geotechnical Engineer and evaluation by the County. . Zone 3 involves non-cohesive soil and weathered bedrock along the Front Range. The Preliminary Pavement Design shall be replaced with the Final Pavement Design, and the associated "Exhibit A" financial security costs recalculated, after County approval of the Final Pavement Design Report.

### 4.2.2 Final Pavement Design:

The final pavement design shall be completed and submitted after or in conjunction with County approval of the associated construction plans. All soil samples must be taken after overlot grading, or represent the "as-constructed" soil conditions after construction has been completed. Pavement design approval is required prior to placement of any concrete flatwork and/or paving within County Right-of-Way.

The report shall be prepared by or under the supervision of and signed by a Professional Engineer registered in the State of Colorado and shall include the following information:

- A. Vicinity map to locate the investigated area.
- B. Scaled drawings showing the location of borings, and required information stated in 4.3.2.
- C. Scaled drawings showing the estimated extent of subgrade soil types and Equivalent Daily Load Application (EDLA) for each street.
- D. Pavement design alternatives for each street on a scaled drawing.
- E. Tabular listing of Sample Designation, Sample Depth, Composite Group Number, Liquid Limit, Plasticity Index, Percent Passing the No. 200 sieve, American Association of State Highway and Transportation Officials (AASHTO) Classification, Group Index, Percent Swell from Swell Consolidation tests, and Soil Description.
- F. California Bearing Ratio (CBR) or R-value test results and calculations for each soil type used in the design. Include natural moisture content and natural density.
- G. Pavement design nomographs supplied by Jefferson County properly drawn to show Soil Support, EDLA and Structural Number (SN).
- H. Design calculations for pavement thickness.
- I. Percentage water soluble sulfates, sampled at a minimum of every other boring.
- J. A discussion regarding potential subgrade soil problems including, but not limited to:
  - 1. heave or settlement prone soils
  - 2. frost susceptible soils
  - 3. ground water
  - 4. drainage considerations (surface and subsurface)
  - 5. cold weather construction (if appropriate)

6. other factors or properties which could affect the design or performance of the pavement system

K. Recommendations to alleviate or mitigate the impact of problems discussed in Item J above.

### **4.3. Subgrade Investigation**

4.3.1 Field Investigation: The field investigation shall consist of boring soils to a depth of at least five feet below the bottom of the proposed asphalt pavement layer elevation for roads classified as Local or Collector. Borings shall extend 10 feet below the bottom of the proposed asphalt pavement layer elevation on Major Collector / Minor Arterial and Major Arterial roadways. In all cases borings shall be spaced no more than 250 feet apart, or a minimum of one boring for each section of street, unless otherwise required by Transportation and Engineering. The borings shall be checked for ground water at the time of drilling, and then 24-hours after the borings are completed. Samples shall be taken after overlot grading is completed and the subgrade is "rough cut" (1 to 2 feet of proposed elevation). Soil classifications shall be verified after installation of utilities.

Geological features within five feet of the existing ground surface, and all new roadways proposed in the Dipping Bedrock Area, require more detailed investigation including drilling and/or trenching. Every third bore hole shall be a minimum of 10 feet deep, regardless of the road classification.

California Drive samples shall be obtained from each boring within 12-18 inches of the final subgrade elevation.

4.3.2. Boring Profiles: Boring logs shall include the following:

- a. Date, Strata Elevations, Depth of Boring.
- b. Natural moisture content, Blow Count and Dry Density of each undisturbed sample.
- c. Water table elevation.

4.3.3. Classification Testing: Each soil sample shall be tested according to AASHTO and/or the American Society for Testing Materials (ASTM) criteria to determine: Liquid Limit, Plastic Limit, Plasticity Index, and Percentage passing the U.S. Standard No. 200 sieve. Samples of sands and gravels shall require gradation analysis for classification determination.

These data shall be determined using the following methods:

- a. Liquid Limit - AASHTO T 89 (ASTM D 4318)
- b. Plastic Limit - AASHTO T 90 (ASTM D 4318)
- c. Passing No. 200 - AASHTO T 11 (ASTM C 117)
- d. Gradation - AASHTO T 27 (ASTM D 422)

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

4.3.4. Soil Grouping: Soil samples collected in the field investigation can be combined to form soil groups. These groups shall be based upon the AASHTO Classification, Group Index and location within the area investigated. Groupings shall not consist of samples with different AASHTO Classifications (Note: There may be more than one group index within a given classification). Composite samples can be manufactured by combining representative, equal portions of each sample contained within the group and mixing to provide a uniform composite sample of the soil group. This shall be limited to group indices within the range of 7. Composite samples shall be subjected to Classification Testing as outlined in Section 4.3.3. Moisture-Density curves must be included for groups used in the design.

4.3.5. Subbase Support Testing: Individual subbase or composite samples shall be tested to determine the support value using either CBR (California Bearing Ratio) or Hveem Stabilometer (R-value) testing. These values shall be used in the design of pavement sections in accordance with the procedures outlined in Section 4.5. Tests shall be conducted in accordance with the following procedures:

4.3.5.1. CBR Tests: California Bearing Ratio tests shall be conducted in accordance with AASHTO T 193 with the following modifications:

- a. Note 4 of AASHTO T 193 shall not apply. A 3- point CBR evaluation is required.
- b. The compaction method used for the CBR test shall be determined by the soil classification.

- c. Surcharge shall be calculated using a unit weight of 140 pcf for bituminous pavement and 135 pcf for untreated aggregate base course.
- d. The design CBR value shall be determined from the CBR - Dry Density Curve and shall be the CBR value at 95 percent compaction.
- e. In addition to the values requested in AASHTO T 193, Stress-Penetration curves for each sample, a CBR - Dry Density curve and Proctor Compaction test results shall be reported.

4.3.5.2. R-Value Tests: Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

- a. Dry density and moisture content for each sample.
- b. Expansion pressure for each sample.
- c. Exudation Pressure - corrected R-value curve showing the 300 psi design R-value.

#### 4.4. Pavement Design Criteria

This section sets forth the parametric input data to be used for the design of pavements of various roadway classifications. If cohesive soil mitigation is required, the soil treatment shall extend from back of sidewalk to back of sidewalk.

4.4.1. Equivalent (18 Kip) Daily Load Applications (EDLA): The pavement design procedure in this chapter is intended to provide for a 20-year service life of pavement, given that normal maintenance is provided to keep roadway surface in an acceptable condition. EDLA and Design Traffic Number (DTN) are considered equivalent units based on 20-year design criteria and an 18 kip axle loading. All data and design nomographs in this chapter use EDLA units for pavement loading repetitions. Calculations shall be included, where applicable.

EDLA criteria for each Jefferson County roadway classification are given in Table 4.1.

**Table 4.1 Recommended Equivalent (18 Kip) - Daily Load Applications (EDLA)**

Classification	Class Modifier	EDLA Values
Local	Serving <50 D.U.	8
	Serving >50 D.U.	10
Collector	Residential	30
	Other	100
Major Collector/Minor Arterial	All	200
Principal Arterial	All	200

*NOTE: Alternative EDLA values may be considered with justification provided by the Transportation Study, proposed land uses, and traffic analysis that defines proportion of truck vehicles, including construction truck traffic.*

4.4.2. Design Serviceability: The following criteria shall be used for all Jefferson County roadways to be dedicated for public use and for all private street/roads and non-maintained streets/roads in County ROW:

**Table 4.2 Serviceability Index**

Roadway Classification	SI
Arterials	2.5
Collectors	2.5

Local	2.0
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4.4.3. Minimum Pavement Layers: This paragraph provides the minimum acceptable pavement layers for public and private streets/roads in Jefferson County. These pavement layer thicknesses may be used for preliminary planning purposes. Final pavement designs must be based on actual subbase support test results. Table 4.3 lists these minimum thicknesses for each roadway classification.

**Table 4.3 Minimum Pavement Sections**

Road Classification	EDLA	Composite Section (inches)			Full Depth Asphalt (inches)
		Asphalt	Subbase		
			Base Course	Stabilized	
<50 D.U.	8	4	6	12	5
=>50 D.U.	10	4	6	12	5
Residential	30	4	6	12	5
Other	100	5	6	12	6
Major Collec- tor	200	5	6	12	7
Minor Arterial	200	5	6	12	7
Major Arterial	200	5	6	12	8

Regardless of the pavement layer design, all soils with an R-value less than 10, or PI greater than 15, shall be stabilized to a minimum of 12 inches below the bottom of the asphalt pavement layer, and shall be included in the depth of treatment.

Cohesive soil subbases shall be overexcavated and replaced with moisture conditioned fill. Minimum requirements for overexcavation are listed below in Table 4.3a.

**Table 4.3a Minimum Overexcavation Requirement for Cohesive Soils**

Plasticity Index	Depth of Overburden/Fill Treatment	
	Locals/Collectors	Major Collectors/Arterials
15-20	1 foot	2 feet
21-30	2 feet	3 feet
31-40	3 feet	4 feet

**NOTES:**

1. Road segments with isolated soil types may be designed separately for that individual segment.
2. Soil with (PI) over 40 shall be removed and wasted to a depth of five feet for any type of street.
3. In the Designated Dipping Bedrock Area, all bedrock shall be overexcavated to a depth of at least five (5) feet below the bottom of the proposed pavement layer. Where the bedrock is claystone, the top of the weathered claystone shall be considered as the top of bedrock. Should soil other than bedrock be found throughout the five (5) foot zone, it shall be overexcavated as shown in Table 4.3a.
4. The overexcavation areas shall be recompact to 95% of maximum Standard Proctor Density (ASTM D-698) at 0 to +4% above optimum moisture content. There shall be a minimum of 12 inches of soil stabilization below the bottom of the asphalt layer that is included in the total depth of overexcavation.
5. Overexcavation of overburden/fill below the stabilization section may be waived by Transportation and Engineering in areas where either previous overexcavation work during overlot grading has been validated or in cases where a thorough geotechnical investigation determines overexcavation is not warranted. Previous overexcavation work must be validated by compaction reports provided by the developer's geotechnical firm and in accordance with the Land Development Regulation (LDR).

4.4.4. Flexible Pavement Strength Coefficients: Table 4.4. contains standard design coefficients for various pavement materials. Non-standard design coefficients may be used only if approved in advance by Transportation and Engineering. In addition, design values must be verified by predesign mix test data and supported by daily construction tests; or, redesign values will be required.

**Table 4.4 Strength Coefficients**

Pavement Structure Component*	Strength Coefficients	(Limiting Test Criteria)
Conventional Materials		
Hot Mix Asphalt	0.40	1800 Lbs. Marshall Or R 90+)
Exist. Asphalt Pavement	0.30	(9-15 Yr)
	0.24	(>15 Yr)
Aggregate Base Course	0.12	(Cbr 80+ Or R 78+)
Exist. Aggregate Base Course	0.10	(Cbr 50+ Or R 69+)
Granular Subbase Course	0.07	(Cbr 15 Or R 50+)
Treated Materials		
Cement Treated Aggregate Base	0.23	(7 day, 650-1000 psi)
Lime Stabilized Subbase	0.14	(PI.<6, net swell <.5%, PH >12.3) Compressive Strength >/200 psi, per ASTM 5102-04, Procedure B
All Stabilized Subbase	0.14	Compressive Strength >/200 psi, per ASTM 5102-04, Procedure B

\* The combination of one or more of the following courses placed on a subgrade to support the traffic load and distribute it to the roadbed.

Structural Layers of a conventional flexible pavement design are defined below.

- a) Surface Course: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course.”
- b) Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course. The use of base course is not accepted in areas that base course does not adequately drain from roadway system.
- c) Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course, surface course or both.
- d) Subgrade: Prepared and compacted soil extending to such a depth as to affect the structural design.

## 4.5. Pavement Design Procedure

4.5.1. Flexible Pavements: The following procedure should be used in determining the Structural Number (SN) of the pavement being designed:

4.5.1.1. Using the appropriate roadway classification, determine the corresponding EDLA (Table 4.1).

4.5.1.2. Determine the Serviceability Index (SI) of the roadway classification (Table 4.2).

4.5.1.3. Select the proper nomograph:

Example: Figure 4.1 Flexible Pavements with SI = 2.0

Example: Figure 4.2 Flexible Pavements with SI = 2.5

NOTE: Original nomographs required are available from Transportation and Engineering.

4.5.1.4. Using subgrade CBR or R-Value test results and EDLA, determine the SN from the appropriate design nomograph.

4.5.1.5. Once the Structural Number (SN) has been determined, the design thicknesses of the pavement structure can be determined

by the general equation:

$$SN = a_1D_1 + a_2D_2 + a_3D_3 + \dots$$

where

$a_1$  = Hot Mix Asphalt (HMA) strength coefficients

$a_2, a_3, a_n$  = strength coefficients of additional pavement components

$D_1$  = thickness of Hot Mix Asphalt (HMA) (inches)

$D_2, D_3, D_n$  = thickness of additional pavement component sections

The strength coefficients for various components of the pavement structure are given in Table 4.4.

The component thickness selected must meet two conditions:

- a. Total HMA thickness selected cannot be less than the minimum specified in Table 4.3. for the roadway classification.
- b. The base course thickness selected cannot exceed 2.5 times the HMA thickness selected, with a maximum thickness of eight (8) inches.

4.5.1.6. The design must reference any mitigative measures required when the subbase and / or subgrade contains cohesive or expansive soils. Design reports recommending permeable layers such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the fine-grained soils. If cohesive or expansive soil mitigation is required, the soil stabilization shall extend from back of sidewalk to back of sidewalk. It is required that soils with R-values less than 10 or Plasticity Index greater than 15 be stabilized. Stabilization is for a minimum of the upper twelve (12) inches below the bottom asphalt pavement layer, and shall be included in the depth of treatment.

4.5.2 Rigid Pavements: This procedure has been deleted.

## **4.6. Material Specifications**

The Specifications presented in this section are performance oriented. The County's objective in setting forth these Specifications is to achieve an acceptable quality of roadway structures. All sources for the mined or manufactured materials must be annually approved by Transportation and Engineering as having met the appropriate materials performance specifications. This approval is a condition of using those material sources for improvement construction. For the purpose of these Standards, improvements are all roadway improvements (both public and private), sidewalks, curbs and gutters, appurtenant drainage basins or structures, storm sewer and their access ways, other public works within Jefferson County Right-of-Way, and required stormwater detention structures built on private property and maintained by the property owner(s).

### **4.6.1. Violations of Approval Conditions**

4.6.1.1. Random Testing. Transportation and Engineering may order random tests of materials used in County public improvements and for all private street/roads and non-maintained streets/roads in County ROW to verify compliance with material specifications. These tests are in addition to the requirements of the roadway inspection and testing procedures.

4.6.1.2. Any and all material used to construct public improvements that is not from a certified source, or that is from a certified source and fails one or more random material test, may be subject to complete removal as a condition of County acceptance of that public improvement. Additional tests will be required to confirm the existence and extent of the sub-standard material prior to the initiation of remedial action. The extent of the material to be removed will be at the discretion of Transportation and Engineering.

4.6.2. Use of Materials Not Listed in Section 4.6. Materials in this section and provided with a set of specifications are those deemed to be the primary structural materials commonly or typically used in public improvements. Ancillary public improvement materials such as manufactured paints and coatings, bonding agents, sealers, fabrics or gaskets, insulating materials, etc., should be in compliance with CDOT material specifications for the appropriate material employed. Alternative materials for construction may be proposed for Transportation Design and Construction Manual – Amended XX-XX-XX



use. Decisions on acceptability of alternative materials will be made by Transportation and Engineering.

#### 4.6.3. Material Specifications

4.6.3.1. Hot Mix Asphalt: This shall comply with material specifications for PG Binders and asphalt mixes in accordance with CDOT's most recent edition of Standard Specifications for Road and Bridge Construction, 702 and 703. This is hereby referred to as "CDOT Standard Specifications".

4.6.3.2. Stone Mastic Asphalt (SMA): SMA mix shall comply with CDOT Standard Specifications as referenced in Section 4.6.3.1. SMA shall be placed as a 2-inch top lift on all new arterial and collector roads and streets. Local roads and streets may be constructed with all HMA. New acceleration and deceleration lanes added to existing arterials or collectors shall match the existing asphalt mix, whether HMA or SMA.

4.6.3.3. Aggregate Base Course Material. This material shall consist of hard, durable particles or fragments of stone or gravel, crushed to required sizes, containing an appropriate quantity of sand or other finely-divided mineral matter which conforms to the requirements of AASHTO M 147, and to Section 703.03, CDOT Standard Specifications.

Specifications. In addition, the material must have an R-value of 78 or greater, or a CBR of 80+, and must be moisture stabilized. Moisture stability is determined by R-value testing which shows a drop of 12 points or less in R-value between exudation pressures of 300 psi and 100 psi.

Only aggregate from sources approved by the Transportation and Engineering shall be used.

**Table 4.5 Aggregate Base Course Materials**

Sieve Size	Mass Percent Passing Square Mesh Sieves	
	Class 5	Class 6
2"	100	
1"	95 - 100	100
3/4"	—	95
#4	30 - 70	30 - 65**
#8	—	25 - 55
#200*	03 - 15	03 - 12**
Liquid Limit (LL)	30 Max.	30 Max.

\*ASTM (C117)

\*\*For gravel shoulders, No. 200 shall be 9-12 and No. 4 shall be 30-50.

Base course may be used only where the base can daylight in barrow ditches or where the subgrade consists of material classifying as GM, GW, GP, SM, SW, or SP using the Unified Soil Classification System.

4.6.3.4. Cement Treated Aggregate Base Course. This material shall consist of a mixture of aggregate materials, Portland cement and water as outlined in Section 304 of the CDOT Standard Specifications. Acceptable aggregates include CDOT Classes 5 and 6. Other aggregates may be used, if previously approved by Transportation and Engineering.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering. As a minimum, the mix design report shall contain a description of material sources, gradations and Atterberg limits of aggregates, cement type, Proctor compaction curves and unconfined compressive strength results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO specifications. Transportation Design and Construction Manual – Amended XX-XX-XX

Minimum in-place thickness for cement treated aggregate base course shall be twelve (12) inches.

To be approved, the mix shall have a seven-day compressive strength of at least 650 psi and no more than 1,000 psi. The minimum acceptable cement content shall be five percent by weight. Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis, or an annual basis for suppliers, prior to issuing construction permits.

4.6.3.5. Lime Treated Subgrade: This Material consists of a mixture of native or imported soils, hydrated or quick lime and water as outlined by ASTM Specification C977, CDOT Standard Specification 307.

The materials to be used in construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five day, 100°F cure unconfined compressive test results for each mix, strength versus lime content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Minimum pH of 12.3 after completion of initial mixing.
2. Plasticity Index less than 6, per ASTM D4318.
3. Minimum hydrated lime of 5.0% dry weight, per ASTM D3.
4. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
5. Sulfate concentrations not to exceed .5%

Note: Field validation shall be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.6. Lime/Fly-Ash Stabilized: This material consists of a mixture of native or imported soils, hydrated or quick lime, Class "C" Fly-Ash, and water as outlined by ASTM Specification C977, CDOT Section 307.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus lime/fly-ash content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Plasticity Index less than 6, per ASTM D4318.
2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
3. Sulfate concentrations not to exceed .5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.7. Cement Stabilized Subgrade. This material consists of a mixture of native or imported soils, Portland cement and water.

The materials to be used on construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Minimum Portland cement of 3.0% dry weight per ASTM D3.
2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
3. Sulfate concentrations not to exceed 0.5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

## *Chapter 5*

# Construction Specifications and Standards

## 5.1 Construction Specifications

The Permittee agrees to adhere to all construction specifications set forth in the latest edition of the Jefferson County Land Development Regulation, the Jefferson County Transportation Design and Construction Manual and the Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction manuals.

5.1.1. Permits: All work performed within County Rights-of-Way and/or easements shall require the issuance of a street/road construction permit. Permits shall be obtained at the Jefferson County Transportation and Engineering office, located at 100 Jefferson County Parkway, Suite 3500, Golden, Colorado.

5.1.1.1. Any permit issued shall pertain only to construction within the County-owned Right-of-Way and is in no way considered a permit to enter on any private property adjacent to such Right-of-Way nor to alter or disturb any facilities or installations existing within the Right-of-Way which may have been installed, and are owned, by others.

5.1.1.2. Permits, when issued, shall be valid for a period of ninety (90) calendar days, and may be renewed for one (1) additional ninety (90) calendar day period, providing the renewal is obtained (renewal may be obtained by telephone) prior to the permit expiration date. Failure to obtain a renewal as stated herein will require obtaining a new permit and payment of applicable fees.

5.1.1.3. Any permit determined to be without an adequate bond as required in Section 5.1.2. below, shall be subject to immediate revocation by Transportation and Engineering.

5.1.2. Bonds: A non-cancellable permit bond shall be required for Right-of-Way Use and Construction Permits and License Agreements Section of the County Policies and Procedures for Streets and Roads.

5.1.3. General Specifications:

5.1.3.1. Any work done to a street/road or other County property under a permit shall result in the street/road or other property being returned to a condition equal to or better than original, within the limits of careful, diligent workmanship, good planning, and quality materials, with said work being accomplished in the least possible time and with the least disturbance to the normal functioning of the street/road or other property.

5.1.3.2. All backfill material, compaction, and resurfacing of any excavation made in the County property shall be done in accordance with specifications and standards approved by and on file with Transportation and Engineering.

5.1.4. Road Closures: Normally, only one side of a public street/road may be blocked at any given time. Should operating conditions require complete closure, advance approval of the closing of a public street/road must be obtained from Transportation and Engineering or advance approval of the closing of a private road must be obtained from Planning and Zoning. The permittee shall notify the appropriate fire protection district, the Jefferson County Sheriff's Department, and the Colorado State Patrol concerning exact location of

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barricades and dates traffic will be impeded. Barricades shall be maintained by the responsible contractor.

#### 5.1.5. Utility Installations:

5.1.5.1. Underground: All utility lines, including Cable TV, shall be installed a minimum of two (2) feet below ground surface, or proposed roadway elevation, whichever is lower. This requirement is applicable throughout the Right-of-Way, including ditch lines and/or borrow pits. Exceptions may be granted by Transportation and Engineering where warranted and upon prior written request and approval.

5.1.5.2. Overhead: A minimum ground clearance of 18 feet 0 inches shall be provided where overhead utility lines cross public roads and streets. The clearance shall be measured at the lowest point where the line crosses the traveled portion of the road and/or street.

5.1.6. Base Course: All aggregate base course shall meet CDOT Class 6 Specifications, or an acceptable base course predicated on specific site conditions as approved by Transportation and Engineering. Native material is unacceptable as base course.

5.1.7. All concrete shall be in conformance with the appropriate class as specified in Section 601 of the CDOT Standard Specifications. A combination cure-sealer shall be used for concrete flatwork. Provide adequate texture by means of a moderately heavy broom finish to surfaces prior to applying the cure-sealer. The product shall be Dayton Superior Cure & Seal LV 25% J20 UV or approved equal. Apply two coats per manufacturer's instructions to all exposed surfaces, with the second coat applied at right angles to the first for complete coverage. The temperature range of application is 35 to 90 degrees F. Concrete shall not be left exposed for more than one hour between the time finishing is completed and commencement of curing treatment.

5.1.7.1. Concrete may be placed by machine methods provided that all finish lines are within 1/8" ± tolerance of the lines shown on the plans. The flowline must be free draining.

5.1.7.2. One-half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.

5.1.7.3 Median Cover Material and Median Edging Patterned Concrete: Median cover material and median edging patterned concrete shall be colored concrete that is Davis color #5084 "Harvest Gold" or approved equal. The release agent shall be Concrete Coatings Stamp-TEK™ liquid release or approved equal. The stamp pattern shall be Matcrete "UK Cobblestone" or equivalent. A combination cure-sealer containing silane shall be used for concrete flatwork. The cure-seal product shall be SpecChem Cure Shield EX or approved equal. Control joints are saw cut every 10 feet. Expansion joint material with a zip-strip shall be installed between the patterned concrete and the back of curb. Control joints and expansion joints shall be sealed with Sikaflex-2C or approved equal. Refer to STND-18 and STND-19 for details. Granular pre-emergent herbicide shall be placed in the areas that are to receive median cover.

5.1.7.4. Detectable Warnings on Concrete Curb Ramps: Detectable Warnings on concrete curb ramps shall be truncated domes of the dimensions shown on the plans. Domes shall be BRICK RED in color. Domes shall be prefabricated by the manufacturer as a pattern on embeddable surface plates. Dome plates shall be set into wet concrete and shall not be glue or spray-on varieties. Detectable warning plates shall not be concrete pavers, masonry pavers, or cast-iron plates. Refer to STND-16 for details.

5.1.7.5. Waterproofing Membranes: Waterproofing membrane shall be placed on concrete bridge deck surfaces, and concrete box culverts per the waterproofing membrane detail. Surfaces to receive waterproofing membrane shall be thoroughly cleaned via sand-blasting or high pressure water. The waterproofing membrane shall be a hot pour asphaltic material, with 55 pound (#55) minimum asphaltic based roll material immediately placed on top. Refer to STND-17 for details.

5.1.8.1 Storm Sewer Pipe: Within County Right-of-Way and/or easements, all storm sewer pipe shall be minimum Class II Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76-03, C-506-02 or C-507-02 or HP Storm Pipe. Actual depth of cover, live load, and field conditions may require structurally stronger pipe. CSP and HDPE pipe, in accordance with manufacturer's specifications, are only permitted in privately owned and maintained installations and shall be located within County drainage easements.

5.1.8.2 All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T" in accordance Transportation Design and Construction Manual – Amended XX-XX-XX

with Jefferson County Land Development Regulation Section 33. Test boxes shall be placed behind curb and gutter if sidewalk is detached, and behind sidewalk if attached. See details for the tracer wire and test box installation 28-1 through 28-3.

5.1.9. Culverts: Within County Right-of-Way and/or easements, all culverts shall conform to the Storm Drainage Design and Technical Criteria.

#### 5.1.10. Traffic Control Devices

All traffic control devices shall conform to the MUTCD and be approved by Transportation and Engineering prior to installation. Conformance to the following minimum materials specifications or approved equal is required. Traffic signals shall conform to CDOT standards.

5.1.10.1. Signs, Sign Posts, and Anchors: Sign faces, posts and anchors shall conform with the following materials specifications. Non-standard signs, posts, and anchors will not be maintained by the County. Post anchors for sign installation after complete construction require approval by Transportation and Engineering.

5.1.10.1.1. Street Name Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy 0.100 inches thick. Polyethylene plates (Polyplate) is not allowed. Facing shall be green, electrocut High-Intensity reflective sheeting with white High-Intensity Prismatic grade retroreflective letters and numerals. Refer to STND-12 for details.

5.1.10.1.2. Regulatory and Warning Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy 0.100 inches thick. High-Intensity prismatic grade retroreflective sheeting shall be used for the background color, and letters and numerals for all regulatory and warning signs. Refer to STND-12 for details.

5.1.10.1.3. Sign Posts: All sign posts shall be two (2) inch by two (2) inch galvanized TELES PAR® (or equivalent) tube with 12 Gauge (0.105 inch wall thickness), and 7/16 inch pre-punched holes on one (1) inch centers, all sides over full length, ten (10) feet in length. U-posts are not allowed.

5.1.10.1.4. Sign Post Bases: All sign post anchors shall be anchored securely in the soil or concrete to create a breakaway system. All sign post anchors shall be 2.25 inch x 2.25 inch perforated square tubing, galvanized steel, TELES PAR® (or equivalent), a minimum of 3 feet in length. Each tube section shall be 12 Gauge (0.105 inch wall thickness) with 7/16 inch diameter pre-punched holes on 1-inch centers, all sides over full length. The anchor tubing shall be twist resistant and allow mounting of a one-size smaller TELES PAR® (or equivalent) sign post. The anchor shall be driven into the soil no less than 30 inches. The sign post shall be inserted 8 inches inside the anchor tubing and double bolted in place prior to covering. Each bolt shall be a Hex Head with a Washer and matching Hex Nut. Bolts shall be secured at the exposed top of the anchor base and placed at opposite tube sides, 90 degrees apart. Signs to be placed in concrete medians or islands shall have the anchor driven inside of a 6-inch Schedule 40 PVC sleeve, with the sleeve measuring the thickness of the concrete plus 1-inch, and secured to the post in the same fashion as described in 5.1.10.1.3. The PVC sleeve shall be embedded in the surrounding concrete when the concrete is placed. Sign post anchors driven in soil not within concrete medians or islands shall be anchored in the same fashion without the PVC sleeve. Refer to STND-13 for details.

5.1.10.2. Pavement Marking: Pavement marking materials shall be used as specified for the service life, type, and locations as identified below.

5.1.10.2.1. Temporary Application, Construction, or Detours: Waterborne paint (High Build) shall be used for short duration striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. The same waterborne paint may be used for crosswalks and stop (bar) lines as deemed necessary. Stencil markings, such as symbols or arrows, shall not be placed for temporary use unless approved by the engineer.

5.1.10.2.2. Permanent Application: Epoxy paint shall be used for striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. Preformed Thermoplastic Pavement Markings shall be used for crosswalk and stop (bar) line markings, railroad (RR) crossings, words, symbols, and arrows. The thickness of all Preformed Thermoplastic Pavement Markings shall be 125 mils. Preformed Plastic Marking Tape (Type I), may be used in lieu of Preformed Thermoplastic Pavement Markings, if approved by Transportation and Transportation Design and Construction Manual – Amended XX-XX-XX

Engineering prior to installation. Preformed Plastic Marking Tape shall be 3M™ Stamark™ 5730 (White), 3M™ Stamark™ A270ES (White), or approved equivalent.

5.1.10.3. Curb Ramps: All required curb ramps shall conform to current CDOT M&S Standard Plans and be approved by Transportation and Engineering.

5.1.10.4. Bike Racks: All required bike racks shall conform to Association of Pedestrian and Bicycle Professionals “Essentials of Bike Parking: Selecting and Installing Bike Parking that Works”.

## 5.2 Construction Standards

All construction within County Right-of-Way and/or easements shall be in conformance with current CDOT M & S Standards and the following County construction standards.

Standard Number	Description
1	Curb and Gutter
2	Combination Curb, Gutter and Sidewalk
3	6" Vertical Curb, Gutter and Attached Sidewalk
4	6" Vertical Curb, Gutter and Detached Sidewalk
5	Typical Intersection Crossspan
6	Driveway Section for 6" Vertical Curb and Gutter
7-1 and 7-2	Concrete Driveway Sections for Combination Curb, Gutter and Sidewalk (Type 2 and Type 3)
8	Driveway/Private Road Approaches =
9	Typical Median Designs
10	Concrete Joint Details
11	Raised Crossing Details
12	Speed Hump Installation
13	Asphalt Street/Road Patchback
14	Road and Street Name Signs
15	Sign Posts and Bases
16	Typical Arterial/Major Collector Street Lighting
17	Street Name Sign and Bracket on Traffic Signal Pole
18	Waterproofing Membranes for Concrete Box Culvert

19	Waterproofing Membranes for Bridge Deck
20	Median Cover Material Patterned Concrete
21	Median Edging Patterned Concrete
22	Zone 1 Foothills / Mountain Area Preliminary Pavement Design
23-1 and 23-2	Zone 2 Dipping Bedrock Area Preliminary Pavement Design Attached and Detached Sidewalks in ROW
24	Zone 3 Front Range Area Preliminary Pavement Design
25	Design Zone Preliminary Pavement Sections
26-1	Signal Poles Design Information
26-2	Signal Poles General Layout
26-3	Signal Poles Maximum Loading Information (1)
26-4	Signal Poles Maximum Loading Information (2)
26-5	Signal Poles Details (1)
26-6	Signal Poles Details (2)
26-7	Signal Poles Caisson Details (1)
26-8	Signal Poles Caisson Details (2)
26-9	Signal Poles Caisson Details (3)
26-10	Signal Pole and Mast Arm Mounting Details (1)
26-11	Signal Pole and Mast Arm Mounting Details (2)
26-12	Traffic Signal Pull Box
27-1, 27-2 and 27-3	Flashing Beacon and Sign Installations
28-1, 28-2, and 28-3	Utility Wire Installation Location – Storm Sewer

## *Chapter 6*

# Transportation Studies

## 6.1 Requirements for Transportation Studies (TS)

All traffic data collected must align with industry best practices to ensure consistency across the County. The below

criteria must be met:

- Locations for traffic data collection shall be determined at pre-application or equivalent meeting with Jefferson County Staff and cater to the unique circumstances of each development application. Developments with local impacts will have fewer intersections to analyze whereas regional impacts will require a greater number of intersections to be analyzed. Vehicle volumes must be collected for at least a 24-hour period on a Tuesday, Wednesday, or Thursday and shall not be collected during inclement weather events, holidays, or adjacent to County holidays (Thanksgiving, Christmas, New Years, etc.). Land uses with weekend peak-hour volumes shall collect at least one weekday and full weekend volumes.
- Bicycle and/or pedestrian volumes will be required in Activity Centers as defined by the Jefferson County Comprehensive Master Plan or with proposed land uses that foster active modes of transportation. Additional vulnerable roadway users, such as equestrians, children, or seniors will require special consideration if nearby land uses are conducive to a higher volume of vulnerable roadway users. Transportation & Engineering may request additional data collection or Measures of Effectiveness as identified in CDOT's Traffic Analysis and Forecasting Guidelines for unique site-specific or off-site conditions.

All traffic projections must use the latest addition of the ITE Trip Generation Manual.

6.1.1 The TS categories are as follows:

**Transportation Information:** Transportation Information shall be submitted for any development that generates fewer than 150 vehicle-trips per day. The submitted information will describe the proposed land use and estimate the expected number of daily vehicle trips. If submitting for a rezoning, provide a comparison of the existing land use and zoning to the most intense land use under the proposed zoning. If submitting for any other application type, provide a comparison of the existing land use compared to the proposed land use. This comparison shall be performed using the ITE Trip Generation Manual and/or by providing support for the expected vehicle usage of the site. The Transportation Information shall also describe any other relevant information that would impact transportation operations and safety.

**Trip Generation Memorandum:** A Trip Generation Memorandum (TGM) is required when the land uses proposed with a development are expected to generate between 150 and 800 vehicle-trips per day. The TGM should show a computation of trips generated from the proposed land use(s). The TGM for a proposed rezoning should also include a computational comparison of the maximum possible number of trips generated from the proposed land uses and the maximum possible trips generated from existing and allowed land uses. Include a table summarizing trip generation estimates.

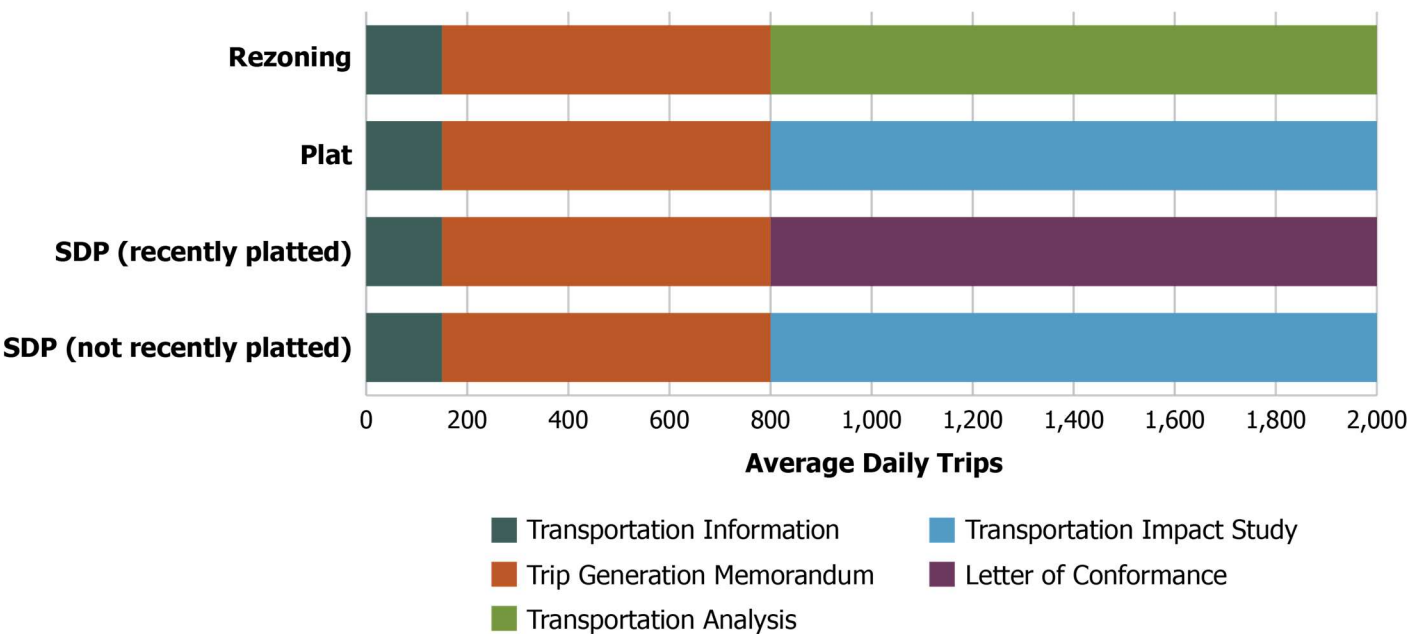
**Transportation Analysis:** A Transportation Analysis (TA) is required during a rezoning to determine the amount and/or distribution of traffic generated from a proposed development that is expected to generate 800 average daily vehicle-trips or more. The TA should show a computational comparison of the maximum possible trips generated from the proposed land use(s) compared to the number of maximum possible trips generated from existing zoning. It should also include a percentage change in the average daily traffic (ADT) and peak hour traffic of adjacent roadways. The analysis should conceptually address potential onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development, including improvements that may already be required by County regulations.

**Transportation Impact Study:** A Transportation Impact Study (TIS) is required during a Site Development Plan (SDP) or Plat process when a proposed development is expected to generate 800 average daily vehicle-trips or more. While the trip generation from a proposed development is the main quantitative threshold, existing transportation issues such as a high crash location, complex intersection geometrics or other specific problems or deficiencies may also necessitate a TIS. The scope of the TIS should be agreed upon by the County and the applicant during the Preliminary Application process. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the



study.

**Letter of Conformance with an Approved TIS:** If a development in the Site Development Plan process is expected to generate more than 800 new vehicle trips, and there is an approved TIS on file from the last 3 years for the overall or regional development, a letter of conformance describing that the land uses proposed in the development match those assumed in the overall TIS and a copy of that TIS are required. This letter of conformance must confirm all current County regulations are met.



Transportation Information

6.2.1 Responsibility

General: The applicant is responsible for providing trip generation information, from the latest addition of the ITE Trip Generation Manual, when proposing a development generating below 150 vehicle trips.

Review Process: Transportation Information for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Information with each re-submittal.

Certification: The Transportation Information should be prepared under the supervision of a qualified and experienced transportation professional who has training in traffic and transportation engineering or planning. Such supervision is not required if applicant has access to the ITE Trip Generation Manual.

6.2.2: Format

Transportation Information should be presented in tables, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Transportation Information.

6.3 Trip Generation Memoranda

6.3.1 Responsibility

General: The applicant is responsible for providing trip generation computation when proposing a development generating between 150 and 800 vehicle trips.

Review Process: The TGM for a proposed development will undergo an iterative review process in accordance with the Land Transportation Design and Construction Manual – Amended XX-XX-XX

Development Regulation. The applicant shall provide a letter identifying changes to the TGM with each re-submittal.

*Certification:* The TGM shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

#### **6.3.2 Format**

The TGM data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Trip General Memoranda.

### **6.4 Responsibility for Transportation Studies**

*General:* The impacts from a proposed development as assessed in the TS are the primary responsibility of the applicant and their engineer.

*Review Process:* The TS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study, if applicable.

*Certification:* The TS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TS shall be signed and sealed by a registered professional engineer in the State of Colorado.

### **6.5 Transportation Analyses**

#### **6.5.1 Responsibility**

*General:* The applicant is responsible to demonstrate how transportation systems can accommodate the traffic generated by a proposed development or how the system can be improved to accommodate the traffic generated by the development.

*Review Process:* The TA for a proposed rezone will undergo an iterative review process in accordance with the Zoning Resolution. The applicant shall provide a letter identifying changes to the TA with each re-submittal.

*Certification:* The TA shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

#### **6.5.2 Format**

Throughout the TA, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Transportation Analyses.

### **6.6 Transportation Impact Studies**

#### **6.6.1 Responsibility**

*General:* The applicant and their engineer are responsible for mitigating the impacts from a proposed development as assessed in the TIS.

*Review Process:* The TIS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study with each re-submittal of the TIS.

*Certification:* The TIS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TIS shall be signed and sealed by a registered Professional Engineer in the State of Colorado.

#### **6.6.2 Format**

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Throughout the TIS, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Transportation Impact Studies.

## Definitions

### AASHTO

American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, current edition.

### ADT

Average Daily Traffic

### All Weather Travel Surface

An all weather travel surface is defined as an improved surface that is designed to withstand all weather conditions for typical road use and able to support emergency vehicles. The surface is required to be constructed of concrete, asphalt, recycled asphalt or a minimum of 6-inches of class 6 road base.

**Axle Load**  
The total load transmitted by all wheels on a single axle extending across the full width of the vehicle. Tandem axles 40 inches or less apart shall be considered as a single axle.

### California Bearing Ratio

A measure of the ability of a soil or aggregate to resist the transmission of a vertical load in a lateral direction.

### CDOT

Colorado Department of Transportation

### Dip of Natural Terrain

The dip of the natural terrain refers to the direction at which the existing ground surface slopes downward. The direction of the dip should be drawn perpendicular to the existing contour lines.

### Emulsified Asphalt Treated Base

A base consisting of a mixture of mineral aggregate and emulsified asphalt spread on a prepared surface to support a surface course.

### Equivalent Single Axle Loads (ESAL)

A numerical factor that expresses the relationship of a given axle load to another axle load in terms of their effect on a serviceability of a pavement structure. All axle loads are equated in terms of the equivalent number of repetitions of an 18,000 pound single axle.

### 18k EDLA

18,000 pound single axle Equivalent Daily Load Applications (explained in “Axle Load” and “ESAL” above).

### Flexible Pavement

A pavement structure which maintains contact with and distributes loads to the subgrade and depends upon aggregate interlock, particle friction, and cohesion for stability.

### Flowline

The transition point between the gutter and the face of the curb. For a cross or valley pan, it is the center of the pan. Where no curb exists, the flowline will be considered the edge of the outside traveled lane.

#### Grade

Rate or percent of change in slope, either ascending or descending from or along the highway. It is measured along the centerline of the highway or access.

#### Lime Treated Subgrade

Subgrade consisting of a mixture of soil, hydrated lime and water, usually mixed in place and placed to support a pavement structure.

#### MUTCD

The Manual on Uniform Traffic Control Devices and the Colorado Supplement, current editions.

#### Mountains

See “Mountains” definition in the Zoning Resolution.

#### Passing Sight Distance

The visibility distance required to allow drivers to execute safe passing maneuvers in the opposing traffic lane of a two-lane, two-way highway.

#### Pavement Structure

The combination of subbase, base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

- a. Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course.
- b. Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or subgrade to support a surface course.
- c. Surface Course: The uppermost component of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course”.

#### Plains

See “Plains” definition in the Zoning Resolution.

#### Plant Mixed Bituminous Base

A base consisting of mineral aggregate and bituminous material, mixed in a central plant, laid and compacted while hot, on a subbase or a subgrade, to support a surface course.

#### Plant Mixed Bituminous Pavement

A combination of mineral aggregate and bituminous material mixed in a central plant, laid and compacted while hot.

#### Regional Factor

A numerical factor expressed as a summation of the values assigned for precipitation, elevation, and drainage. This factor is used to adjust the structural number.

#### Roads

Public or private Rights-of-Way within the Mountain Area or as otherwise designated within this MANUAL.

#### Serviceability Index

A number indicative of the ability of the pavement to serve traffic at any particular time in its design life.

#### Sidewalk

A portion of a street designated for pedestrians and other vulnerable roadway users, in accordance with state law.

#### Signal Progression

Transportation Design and Construction Manual – Amended XX-XX-XX

Progressive movement of traffic at a planned rate of speed through adjacent signalized locations within a traffic control system without stopping.

#### Soil Support Value

A number which expresses the relative ability of a soil or aggregate mixture to support traffic loads through the pavement structure.

#### Speed Change Lane

A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase (acceleration lane) or decrease (deceleration lane) its speed to a rate at which it can more safely merge or diverge with through traffic.

#### Stabilometer "R" Value

A numerical value expressing the ability of a soil or aggregate to resist the transmission of vertical load in a lateral or horizontal direction.

#### Stopping Sight Distance

The minimum sight distance necessary to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

#### Storage Lane

Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during critical periods without interfering with the through lanes.

#### Streets

Public or private Rights-of-Way within the Plains Area or as otherwise designated within this MANUAL.

#### Strength Coefficient

A factor used for expressing the relative strength of each layer in a pavement structure.

#### Structural Number

A number derived from an analysis of roadbed and traffic conditions. A Weighted Structural Number is a Structural Number which has been adjusted for environmental conditions. A Weighted Structural Number may be converted to pavement structure thickness through the use of suitable factors related to the type of material being used in the pavement structure.

#### Traffic Analysis Period

A common analysis period (usually 20 years) used in geometric design.

#### Untreated Base Course

A layer or layers of base course without treatment of any kind.

#### Vulnerable Roadway User

Roadway users that are not protected by a vehicle or other shield while on a roadway and is at a greater risk for involvement in a serious injury or fatal crash. Vulnerable roadway users include, but are not limited to, bicyclists, pedestrian, and equestrians; those using mobility devices such as wheelchairs; those using micromobility devices such as electric scooters; and other forms of rolling such as roller blades and skateboards.

# Appendix A:

## Transportation Studies Formatting

## A.1 Transportation Information Format:

### Introduction and Summary

The purpose of the Transportation Information should be clearly stated. This section should concisely summarize findings and conclusions.

### Proposed Development

Provide a description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning (if applicable), and access roadways.

### Trip Generation Comparison Table

Provide a trip generation comparison table showing the traffic generated from existing land use(s) compared to the maximum potential trip generation for land uses associated with the proposed development. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Handbook, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered.

Table 1: Rezone Transportation Information

<u>Land Use Type /Zoning (Type)</u>	<u>Land Use Type</u>	<u>ITE Code</u>	<u>Unit</u>	<u>Size</u>	<u>Vehicles per day</u>
<u>Existing Land Use</u>					
<u>Total</u>					
<u>Existing Maximum* Zoning</u>					
<u>Total</u>					
<u>Proposed Maximum* Zoning</u>					
<u>Total</u>					
<u>Additional Trips (Proposed Zoning Total minus Existing Zoning Total)</u>					

Table 2: Change in Land Use Transportation Information

<u>Land Use Type</u>	<u>Land Use Type</u>	<u>ITE Code</u>	<u>Unit</u>	<u>Size</u>	<u>Vehicles per day</u>
<u>Existing Land Use</u>					
<u>Total</u>					

Proposed Land Use					
Total					
Additional Trips (Proposed Land Use Total minus Existing Land Use Total)					

### Findings

Provide a summary of findings.



## **A.2 Trip Generation Memoranda Format:**

### **Introduction and Summary**

The purpose of the TGM should be clearly stated. This section should concisely summarize findings and conclusions.

### **Proposed Development**

Provide a description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, and access roadways.

### **Existing Conditions**

Current traffic volume counts including a minimum of 24 hours of data should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected.

### **Trip Generation Comparison Table**

Provide a trip generation comparison table showing the traffic generated from existing land use(s) compared to the maximum potential trip generation for land uses associated with the proposed development. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Handbook, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered.

### **Findings**

Provide a summary of findings, including the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed.

## **C. Example Outline**

### **Trip Generation Memo**

[Development Title]

Case Number: XX-XXXXXX XX

#### **Applicant Information**

[Name]

[Address]

[Phone Number]

[Email]

#### **Report Author**

[Name]

[Address]

[Phone Number]

[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

## Purpose of Analysis

### Introduction

The purpose of this Trip Generation Memo is to evaluate the potential impacts of the proposed development to the surrounding transportation network.

### Project Overview

[Description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, access roadways, and proposed development phasing. Site plan should not be included in this analysis.]

### Existing Roadway System

[Include a description of the study area roadways and intersections including current traffic counts.]

### Projected Transportation Impact

#### Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable]

**Table 1: Trip Generation Summary Table**

Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											
Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
Comparison Table											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

### Findings

[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the Transportation Design and Construction Manual – Amended XX-XX-XX]

transportation network]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

## **Appendix**

[Insert any data used in analysis:]

### **Trip Generation Calculations**

### **Traffic Counts**

### **A.3 Transportation Analysis Format:**

#### **Introduction and Summary**

The purpose of the TA should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions, and recommendations of the TA.

#### **Proposed Development**

Provide a description of the land, parcel size and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site specific development should be described. This includes a discussion of location, proposed zoning, land use and intensity. A site plan is not necessary within a TA.

#### **Existing Area Conditions**

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County. Roadways that provide access to the site are included in this section. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts should include average daily traffic within the study area.

#### **Projected Traffic**

The main component of the TA is estimating the amount of traffic being generated from a proposed development. A trip generation comparison table showing computational comparison of the maximum possible trips generated from the proposed land uses and the maximum possible trips generated from existing and allowed land uses shall be provided. The latest addition of ITE's *Trip Generation Handbook* provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered. Include a table summarizing trip generation estimates. Calculate the percentage increase in average daily traffic with the proposed development over the existing traffic.

#### **Findings and Recommendations**

Summarize the proposed development, its impacts, and the possible mitigation strategies.

C. Example Outline

#### **Rezoning Transportation Analysis**

[Development Title]

Case Number: XX-XXXXXX RZ

Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

Report Author

Transportation Design and Construction Manual – Amended XX-XX-XX

[Name]  
[Address]  
[Phone Number]  
[Email]

Date of Original Report: XX-XX-XXXX  
Date of Revision: XX-XX-XXXX

[Cert Number/Seal and Signature of Certified Transportation Professional (PE, AICP-CTP, ITE-PTP) (If applicable)]

**Purpose of Analysis**

**Introduction**

The purpose of this Transportation Analysis is to evaluate the potential impacts of the proposed zoning to the surrounding transportation network. If the proposed zoning is approved, the Applicant will be required to submit a Transportation Impact Study to determine specific mitigation measures and must satisfy County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates at the time of Site Development Plan (SDP) and/or Preliminary and Final Plat (PF).

**Project Overview**

[Description of the project site including size, location, current land use, intensity, existing zoning, and proposed zoning. Site plan should not be included in this analysis.]

**Study Area**

[Description of the study area and impacted roadways and intersections. The study area limits should be described and mutually agreed to between the applicant and the county. The study area should not include roadways proposed interior to the development.]

**Existing Roadway System**

[Include a description of the study area roadways and intersections including existing traffic counts, lane geometry, posted speed limits, current traffic control at intersections, presence of pedestrian and bicycle infrastructure, availability of on-street parking, and whether a roadway is private or public.]

**Projected Transportation Impact**

**Trip Generation**

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable during rezoning]

**Table 1: Trip Generation Summary**

Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											

Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
<b>Comparison Table</b>											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

### Analysis

[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the transportation network. Provide the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed. Level of Service (LOS) calculations are not required with a TA.]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

### Recommendations

[Summarize the anticipated public improvements and strategies and/or recommendations to mitigate potential negative impacts to the transportation network in the study area]

#### Table 2: Anticipated Public Improvements

Summary of the anticipated public improvements per County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates (shoulders, sidewalks, curb and gutter, bicycle infrastructure, etc.) if the zoning is approved and the applicant proceeds to subsequent development processes.

Location	Improvements

#### Table 3: Potential Mitigation Strategies

Summary of potential strategies and/or recommendations that show an ability to mitigate traffic impacts from the proposed rezoning to the study area.

[List strategies that can address potential impacts of increased trip generation from the proposed zoning. Impacts should be those that are common for the location type and the level of trip generation increase. Recommendations should generally indicate if strategy is feasible at the location indicated.]

Location	Strategy	Recommendation

**Appendix**

[Insert any data used in analysis]

**Trip Generation Calculations**

**Traffic Counts**

## **A.4 Transportation Impact Study Format:**

### **Introduction and Summary**

The purpose of the TIS should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions, and recommendations of the TIS.

### **Proposed Development**

Provide a description of the land parcel size, general terrain features and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site-specific development should be described. This includes a discussion of land use and intensity, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

### **Existing Area Conditions**

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County, during the Preliminary Application process or prior to submittal. Roadways that provide access to the site as well as future roadways included in the study area are included in this section. Existing intersections within the study area as well as geometrics and traffic signals should be identified. The existing and proposed land uses of the site should be identified. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts should include average daily traffic and intersection peak hour turning movements within the study area.

### **Background Traffic**

Background traffic growth estimates should be based on the most recent regional Travel Demand Model available. Overly conservative projections of background growth will not be accepted. If a growth model is not available for the study area, a reasonable growth rate considering area development potential shall be agreed upon by the applicant and the County during the Preliminary Application process. Growth rates above 2% per year will not be considered.

Trips generated by other approved developments within the study area, that were not included in the traffic counts collected, may be added to the background growth and referenced in the TIS. However, the combined background growth rate from area development and growth modelling shall not exceed an average of 2% per year.

### **Projected Traffic**

One of the most critical elements of the TIS is estimating the amount of traffic being generated. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered. Include a table summarizing trip generation estimates.

**Trip Distribution:** The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

**Trip Assignment:** The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3-year projected and 20-year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

**Internal Trips:** Trips captured internally by a proposed development may be applicable depending on the land use. The



internal capture rates used should be based on the current version of the ITE's Trip Generation Handbook.

Pass-by trips: Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway. Pass-by trips shall still be applied to the site's driveways and any local roadways between the site and the roadway from which the trips are diverted. Pass-by trip reductions should not be made to the overall trip generation prior to trip assignment.

### **Transportation Analysis**

Capacity analysis is required for each of the major street and site access locations (signalized and un-signalized) within the study area. A clearer understanding of both the transportation related implications of the project and the necessary improvements to ensure acceptable operating conditions should result from this section of the TS. In addition, the following County plans and program and factors shall be considered in the transportation analysis: Major Thoroughfare Plan, Bicycle Plan and Traffic Impact Fee Program.

Factors:

- Safety
- Neighborhood Impacts
- School Zone Traffic Control
- Traffic Control Needs
- Transit Needs or Impacts
- Transportation Demand Management
- Circulation Patterns
- On-site Parking Adequacy and Off-site Parking Facilities
- Pedestrian and Bicycle Movements/Continuity of Facilities
- Other vulnerable roadway users applicable to proposed or nearby land uses
- Service and Delivery Vehicle Access
- Emergency and Fire Apparatus Access

*Transportation Safety:* The initial review of existing conditions within the TIS area shall include analysis of crash data from the 3 most recent years available. Any intersection experiencing Level of Service of Safety (LOSS) III or IV, or above average crashes on the state-specific Safety Performance Functions, will need additional analysis. The proposed site plan should ensure that the internal circulation system and external access points improve pedestrian and bicyclist safety and minimize vehicle/pedestrian and vehicle/bicyclist conflict points. Additional vulnerable roadway users shall be considered if applicable to a proposed land use or adjacent to existing land uses.

*Transportation Operations:* Impacts on transportation operations shall be measured based on the definitions contained in the current version of the *Highway Capacity Manual (Transportation Research Board)*. For each analysis period studied (typically 3 and 20 year periods) and for each phase of the project a projected total traffic volume must be estimated for each critical intersection and roadway segment being analyzed. The projected total traffic volumes (consisting of the summation of existing traffic, background growth traffic, background development traffic and site traffic) will be used in the next step-capacity analysis of future conditions.

*Signalized Intersections:* Level of Service (LOS) is based on roadway system characteristics that include:

- traffic volume
- lane geometry
- percentage of trucks
- peak hour factor

- number of lanes
- signal progression
- ratio of green time to cycle time (G/C)
- roadway grades
- parking conditions
- bicycle and pedestrian flows

The LOS categories are established in the *Highway Capacity Manual*. In general, LOS ratings of A to D are acceptable for the overall intersection and individual movements while E & F ratings must be mitigated. There are a number of software programs that can determine highway capacity.

*Unsignalized Intersections:* LOS for multi-way stop controlled intersections and driveway intersections must be determined by computing or measuring control delay. Where capacity analysis shows a LOS of D or worse for the overall intersection or any individual movements, mitigation must be provided. Mitigation could be a traffic signal, roundabout, turn restriction, or other measure to improve LOS. An analysis must be completed to determine the proposed measure mitigates the failing LOS. Any proposed all-way stop intersection must be justified using MUTCD's guidance on multi-way stop applications. Any newly signalized intersections must be justified using MUTCD Warrant 2 (Four-Hour Vehicular Volume). Alternatively, Warrant 3 (Peak Hour Volume) may be evaluated only if the unusual cases as defined in the MUTCD apply.

*Roundabouts:* In cases where LOS analysis indicates that an unsignalized intersection is expected to be LOS D or worse, a roundabout will be assessed before consideration will be given to a proposed signalized or multiway stop intersection. Factors for consideration of a roundabout include:

- availability of right-of-way
- crash history or potential
- traffic volume
- lane geometry
- number of lanes
- roadway grades
- parking conditions
- bicycle and pedestrian flows
- level of service

Each proposed location for a roundabout will be evaluated on a case by case basis. The capacity of a roundabout must be evaluated, and appropriate analytical software programs shall be utilized.

**Parking:** Utilizing ITE's Parking Generation Manual as a starting point, provide an estimate of how much parking the proposed development will generate. Parking utilization rates from similar sites may aid in this analysis.

**Queueing:** Provide an analysis of projected 95th percentile queues to determine adequacy of existing and proposed turn lane storage lengths, and whether any through-queues block adjacent intersections.

### **Improvement Analysis**

The improvements required to accommodate existing, background and site generated traffic are summarized in this section. Intersections serving the development should be analyzed first. The analysis should include the following steps:

- Identification of critical movements and corresponding intersection approaches.
- Determine if the intersection needs new types of traffic control such as roundabout, signalization or multi-way stop control.

- Evaluation of each critical movement under potential scenarios of adding lanes, altering signal phasing, signal timing or lane use.
- Evaluation of signal locations, phasing and timing, with particular emphasis on corridor signal progression.
- Evaluation of queue lengths for both turn and through lanes to ensure adequate storage space.
- Identification of potential improvements within the contexts of Right-of-Way availability, intersection spacing, signal progression, County design standards and practical feasibility.

### Findings & Recommendations

Summarize the proposed development, its impacts, and the proposed mitigation measures.

C. Example Transportation Impact Study Outline

### Transportation Study

[Development Title]

Case Number: XX-XXXXXX SD/PF

Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

Report Author

[Name]

[Address]

[Phone Number]

[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

[Seal and Signature of Colorado Professional Engineer]

Page Break

### Executive Summary

### Table of Contents

List of Figures

List of Tables

## **Purpose of Analysis**

### **Proposed Development**

Project Location

[Insert vicinity map showing the location of the project site in relation to the surrounding transportation network]

Project Overview

[Description of the site including size, location, land use, intensity, existing zoning, proposed zoning, access locations and proposed development phasing.]

### **Existing Area Conditions**

[Include diagrams and narrative of traffic counts collected]

### **Background Traffic**

[Include reference to source Travel Demand Model, any nearby developments considered, and diagrams of 3-year and 20-year projections]

### **Projected Traffic**

Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development including any trip reduction considerations, internal trip capture rates and pass-by trips as applicable]

Trip Generation Summary

[Table including land use, intensity, ITE Code, daily traffic volume, peak hour: in, out and total traffic volumes.]

Trip Distribution

Pass-by Trips (if applicable)

Trip Assignment

3-Year Horizon

20-Year Horizon

### **Transportation Analysis**

Level of Service

[LOS diagrams at all study area intersections]

Safety

[LOSS Analysis]

Intersection Controls

[Roundabout analysis, signal- or all-way-stop-warrant analysis]

Parking

Transportation Design and Construction Manual – Amended XX-XX-XX

[Include parking generation and availability]

Queueing

[Queueing analysis at study area intersections]

### **Improvement Analysis**

[Describe any improvements needed to mitigate impacts]

### **Conclusion and Recommendations**

[Summarize the proposed development including site location, proposed accesses, and trip generation.]

### **Appendices**

Site Plan

Traffic Counts

Growth Calculations

Nearby Development Trip Estimates\*

Trip Generation Sheets

LOS Worksheets (Synchro or equivalent)

Roundabout Analysis\*

Signal and/or All-Way Stop Warrants\*

LOSS Worksheets

Parking Generation Sheets

Queueing Analysis Worksheets

Signal Progression Analysis\*

\*as applicable

**LAND  
DEVELOPMENT  
REGULATION  
SECTION 15 –  
CLEAN COPY**

## Section 15 - Circulation

(orig. 7-12-05)

### A. Planning Standards

1. Street/Road Standards: Plans for streets/roads shall be prepared in accordance with the Jefferson County Transportation Design and Construction Manual and shall be approved by Planning and Zoning prior to plat recordation. (am. 7-12-05; am. 5-20-08; am. 11-24-15)
  - a. Rights-of-Way for public streets/roads, easements for private streets/roads, and emergency access easements shall be granted, conveyed and transferred in accordance with the following: (reloc. 7-12-05; am. 7-17-18)
    - (1) Public Street/Road System:
      - (a) The fee simple property owner shall be required to dedicate rights-of-way for the following: (am. 7-12-05; am. 7-17-18)
        - (a-1) Streets/roads shown on the current Major Thoroughfare Plan within or adjoining the subdivision. (reloc. 7-12-05)
        - (a-2) Proposed public streets/roads within the subdivision. (reloc. 7-12-05)
        - (a-3) Proposed public streets/roads that connect the subdivision to existing County, state or city maintained streets/roads. (reloc. 7-12-05)
        - (a-4) Existing public streets/roads, not previously dedicated, that are within or adjoining the subdivision. The dedication requirement for adjoining streets shall be for the adjoining one-half of the street, and for any portion of the opposite one-half of the street which is under the ownership of the developer. (reloc. 7-12-05; am. 7-17-18)
        - (a-5) Turn lanes, speed change lanes and tapers along adjoining property or properties required for construction and safe operation of intersections and new street/road facilities for the proposed subdivision. (reloc. 7-12-05)
      - (b) Rights of way for public streets/roads within the boundaries of the subdivision shall be dedicated to Jefferson County in accordance with the Dedication Certificate provisions in the Final Plat Section of this regulation. (orig. 7-17-18)
      - (c) Rights of way for public streets/roads exterior to the subdivision boundaries shall be conveyed to the County of Jefferson, in fee simple by general warranty deed, or another type of deed in a form acceptable to the Office of the County Attorney. Unless otherwise approved by the Office of the County Attorney, rights of way shall be free of all encumbrances, including, without limitation, liens, easements, and deeds of trust. (orig. 7-17-18)
    - (2) Private Street/Road Systems:
      - (a) The provision of access by private streets/roads shall only be permitted if the following applies: (reloc. 7-12-05)
        - (a-1) The developer has taken all actions necessary to ensure perpetual access for the benefit of each lot, tract or parcel, and to ensure that the private street/road system within the subdivision is maintained. (reloc. 7-12-05; am. 5-20-08)
        - (a-2) The developer has acquired sufficient rights, title, and interest in adjoining property to construct an exterior street/road system to connect the subdivision to public streets/roads to ensure perpetual access to each lot, tract or parcel, and establish permanent maintenance of the private streets/roads. (reloc. 7-12-05)
        - (a-3) Access to adjoining properties is not necessary unless required pursuant to A.1.c.(5). (am. 7-12-05; am. 7-17-18)
      - (b) Each private street/road within the subdivision boundary shall be designated as a "Utility, Drainage and Emergency Access Easement" on the plat. This Utility, Drainage and

Emergency Access Easement will be dedicated to Jefferson County in accordance with the Dedication Certificate provisions in the Final Plat Section of this regulation. (orig. 7-17-18)

(3) Exterior Emergency Access Easements:

- (a) Emergency Access Easements shall be conveyed to Jefferson County for required exterior emergency access connections where the developer does not have the necessary rights to ensure perpetual access for the benefit of each lot, tract or parcel within the development boundary. (am. 7-17-18)
- (b) Emergency Access Easements shall be conveyed to Jefferson County by easement deed in a form acceptable to the Office of the County Attorney. The following shall apply to the dedication of the Emergency Access Easements: (am. 7-17-18)
  - (b-1) The easement shall be for emergency and service vehicle access, and drainage and utility purposes. (orig. 7-17-18)
  - (b-2) The easement shall not obligate the County to provide maintenance services. (am. 7-17-18)
  - (b-3) The easement deed shall expressly state that it conveys to the County an easement for each of the following purposes: (i) passage of service vehicles and passage of all vehicles and pedestrians during an emergency; (ii) drainage; and (iii) utilities. (am. 7-12-05; am. 7-17-18)
  - (b-4) The easement shall be from the fee simple property owner or the owner of a prior easement that expressly provides that it can be assigned or conveyed to the County. (orig. 7-17-18)
- (4) Public street/road right-of-way widths and private street/road easement widths shall be provided in accordance with the templates in the Transportation Design and Construction Manual. Additional rights-of-way/easements may be required at locations such as, but not limited to, roundabouts, interchanges, acceleration, deceleration, turn or climbing lanes, cut and fill slopes, sidewalks, trails, medians, traffic signs, and drainage structures, and for maintenance. (reloc. 7-12-05; am. 11-24-15; am. 7-17-18)

b. Street/Road Design

- (1) Streets/roads, whether public or private, shall be designed in accordance with the current American Association of State Highway and Transportation Officials (AASHTO) Standards unless modified by the Jefferson County Transportation Design and Construction Manual. (reloc. 7-12-05; am 11-24-15)
- (2) Paving of streets/roads within the proposed development and streets/roads connecting the proposed development with other County, state or city paved streets/roads shall be in accordance with the following: (reloc. 7-12-05; am. 12-5-06)
  - (a) New street/roads to be maintained by the County, state or city shall be constructed to the appropriate public street/road template standard, which includes paving. (orig. 12-5-06)
  - (b) Existing unpaved County maintained streets/roads shall be constructed to the appropriate public template standard (which includes paving) for a length that is equal to the development impact on the street/road system. For residential development, the development impact shall not exceed a maximum of 4% per lot. If the development impact to a street/road exceeds 80%, then paving for the entire length will be required. The impact on a street/road system will be determined using the following formulas. (reloc. 7-12-05; am. 12-5-06)

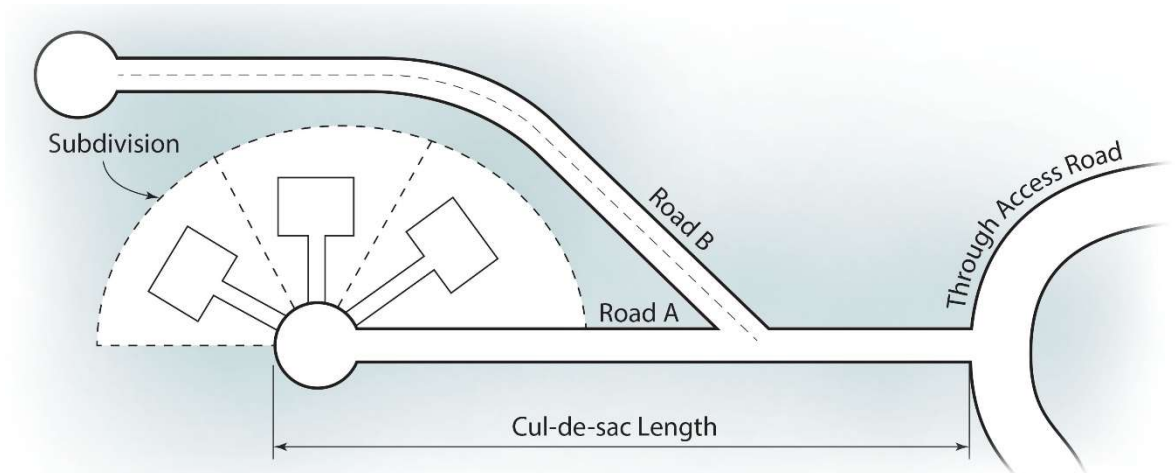
**Development Impact (%) = Proposed ADT / (Existing ADT + Proposed ADT)**

**Paving Requirement = Length of Unpaved Section X Development Impact (%)**

- Length of Unpaved Section is the distance from the development access point(s) to the paved street/road. (orig. 12-5-06)
- Proposed ADT is the number of trips generated by the proposed development. (orig. 12-5-06)



- Existing ADT is the number of actual trips on the street/road. Existing ADT shall be determined using a traffic counting device located on the gravel portion of the street/road immediately adjacent to the paved section. (orig. 12-5-06)
- (c) Should the County choose to accept a cash-in-lieu of construction payment for the paving requirement, the required paving contribution shall be calculated using following:
- Appropriate public street/road template width
  - Minimum 5" full depth asphalt surface
  - Current County cost for asphalt in place at the development location
- The County shall use the cash-in-lieu of construction monies for any improvement on the street/road as deemed necessary or desirable by the County. (orig. 12-5-06)
- (d) All private roads and all non-maintained roads in County right-of-way shall be paved if the sum of the existing and proposed ADT on the roads exceeds 150. The paving requirement will apply to that portion of the roads that exceeds 150 ADT (reloc. 7-12-05; am. 12-5-06)
- (e) All private streets shall be paved. (orig. 7-17-18)
- c. Patterns: Street/road patterns shall be planned consistent with the dedication and design requirements and the following: (reloc. 7-12-05)
- (1) Street/road patterns shall induce traffic flow appropriate to the function of the streets/roads. Long, straight and other local street alignments conducive to speeds in excess of 30 M.P.H. shall be avoided. In areas where that is not possible traffic calming measures such as bump outs, neckdowns shall be incorporated at approved intervals to effectively slow down design speeds. (reloc. 7-12-05; am. 7-17-18)
- (2) Cul-de-sacs may be used when meeting the following criteria:
- (a) Does not exceed 1 mile in length and serves no more than 30 existing plus proposed single family residential units (including platted lots) or obtain approval from Planning and Zoning for alternate standards that provide acceptable fire protection and safety mitigation measures concerning access and water. (orig. 11-24-15; am. 7-17-18; am. XX-XX-XX)
  - (b) Serves no more than 100 multi-family units or obtain approval from Planning and Zoning for alternate standards that provide acceptable fire protection and safety mitigation measures concerning access and water. (orig. 11-24-15; am. 7-17-18; am XX-XX-XX)
  - (c) Cul-De-Sac length is measured from the maximum street/road length of the developable lot within the proposed subdivision to the beginning of the cul-de-sac. (orig. 7-17-18)



- (3) Streets/roads shall be planned and designed to minimize grading and scarring of the terrain, and not create erosion and drainage problems. (reloc. 7-12-05)

- (4) Streets/roads shall be continuous and conform in alignment and grade with existing, planned or platted streets/roads with which they are to connect. (reloc. 7-12-05)
- (5) Streets/roads shall extend to the subdivision boundary lines as deemed necessary by Planning and Zoning for the connection with adjacent lands. Public streets/roads so extended shall be dedicated as collector streets/roads unless a template for a local street/road is approved by Planning and Zoning. Private streets/roads may be extended to the subdivision boundary provided said private streets/roads are equivalent to public streets/roads for the connection with adjacent lands, if approved by Planning and Zoning (reloc. 7-12-05; am. 5-20-08; am. 7-17-18)
- (6) Streets/roads that extend to the boundary line shall be provided with a turn-around. Temporary portions of the turn-around shall be labeled as tracts to facilitate the ultimate reversion of the same. If lots are not dependent upon the extended streets/roads for access, the right-of-way, not including a turn-around, shall be dedicated, but construction of the extended street/road will not be required. (reloc. 7-12-05)
- (7) Streets/roads shall intersect one another at right angles or as nearly at right angles as topography and other limiting factors permit. (reloc. 7-12-05)
- (8) Intersection spacing shall conform to the Jefferson County Transportation Design and Construction Manual. (am. 7-12-05; am. 5-20-08; am. 11-24-15; am. 7-17-18)
- (9) Traffic calming physical devices, such as speed bumps and raised crosswalks shall require approval from the fire protection district and conform to current County policies and procedures. All other traffic calming devices are considered non-physical devices, such as bumpouts, pedestrian refuges and the like, are allowed subject to approval by Planning and Zoning. (orig. 11-24-15)
- (10) Subdivisions shall have a street/road system that provides primary and secondary access to existing County, state or city maintained streets/roads, except that secondary access is not required for developments with access provided it meets the cul-de-sac requirements as set forth in this Section. The minimum distance between the centerlines of the primary and secondary access streets/roads shall be in accordance with the spacing provision. The provision of emergency access in-lieu of secondary access shall only be permitted if the following applies: (am. 7-12-05; am. 11-24-15)
  - (a) Secondary full-time access is not needed for transportation operations and maintenance and level of service to provide appropriate vehicular access and circulation control. (am. 7-12-05; am. 7-17-18)
  - (b) The developer has taken or agrees to take all actions necessary to ensure that an emergency access has been dedicated to the County and that an emergency access system is maintained. (reloc. 7-12-05)
  - (c) The developer has taken or agrees to take all actions necessary to ensure that the emergency access will be closed always, except during emergency situations, to vehicle traffic. (reloc. 7-12-05)
  - (d) The applicable fire protection district has approved the plans for the emergency access facilities and appurtenances thereto. (reloc. 7-12-05)
  - (e) Access to adjoining properties is not required pursuant to A.1.c.(5) of this Section. (am. 7-12-05; am. 7-17-18)
  - (f) The emergency access street/road is designated as an "Emergency Access Easement" on the plat and the developer has complied with A.1.a.(2)(b) and A.1.a.(3) of this Section for any portion of the emergency access system exterior to the subdivision. (am. 7-12-05)
- d. Names: Streets/roads shall be named in accordance with the following: (reloc. 7-12-05)
  - (1) Plains: Names of all streets shall be in full conformance with the metropolitan grid system as shown on the Official Jefferson County Base Maps. (reloc. 7-12-05)
  - (2) Mountains: Names of all roads shall be sufficiently different from previously adopted road names. (reloc. 7-12-05)

- e. Street/Road Improvements: Street/road improvements shall be provided for the following: (reloc. 7-12-05)
  - (1) Streets/roads interior to the development. (reloc. 7-12-05)
  - (2) The adjoining one-half of contiguous arterial, collector and local streets/roads including streets/roads adjoining park and school lands created by the plat. (reloc. 7-12-05; am. 7-17-18; am. XX-XX-XX)
  - (3) If existing pavement on the opposite one-half of the street/road does not match with and tie to the required pavement section on the adjoining one-half, then a pavement overlay on part of the opposite one-half shall be required. If the existing pavement cross section is higher than the approved pavement cross section, then the existing pavement on the opposite one-half shall be adjusted or reconstructed to the approved height. (reloc. 7-12-05; am. 7-17-18)
  - (4) If the opposite side one-half of the street/road is not paved to current Jefferson County standards or does not exist, the developer shall be responsible for a 24-foot total pavement width plus the opposite side shoulder. If existing pavement on the opposite one-half of the street/road does not match with and tie to the required pavement section on the adjoining one-half, then a pavement overlay on part of the opposite one-half shall be required. If the existing pavement cross section is higher than the approved pavement cross section, then the existing pavement on the opposite one-half shall be adjusted or reconstructed to the approved height. (reloc. 7-12-05; reloc. 7-17-18)
  - (5) Street(s)/road(s) connecting the subdivision with existing Jefferson County, state or city maintained street(s)/road(s). The pavement width of the connecting street/road shall be the same as the street(s)/road(s) within the subdivision with which they connect. Shoulders shall be provided if curb/gutter and sidewalks are not required. (reloc. 7-12-05)
  - (6) ADA ramps shall be provided including the appropriate receiving ramp even if the entire construction is not adjoining the property. (orig. 7-17-18)
- f. Applicants shall not be required to comply with A.1.e.(2), A.1.e.(3) and A.1.e.4 regarding adjoining street/road improvements when: (am. 7-12-05; am. 7-17-18)
  - (1) The proposed ADT is less than 50 where access is proposed to an existing paved street/road. (reloc. 7-12-05)
  - (2) The sum of the existing ADT plus the ADT from the proposed development will not exceed 150 where access is proposed to an existing gravel street/road. (reloc. 7-12-05)
- 2. Driveway Standards: Access from a street/road to 1 residential lot, tract, parcel or structure, or to 1 nonresidential lot, tract, parcel or structure shall meet or exceed the standards set forth below. Access to 2 or more residential or nonresidential lots, tracts, parcels or structures shall be provided by a street/road that conforms to the requirements of this Regulation. (am. 7-12-05; am. 5-20-08; am. 11-24-15)
  - a. Driveways within the lots/tracts shall be provided from the property line to the building site without: (reloc. 7-12-05)
    - (1) Creating erosion or drainage problems. (reloc. 7-12-05)
    - (2) Crossing sewage disposal leaching fields. (reloc. 7-12-05)
  - b. Driveway design shall facilitate all emergency vehicle movement. (reloc. 7-12-05)
  - c. Access shall be provided within residential and nonresidential areas to adjoining residential and nonresidential areas respectively as required by Planning and Zoning when such provisions would reduce or limit access onto a street/road. (am. 7-12-05; am. 4-4-06; am. 5-20-08; am. 12-21-10)
- 3. Curb and Gutter Standards: Curb and gutters or ditches shall be provided for subdivisions in the plains areas in accordance with the Jefferson County Transportation Design and Construction Manual and the following: (reloc. 7-12-05; am. 11-24-15)
  - a. 6" vertical curb and gutter (with detached sidewalk) or a 4-inch mountable curb and gutter (with attached or detached sidewalk) shall be provided along all local streets, unless otherwise approved by Planning and Zoning. (am. 7-12-05; am. 4-4-06; am. 12-21-10; am. 7-17-18)
  - b. A 6-inch vertical curb and gutter shall be provided along all collector and arterial streets and along

- all streets adjoining public and semipublic tracts and multifamily and nonresidential lots. (reloc. 7-12-05)
- c. Ditches may be provided along streets in lieu of curb and gutters where all of the following criteria are met: (reloc. 7-12-05)
    - (1) Streets are classified as local or collector (ADT less than 8,000). (reloc. 7-12-05; am. 7-17-18)
    - (2) Street grades are no less than 2 percent and no greater than 4 percent. (reloc. 7-12-05)
    - (3) Minimum lot frontage is 100 feet. (reloc. 7-12-05)
  - d. Planning and Zoning may approve roadside ditches in lieu of curb and gutter if it is determined that the curb and gutter cannot be designed to drain properly or if it will cause drainage problems in the area. (orig. 7-17-18)
4. Sidewalk Standards: Sidewalks shall be provided for developments in the Plains area in accordance with the Jefferson County Transportation Design and Construction Manual and the following: (reloc. 7-12-05; am 11-24-15; am. 7-17-18)
- a. A 5-foot wide sidewalk (with combination curb and gutter) or a 5-foot wide detached sidewalk or trail shall be provided along local streets adjoining residential developments, unless otherwise approved by Planning and Zoning. (am. 7-12-05; am. 4-4-06; am. 12-21-10; am 11-24-15; am. 7-17-18)
  - b. A 5-foot attached or detached sidewalk shall be provided along all local and collector streets adjoining nonresidential and multifamily developments. (am. 7-12-05; am. 4-4-06; am. 12-21-10; am 11-24-15; am. 7-17-18)
  - c. A 6-foot wide detached sidewalk shall be provided along all minor arterial and major collector streets. (orig. 11-24-15)
  - d. An 8-foot wide detached sidewalk shall be provided along all principal arterial and parkway streets. (am. 7-12-05; am. 4-4-06; am. 11-24-15; am. 7-17-18)
  - e. Curb ramps shall be provided at all intersections. Mid-block ramps shall be provided at all "T" intersections. Mid block pedestrian ramps should be considered where there is an adjacent pedestrian path. (reloc. 7-12-05; am. 7-17-18)
  - f. Sidewalk easements shall be provided and dedicated when the sidewalk is not within a dedicated street right-of-way. (reloc. 7-12-05)
  - g. Adjacent bus stops shall be upgraded to comply with current RTD bus stop requirements. (orig. 7-17-18)
5. Traffic Signal Contributions:
- a. A contribution toward a future traffic signal will be required if the following conditions are met:
    - (1) The development generates over 1000 average daily trips or 100 trips in a peak hour period; and (orig. 7-17-18)
    - (2) The Transportation Study indicates that an intersection internal, adjacent or within 500 feet of the development will satisfy the MUTCD Peak Hour Warrant or Four Hour-Warrant within 20 years. (orig. 7-17-18)

If the above conditions are met, then the applicant shall provide a contribution representing the proportional percentage of the site that is within 500 feet to the intersection requiring future traffic signal improvements. For illustrative purposes only, if the site is at the corner of one quadrant of the intersection the contribution shall be 25% of the traffic signal for the intersection. The contribution should be a cash-in-lieu payment, which will be returned to the applicant if conditions change or the traffic signal is no longer warranted within the original 20-year period. (orig. 7-17-18)

## **B. Construction Specifications**

- 1. Street/Road and Curb/Gutter/Sidewalk Standards: Construction shall be in accordance with the approved Plans and meet the criteria of the Jefferson County Transportation Design and Construction Manual. (am. 7-12-05; am. 12-21-10; am. 11-24-15)

**ZONING  
RESOLUTION  
SECTION 2 – CLEAN  
COPY**

## **Section 2 - General Provisions and Regulations**

(orig. 7-28-58; am. 2-6-84; am 7-1-03)

### **A. Amendment of Underlying Zones**

Any amendment to any underlying conventional zone district, including the Planned Development Zone District, shall in no way supersede or except any existing or subsequently adopted overlay district. (orig. 6-15-76)

### **B. Modification of Lots or Structures**

No lot, or any structure thereon, shall be modified in any way which will not conform to the applicable zone district regulations, except: (orig. 7-28-58; am. 9-6-77)

1. Where the Board of Adjustment, within its authority, grants a variance; or (orig. 7-28-58)
2. Where the Director of Planning and Zoning grants an administrative exception; or (orig. 7-17-18)
3. Where a portion of property has been acquired by an authorized public entity. (orig. 7-28-58; am. 9-6-77)

### **C. Structures Per Lot**

1. Every building shall be constructed and located on a single lot or combination of lots that have been merged, and no lot shall have more than 1 main building, except as otherwise provided by this Zoning Resolution. (orig. 7-28-58; am. 9-6-77; am. 3-26-13)
2. One or more main non-residential or multi-family structures per lot are allowed pursuant to the requirements of the Land Development Regulation or the Policies and Procedures Manual. (orig. 3-8-82; am. 6-14-88; am. 12-17-02)
3. Delineation of building envelopes is not required for accessory buildings, provided that all easements and applicable setbacks are observed. (orig. 6-14-88)
4. No structure shall be placed on a zone district line where such line crosses any portion of a property except where both zone districts would allow the use, and where both zone districts have the same setback limitations. (orig. 7-1-03)

### **D. Permit Requirements**

1. Building Permit
  - a. It shall be unlawful for any person, firm or corporation to erect, construct, reconstruct or structurally alter any building or other structure without first obtaining both of the following: (orig. 5-6-46; am. 12-26-62; am. 9-6-77; am. 8-6-80; am. 5-3-94)
    - (1) Zoning approval from Planning and Zoning including payment of a nonrefundable processing fee in an amount established by the Board of County Commissioners. (orig. 5-3-94; am. 5-25-04; am. 5-20-08)
    - (2) A Building Permit from Building Safety. (orig. 5-3-94; am. 5-25-04)
  - b. A Building Permit shall not be issued unless the lot or parcel is a proper division of land in accordance with Section 30-28-101(10) et. seq. C.R.S., as amended, unless it is the result of a process that has been exempted from the term "subdivision" and "subdivided land" by the Board of County Commissioners. (orig. 4-20-10)
  - c. A Building Permit shall not be issued unless the plans and the use conform to this Zoning Resolution and are approved by Planning and Zoning and Building Safety. (orig. 5-6-46; am. 12-26-62; am. 9-6-77; am. 5-25-04; am. 5-20-08)
  - d. A Building Permit shall not be issued for properties with the following situations:
    - (1) Multiple, unmerged lots or parcels are utilized in order to meet minimum zoning requirements for lot size or the Public Health requirements at the time of permit application; (orig. 6-15-04; am. 10-13-09; reloc. and am. 7-17-18)
    - (2) Underlying setback(s) cannot be met from interior property line(s) and multiple lots are utilized as part of permit process; (orig. 6-15-04; reloc. 7-17-18)

- (3) A well is located on a separate lot or parcel where multiple lots or parcels are required to meet minimum zoning requirements at the time of permit application; (orig. 6-15-04; reloc. 7-17-18)
  - (4) An accessory structure proposed on an adjoining lot where the primary structure is located on a separate lot; or (orig. 6-15-04, am. 10-25-05; reloc. 7-17-18)
  - (5) An Onsite Wastewater Treatment System is located on a separate lot or parcel where multiple lots or parcels are used in combination to meet minimum zoning requirements at the time of permit application. (orig. 6-15-04; am. 10-25-05; reloc. 7-17-18)
- e. Any building, structure or use which is not in compliance with the plans or use approved by Planning and Zoning shall constitute a violation of this Zoning Resolution. (orig. 6 14 88; am. 5-25-04; am. 5-20-08)
- f. The owner, at the time of issuance of the Building Permit, and the person to whom the permit is issued shall be responsible for compliance with all setback requirements set forth in this Zoning Resolution for the building or structure covered by the permit. (orig. 9-6-77)
- g. An Improvement Location Certificate (ILC), stamped by a registered surveyor, licensed in the State of Colorado, shall be required as a site plan for all Building Permits for new or replacement structures, or modifications to the footprint of existing structures. (orig. 7-17-18; am. 1-28-25)
  - (1) However, an Improvement Survey Plat (ISP) shall be required in lieu of an ILC as a submittal item when reduced setbacks for the proposed structure were approved by either the Director of Planning and Zoning, or the Board of Adjustment. (orig. 7-17-18)
  - (2) The ILC must show the structure(s) on adjacent properties when the zone district specifies a minimum separation between buildings. (orig. 7-17-18)
- h. Verification of Setbacks Requirements (orig. 7-17-18):
  - (1) A Setback Verification Form, certified by a registered surveyor, licensed in the State of Colorado, shall be submitted to Planning & Zoning upon completion of concrete/foundation form placement, and prior to sheathing for Building Permits under the following conditions: (orig. 7-17-18; am. 1-28-25)
    - (a) Where a planned setback for a detached accessory structure is less than 3 feet in the Plains areas or 5 feet in Mountain areas from the required setback for the applicable zone district; or (orig. 7-17-18)
    - (b) Where a planned setback for an addition to a primary structure is less than 3 feet in the Plains areas or 5 feet in Mountain areas from the required setback for the applicable zone district; or (orig. 7-17-18)
    - (c) Reduced setbacks for the proposed structure were approved by either the Director of Planning and Zoning, or the Board of Adjustment. (orig. 7-17-18)
  - (2) For Building Permits for new primary structures where a setback verification form is not required, and where a proposed setback is less than 3 feet in the Plains area or 5 feet in the Mountain areas from the required minimum setback for the applicable zone district, prior to the rough framing inspection, an Improvement Location Certificate, certified by a registered surveyor, licensed in the State of Colorado, shall be submitted to Planning & Zoning to verify that the required setbacks are being met. (orig. 7-17-18)
- i. Fire Protection: A written statement from the appropriate fire protection district, indicating that the property, for which the Building Permit is applied for, is within the boundaries of the fire protection district, and will be served by said fire protection district. If the property is not located within a fire protection district, a written statement from a local government indicating that they will provide service to the property shall be required. (orig. 1-18-22; am. 1-28-25)
  - (1) The above written statement shall be submitted for new structures, additions of any size, accessory dwelling units, commercial permits and any changes that modify roads or gates. The following shall be exempted from this requirement: (Orig. 1-28-25)
    - (a) Residential interior remodels with no additional square footage, and; (orig. 1-28-25)
    - (b) Outdoor decks associated with residential structures. (orig. 1-28-25)

- j. Access Standards: Before any Building Permit for a new dwelling, commercial building, industrial building, or other main building, or to replace an existing dwelling, commercial building, industrial building, or other main building, or for additional space of 400 square feet or more, measured cumulatively, may be issued, the applicant must meet the access requirements listed below. These access standards shall be deemed to be general standards that supersede conflicting provisions in any Official Development Plan. (orig. 9-6-77; am. 12-5-95; am. 12-17-02; am. 5-20-08, am. 4-20-10)
- (1) Right of Access: Evidence must be submitted demonstrating that the applicant has a right of access to a county, state or city maintained street/road. If the applicant's property does not have direct access to a county, state or city maintained street/road, then the offsite portion of the access that connects to the county, state or city maintained street/road must be in conformance with one or more of the following: (orig. 12-5-95; am. 12-17-02; am. 7-1-03; am. 10-25-05; am. 5-20-08; am. 4-20-10)
- (a) Right-of-way that has been dedicated and accepted by the county, the state or a city, but is not maintained by the county, the state or a city. (orig. 4-20-10)
  - (b) Right-of-way that has been dedicated to the county or the public, but has not been accepted by the county, and is not maintained by the county, the state or a city. (orig. 4-20-10)
  - (c) A recorded easement that gives the applicant a right of use. Planning and Zoning will review the access information provided by the applicant and information of public record, to determine the apparent right to use the access easement. Planning and Zoning is not making a legal determination as to the right of the use, only a determination that the access is sufficient for the issuance of a building permit. (orig. 4-20-10)
  - (d) A declared access from a recorded court decree that gives the applicant a right of use. (orig. 4-20-10)
  - (e) An existing access across privately owned property that has been declared a "road of record" by the Director of Planning and Zoning. The Director of Planning and Zoning's determination of a "road of record" is a determination of an apparent right to use the access for the purpose of issuing the building permit, not a legal determination as to the right of the use. The Director of Planning and Zoning may declare an access a "road of record" if it meets the following criteria: (orig. 4-20-10; am. 3-3-15)
    - (e-1) The access serving the parcel has been used for at least twenty (20) consecutive years. (orig. 4-20-10)
    - (e-2) The access does not cross property owned by a public entity or other entity over which prescriptive rights cannot be established. (orig. 4-20-10)
    - (e-3) The applicant has made a reasonable attempt to obtain an access easement or other acceptable legal right to use the access road and has been unsuccessful. (orig. 4-20-10)
  - (f) Any access right that is not identified above but is deemed sufficient by the County Attorney's Office for the purpose of issuing a building permit. An example of when this provision may be used would be when an access crosses property that is owned by a public entity or other entity over which prescriptive rights cannot be established, and a letter of authorization for such access road is provided by such entity. (orig. 4-20-10)
- (2) Right of Access Width: The right of access width must comply with the roadway standards of the Transportation Design and Construction Manual. The Transportation Design and Construction Manual standards for widths of streets/roads and driveways is established based on the existing and/or potential use of the access system. (orig. 12-5-95; am. 12-17-02; am. 7-1-03; am. 10-25-05, am. 4-20-10; am. 11-24-15; am. 7-17-18; am XX-XX-XX)



- (3) Physical Location of Access: The physical location of the access must closely align with the described limits of the right of access. If the right of access is based on a centerline description, then the centerline of the physical access shall be located along the centerline description. The evaluation of the physical location of the access shall be completed to a point where the street/road connects to a county, state or city maintained street/road. Planning and Zoning will review the physical location of the access based on documents provided by the applicant, information of public record and with the use of cartographic information. If necessary to locate and clarify access, a survey may be required. Planning and Zoning is not making a legal determination as to the location of the street/road with respect to the right of access. The provisions of this section do not apply if the right of access is a "road of record". The provisions of this section may be determined not to apply to an alternate right of access approved by the County Attorney's Office. (orig. 4-20-10)
- (4) Physical Standard of Access: The evaluation of the physical access shall be completed both on-site and off-site to a point where the street/road or driveway connects to a county, state or city maintained street/road. For the evaluation of the physical access standards, different requirements are established for the different building permit types as listed below: (orig. 12-5-95; am. 6-18-02; am. 12-17-02; am. 10-25-05; am. 5-20-08; am. 4-20-10; am. 11-24-15; am. XX-XX-XX)
- (a) All Building Permits (except those for additions or non-habitable detached structures): The applicant's design engineer must evaluate the access, and identify any necessary improvements to bring the access into compliance with the standards of the Transportation Design and Construction Manual. The Transportation Design and Construction Manual standards for streets/roads and driveways is established based on the existing and/or potential use of the access system. (orig. XX-XX-XX)
- (b) Building Permits for additions, residential interior remodels, or non-habitable detached structures: The applicant shall provide a letter from the Fire Protection District indicating if the existing access is acceptable. The Fire Protection District may add conditions to the acceptance of access as deemed necessary. (orig. XX-XX-XX)
- The Transportation Design and Construction Manual details the relief process for any street/road or driveway that cannot meet the applicable access standards. (orig. XX-XX-XX)
- (5) Previous Review of Access: If the property for which the building permit is sought has gone through an approved Rezoning, Special Use, Plat, Exemption, Minor Adjustment, Site Development Plan, Grading Permit, or Notice of Intent subsequent to April 20, 2010, then the access verification that occurred during that process shall be deemed sufficient for the building permit process, unless the access being proposed for the building permit is not consistent with what was previously reviewed or the access standards of this section have been revised subsequent to the approval of the application. For Rezoning and Special Use applications, if the provisions of the Physical Standard of Access were not reviewed during the process, then those provisions must be satisfied prior to the issuance of the building permit. (orig. 4-20-10)

## 2. Miscellaneous Zoning Permit

- a. It shall be unlawful for any person, firm or corporation to erect, construct, reconstruct, structurally alter any building or structure, and/or commence any of the following activities without first obtaining a Miscellaneous Zoning Permit. The permit shall be valid for one year, all work must be completed within this time frame or a new or renewal permit will be required. Planning and Zoning may request documentation to ensure compliance with the regulations. (orig. 5-3-94; am. 3-28-00; am. 5-25-04; am. 5-20-08; am. 3-26-13)
- (1) Any structure not requiring a Building Permit, including but not limited to entry features, gazebos, retaining walls over 36 inches in height, decks less than 30 inches but greater than 12 inches in height, chicken coops, and beehives. (orig. 5-3-94; am 3-28-00; am. 12-17-02; am. 3-26-13; am 5-10-22)
- (a) Mini-structures that are less than 200 square feet, 14 feet or less at the peak, and do not house livestock do not require a permit (orig. 5-10-22)
- (2) Recreation facilities, including but not limited to tennis courts, swimming pools, playgrounds, and golf courses. (orig. 5-3-94; am. 7-17-18)

- (3) Broadcasting and receiving devices, including but not limited to private satellite dishes over 18 inches in diameter, television and/or radio towers, cellular towers, antenna, and ham radio towers. (orig. 5-3-94; am. 3-28-00; am. 12-17-02)
- (4) Temporary structures not requiring a Building Permit, including but not limited to sales and/or security trailers, temporary buildings and/or facilities, and mobile homes. Temporary uses and/or structures, including but not limited to fireworks stands, Christmas tree sale lots, parking lot sales and seasonal produce and/or flower stands. (orig. 5-3-94; am 5-10-22)
- (5) Home occupations as outlined in the Home Occupations Section of this Zoning Resolution. (orig. 5-3-94; am. 3-26-13)
- (6) Group living facility for more than 3 unrelated persons. (orig. 5-25-04)
- (7) Any gate across access that serves a parcel or parcels, a tract or tracts, or a lot or lots. A Miscellaneous Zoning Permit issued for such purpose shall first be approved by the applicable fire protection district. Access through the gate shall be granted to beneficiaries of any easements and emergency service providers. (orig. 5-10-22)
- (8) A noise barrier fence, maximum of 8 feet in height, may be constructed adjacent to right-of-way for an arterial or higher-class street or road. (orig. 7-1-03; am. 7-17-18; reloc. 5-10-22)
- b. A Miscellaneous Zoning Permit shall not be issued unless the plans and the use conform to the provisions of this Zoning Resolution. (orig. 5-3-94)
- c. The owner, at the time of issuance of a Miscellaneous Zoning Permit, and the person to whom the permit is issued shall be responsible for compliance with all the requirements set forth in this Zoning Resolution for the building, structure and/or activity covered by the permit. (orig. 5-3-94; am. 12-17-02)

### 3. Short-Term Rental Permit

- a. It shall be unlawful for any person, firm or corporation to operate a short-term rental without obtaining an approved Short-Term Rental Permit. In addition, the following criteria must be met before the issuance of a Short-term Rental Permit: (orig. 1-1-12)
  - (1) The property owner shall notify each adjacent property owner in writing by certified mail of the name and contact information for the 24-hour local primary and secondary contacts. If such local contacts change, the property owner shall notify the adjacent property owners and the Jefferson County Planning and Zoning Division of the new local contacts' information in writing by certified mail within five (5) business days of the change in local contacts. (orig. 1-1-12)
  - (2) The dwelling shall be equipped with operable smoke alarms, fire extinguishers and carbon monoxide alarms. An operable carbon monoxide alarm shall be installed within fifteen (15) feet of the entrance to each room used for sleeping purposes. The smoke alarms shall be installed pursuant to the current International Building Code as adopted by the Jefferson County Division of Building Safety. (orig. 1-1-12)
  - (3) The proposed short-term rental shall provide a minimum of one (1) off street parking spaces, plus one (1) additional space per sleeping room. (orig. 1-1-12)
  - (4) Proof of adequate water and sewer. (orig. 1-1-12)
  - (5) Legal access in conformance with the access requirements of this Zoning Resolution. (orig. 1-1-12)
  - (6) Proof of Fire Protection. (orig. 1-1-12)
    - (a) Outdoor fires using wood or charcoal for fuel are always prohibited. (orig. 1-1-12)
  - (7) The property owner shall provide a current sales tax license for the short-term rental issued by the Colorado Department of Revenue. (orig. 1-1-12)
- b. A permit for a short-term rental shall be obtained within thirty (30) days following review by the Board of Adjustment for approval or renewal of a special exception to allow a short-term rental of a single-family dwelling. The review of the Short-Term Rental Permit application will include but is not limited to: failure to comply with any conditions set by the Board of Adjustment on approval of the special exception for short-term rentals, complaints received by the Sheriff's Office for noise or improper parking, any active zoning violations or other impacts that cause the short-term rental to become

incompatible with the surrounding land uses. (orig. 1-1-12)

- c. The owner at the time of issuance of a short-term rental permit and the person to whom the permit is issued shall be responsible for compliance with all the requirements set forth in this Zoning Resolution for the building, structure and/or activity covered by the permit. (orig. 1-1-12)
  - d. Once the short-term rental permit has been issued, the owner shall provide all rental dates to the Jefferson County Planning & Zoning Division. In turn, Planning & Zoning shall provide this information to the Jefferson County Assessor and the Colorado Department of Revenue. This report shall be filed quarterly. (orig. 1-1-12)
  - e. The property owner shall post the 24-hour local contact information as well as the Short-Term Renter Good Neighbor Brochure as created by the Planning and Zoning Division at a prominent location within the structure. In addition, the property owner shall provide each renter with a copy of the brochure at the time of occupancy. (orig. 1-1-12)
  - f. The County may revoke a Short-Term Rental Permit at any time for failure to comply with the provisions of this Zoning Resolution concerning short-term rentals and/or confirmed violation(s) of any federal, state, or local law, ordinance, or regulation. The decision of the County to revoke a Short-Term Rental Permit may be appealed to the Board of Adjustment. No short-term rental of the subject property may occur while an appeal is pending. (orig. 1-1-12)
4. Setback Criteria from Streets/Roads: Setbacks shall be measured from the private access easements, easements associated with public street/road templates set forth in the Jefferson County Transportation Design and Construction Manual or flow line/edge of pavement of public and private streets or roads, except where Planning and Zoning finds that the private access easement functions as a shared driveway, based upon criteria including the following: (orig. 3-15-82; am. 12-17-02; am. 5-20-08; am. 10-13-09; am. 3-3-15; am. 11-24-15; am. 7-17-18)
- a. Estimated current or projected average daily traffic (ADT); (orig. 3-15-82; am.10-13-09)
  - b. Design and topography; (orig. 3-15-82)
  - c. Providing connection between thoroughfares. (orig. 3-15-82)
  - d. Number of properties served by the easement. (orig. 7-17-18)
- In the event the private access easement is determined to be functionally equivalent to a shared driveway, a minimum setback from the access easement of five (5) feet shall apply. (orig. 7-17-18)
5. General Setback Criteria:
- a. All setbacks shall be measured from the foundation or wall; however, eaves, roof overhangs, and fireplaces may protrude 24 inches into the setback. Underground counterforts and window wells may protrude into setbacks. (am. 7-17-18)
  - b. The placement of improvements on any such zoned property may be further restricted by plat notes approved by the Board of County Commissioners in conjunction with an approved Plat, Exemption from Platting, or other process subject to the Land Development Regulations. (reloc. 7-17-18)

#### **E. Zone District Boundaries**

For purposes of determining zone district boundaries after vacation of a right of way dedicated or deeded to the County, the zoning applicable to the property abutting on either side of the right of way shall, after vacation, be deemed to extend to the centerline of such vacated right of way. (orig. 9-6-77)

#### **F. Street/Road Setbacks**

For purposes of measuring front, side and rear setbacks, all measurements shall be measured from the future right of way line when the street or road is designated on the "County Major Thoroughfare Plan". (orig. 7-28-58; am. 9-6-77; am. 12-17-02; am. 10-13-09)

#### **G. Front Yard**

- 1. On a through lot, the front yard requirements of the applicable zone district shall apply to each lot line fronting on a street. (orig. 5-6-46; am. 9-6-77)
- 2. Regardless of the location of, or the direction that any structure faces and regardless of where the main entryway into the structure is located, the front lot line of a lot shall be as indicated on the subdivision plat

or if not shown on a Subdivision Plat, it shall be determined by the main route of access into the property. (orig. 7-28-58; am. 9-6-77; am. 12-17-02)

3. Every part of the required front yard shall be open and unobstructed from its lowest point to the sky, except for landscaping and fencing not prohibited by the appropriate Section of this Zoning Resolution; and except for entry features with a minimum 14 foot height clearance. (orig. 5-6-46; am. 12-26-62; am. 9-6-77; am. 8-6-80; am. 12-17-02; am 7-17-18)

#### **H. Side Yard**

Every part of the required side yard shall be open and unobstructed from its lowest point to the sky, except for landscaping, accessories such as clothes lines, swing sets up to 8 feet in height and fencing not prohibited by the appropriate Section of this Zoning Resolution. (orig. 5-6-46; am. 9-6-77; am. 8-6-80; am. 12-17-02)

#### **I. Rear Yard**

Every part of the required rear yard shall be open and unobstructed from its lowest point to the sky, except for landscaping and accessories such as clothes lines, swing sets up to 8 feet in height and fencing not prohibited by the appropriate Section of this Zoning Resolution. (orig. 5-6-46; am. 9-6-77; am. 8-6-80; am. 12-17-02)

#### **J. Fences**

1. Fences shall meet the standards set forth in the Zoning Resolution and applicable County Regulations. (orig. 5-10-22)
2. A noise barrier fence, maximum of 8 feet in height, may be constructed adjacent to right-of-way for an arterial or higher-class street or road. (orig. 7-1-03; am. 7-17-18; reloc. 5-10-22)
3. Fences on corner lots must comply with vision clearance triangle requirements. (orig. 7-17-18; reloc. 5-10-22)
4. Fences more than 42 inches in height are allowed, subject to the following development standards:
  - a. Side-to-street setback: Fence shall be set back to the edge of the sidewalk, or at least 10 feet from the flowline of adjacent streets if no sidewalk exists. (orig. 7-17-18; reloc. 5-10-22)
  - b. Front setback: Fences shall be set back to the edge of the sidewalk, or at least 10 feet from the flowline of adjacent streets if no sidewalk exists, provided the applicable zone district allows fences in the front setback. (orig. 7-17-18; reloc 5-10-22)
  - c. Fences shall maintain a 25'x25' sight triangle for all driveways, both on-site and off-site, which is measured from the edge of driveway and the flowline of street/road. (orig. 7-17-18; reloc. 5-10-22)

#### **K. Rubbish**

The outdoor storage of rubbish is prohibited unless expressly allowed by the applicable zone district. (orig. 5-20-08)

#### **L. Height Regulation**

1. The height limitations established for each zone district shall apply to flagpoles; and radio, television or microwave towers (including antennas), except as otherwise provided within this section. Noncommercial antenna installations for home use of radio or television are excluded. (orig. 6-14-88; am. 6-7-94; am. 12-17-02; am. 4-20-10)
2. The height limitations established for any zone district, except Planned Development, shall not apply to chimneys, stacks, water towers, grain elevators, silos, elevators, monuments, dome spires, belfries, hangars and accessory symbols of government, religious, fraternal and civic organizations when attached to the respective building. (orig. 5-6-46; am. 9-6-77; am. 6 14 88; am. 4-20-10)

#### **M. Dangerous and/or Wild Animals**

1. Notwithstanding any other provision of this Zoning Resolution and except as provided in paragraphs L.2. and L.3. below, no person shall own, possess, harbor, maintain or keep any of the following species of animals, other than wildlife in existing natural habitat, on any property within any zone district (other than as specified in the Agricultural-Two (A-2) and Agricultural Thirty-Five (A-35) Zone Districts) in the unincorporated area of Jefferson County. The restrictions within this section apply to the A-2 and A-35 Zone Districts, when the property is at least 10 acres in size, and the keeping of dangerous and wild animals is done in accordance with an approved Special Use. (orig. 8-1-78; am. 3-28-00; am. 12-17-02; am. 3-26-13)

- a. Poisonous reptiles, species of nonpoisonous snakes which ordinarily grow to more than 6 feet in length when mature, and lizards belonging to the family Varanidae; (orig. 8-1-78)
  - b. Crocodilians; (orig. 8-1-78)
  - c. All species of non-human mammals except the following: (orig. 8-1-78)
    - (1) Domestic cat (*Felis catus*); (orig. 8-1-78)
    - (2) Chinchilla (*Chinchilla laniger*); (orig. 8-1-78)
    - (3) Domestic dog (*Canis familiaris*); (orig. 8-1-78)
    - (4) Domestic ferret (*Mustela putorius furo*); (orig. 8-1-78)
    - (5) Mongolian gerbil (*Meriones unguicularus*); (orig. 8-1-78)
    - (6) Guinea pig (*Cavia porcellus*); (orig. 8-1-78)
    - (7) Hamster (*Mesocricetus auratus*); (orig. 8-1-78)
    - (8) Domestic laboratory mouse (*Mus domesticus*); (orig. 8-1-78)
    - (9) Domestic rabbit (*Oryctolagus cuniculus*); (orig. 8-1-78)
    - (10) Domestic laboratory rat (*Rattus rattus albino strain*); (orig. 8-1-78)
    - (11) Squirrel monkey (*Saimiri seinrouis*); (orig. 8-1-78)
    - (12) Owl monkey (*Aotus trivirgatus*); (orig. 8-1-78)
    - (13) Woolly monkey (*Lagothrix lagothrica*); (orig. 8-1-78)
    - (14) Pygmy Goat (*Goatus Minimus*); (orig. 7-17-18)
    - (15) Miniature Pig (*Göttinger minipig*); (orig. 7-17-18)
    - (14) Domestic livestock including, but not limited to the following: horses, cattle, sheep, goats, swine, mules, donkeys, burros, llamas, alpacas, emu, and ostrich. (orig. 8-1-78; am. 12-17-02)
  - 2. For any property zoned Agricultural-Two (A-2) and Agricultural Thirty-Five (A-35), the owner thereof shall receive Special Use approval in order to be permitted to own, possess, harbor, maintain or keep any one or more animals of the species listed in paragraph L.1. above, where the ownership, possession, harboring, maintenance or keeping of such animal(s) is necessary to a use which is otherwise in compliance with the applicable zone district regulations and is specifically for one of the following purposes: (orig. 8-1-78; am. 12-17-02; am. 3-26-13)
    - a. To be used for scientific research or for production of scientific or commercial supplies or as breeding stock in connection with a business or other commercial operation or research facility established as a use upon the premises; or (orig. 8-1-78)
    - b. To be used for purposes of public commercial exhibition, whether as a profit or nonprofit operation, such as a permanent zoological gardens or a temporary or traveling menagerie, circus, rodeo or livestock show. (orig. 8-1-78)
  - 3. For any property zoned Agricultural-Two (A-2) and Agricultural Thirty-Five (A-35), the owner thereof shall receive Special Use approval in order to be permitted to own, possess, harbor, maintain or keep any one or more animals of the species prohibited under paragraph L.1. above, where the applicant demonstrates a special interest and competency in caring for such an animal or animals, and where the applicant demonstrates to the satisfaction of the Planning Commission and the Board of County Commissioners that the health, safety and welfare of humans and domestic animals in the area and of the general public is adequately safeguarded. (orig. 8-1-78; am. 12-17-02; am. 3-26-13)
  - 4. The application for a Special Use under paragraphs: L.2. and L.3. above, shall be made to the Planning Commission. If approved by the Planning Commission, the application shall proceed to the Board of County Commissioners, which must also approve the application for the Special Use to be permitted. (orig. 8-1-78; am. 12-17-02)
  - 5. One criterion relevant to the determination of whether to approve the Special Use shall be the agreement by the applicant that proposed facilities for the keeping of such animal(s) will be constructed and maintained in accordance with the requirements of the Colorado Division of Wildlife. (orig. 8-1-78)
- As a condition of the continued validity of any Special Use granted under paragraphs L.2 and L.3 above,

the applicant must at all times ensure that adequate safeguards for the health and security of both the animal(s) and humans and domestic animals in its (their) vicinity are provided, and must at all times be in compliance with all rules and regulations of the Colorado Division of Wildlife, including permit requirements; and, in addition, the applicant must at all times keep the animal(s) securely locked in the facilities approved by the Colorado Division of Wildlife which provide such adequate safeguards. (orig. 8-1-78)

#### **N. Sexually Oriented Businesses**

1. No person may operate or cause to be operated a sexually oriented business within 1,000 feet of any of the following, whether the use or zone district listed below is unincorporated Jefferson County, an adjacent county, or within an incorporated municipality. (orig. 7-8-97)
  - a. A Religious Assembly. (orig. 7-8-97; am. 3-26-13)
  - b. A school meeting all requirements of the compulsory education laws of the state. (orig. 7-8-97)
  - c. The boundary of any zone district in which one of the primary uses is residential. (orig. 7-8-97)
  - d. A dwelling unit (single or multiple). (orig. 7-8-97)
  - e. A public park. (orig. 7-8-97)
  - f. A licensed childcare center. (orig. 7-8-97)
  - g. An establishment holding a liquor license. (orig. 7-8-97)
2. No person may operate or cause to be operated a sexually oriented business within 1,000 feet of another sexually oriented business. (orig. 7-8-97)
3. No person may cause or permit the operation, establishment or maintenance of more than one sexually oriented business within the same building or structure or portion thereof, such as in a shopping center. A sexually oriented business may include one or more types of sexually oriented business provided it has one address and is operated as a single business entity that has one sales tax license number. (orig. 7-8-97)
4. For the purposes of this section, the distance between any two sexually oriented businesses shall be measured in a straight line, without regard to intervening structures, streets, or political boundaries, from the closest exterior structural wall of each business. (orig. 7-8-97)
5. For purposes of this section, the distance between any sexually oriented business and any Religious Assembly, school, child care center, public park, establishment holding a liquor license, dwelling unit (single or multiple) or residential zone district shall be measured in a straight line, without regard to intervening structures or objects or political boundaries, from the closest exterior wall of the structure in which the sexually oriented business is located to the nearest property line of the premises of a Religious Assembly, school, child care center, an establishment holding a liquor license, or dwelling unit (single or multiple), or the nearest boundary of an affected public park or residential zone district, whichever is closest. (orig. 7-8-97; am. 3-26-13)
6. If two or more sexually oriented businesses are within 1,000 feet of one another and are otherwise in a permissible location, the sexually oriented business which was first established and continually operating at its particular location will be deemed to be in compliance with this Zoning Resolution and the later established business(es) will be deemed to be in violation of this Zoning Resolution. (orig. 7-8-97; am. 12-17-02)
7. A sexually oriented business lawfully operating is not rendered in violation of this Zoning Resolution by the subsequent location of a Religious Assembly, school, childcare center, dwelling unit (single or multiple), public park, establishment holding a liquor license, or residential zone district within 1,000 feet of the sexually oriented business. (orig. 7-8-97; 12-17-02; am. 3-26-13)
8. All sexually oriented business shall blacken their windows or arrange the business so that the interior of the business and its stock in trade cannot be viewed from the exterior of the business. (orig. 7-8-97)

#### **O. Bars and Taverns**

1. No establishment holding a liquor license may operate within 1000 feet of a sexually oriented business. (orig. 7-8-97)
2. For purposes of this section, the distance between any sexually oriented business and any establishment holding a liquor license shall be measured in a straight line, without regard to intervening structures or

objects or political boundaries, from the closest exterior wall of the structure in which the sexually oriented business is located to the nearest property line of the premises of an establishment holding a liquor license. (orig. 7-8-97)

**P. Rural Cluster**

Permitted uses, lot and building standards, and general requirements for specific zone districts may differ from the standards specified in this Zoning Resolution for applications undergoing a rural cluster land division. When the regulations of the rural cluster process, as contained in the Land Development Regulation, conflict with any provision of this Zoning Resolution, the provision of the rural cluster process shall control. (orig. 10-13-98; am. 12-17-02)

**Q. Marijuana**

1. Private Marijuana Clubs are prohibited in all zone districts as principal or accessory uses, regardless of whether any such use is operated for profit or not for profit. (orig. 4-14-14)
2. Cultivation or processing of marijuana is only allowed in an enclosed, locked structure located on a residential property which constitutes the primary residence of the cultivator/processor, and only for personal use of the cultivator/processor. No more than 6 plants may be grown on each residential property for each registered medical marijuana patient or adult age 21 or older, and in no case may more than 12 plants be grown on a residential property. Nothing in this section shall be construed to prohibit the cultivation or processing of medical marijuana by a primary caregiver for his or her patients, provided that any such primary caregiver does not exceed the limitations on number of plants set forth in this section and is growing the plants in accordance with applicable provisions of Article XVIII, Section 14 of the Colorado Constitution; C.R.S. § 25-1.5-106, as amended; and any applicable rules promulgated under state law. (orig. 4-14-14)

**ZONING  
RESOLUTION  
SECTION 16 –  
CLEAN COPY**



## Section 16: Land Disturbance

(orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 10-12-04;  
am. 4-20-10; am. 11-20-12; am 6-1-19)

### A. Purpose

The purpose of this section is to:

1. Protect the water quality of the County's drainageways and surface waters; (orig. 10-12-04; am. 12-6-22)
2. Protect life, property and the environment from loss, injury and damage by stormwater runoff, erosion, sediment transport, ponding, flooding, landslides, accelerated soil creep, settlement and subsidence, excessive dust, and other potential hazards caused by grading, construction activities, and denuded soils; (orig. 10-12-04)
3. Allow a temporary land use for land disturbance activities; and (orig. 8-25-86; am. 9-24-91; am. 3-23-99; am. 10-12-04)
4. Establish performance standards to:
  - a. Define grading, drainage, erosion and sediment control, and waste disposal requirements; (orig. 10-12-04)
  - b. Ensure mitigation of adverse impacts; and (orig. 10-12-04)
  - c. Ensure the reclamation of disturbed land. (orig. 10-12-04)

### B. General Provisions

1. Performance Standards:

All Land Disturbance Activities must conform to the performance standards as detailed in this section. These standards apply whether or not a Land Disturbance Permit is required. (orig. 10-12-04; am. 12-6-22)

2. Activities Requiring a Land Disturbance Permit (Grading Permit or Notice of Intent):

It shall be unlawful for any person, firm or corporation to do or authorize any land disturbance in the unincorporated area of Jefferson County without first obtaining a Land Disturbance Permit from the County to authorize temporary land disturbance activities unless specifically exempted by this section. The applicant, the landowner, and the contractor are responsible if a land disturbance activity is not in accordance with the performance standards, or if a land disturbance activity is undertaken beyond the scope of the Land Disturbance Permit without County approval. Land disturbance activities must be completed in compliance with the approved plans. (orig. 8-25-86; am. 9-24-91; 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 12-6-22)

- a. Land Disturbance Activities will require a Grading Permit if one the following apply: (orig. 10-12-04; am. 12-6-22)
  - (1) The disturbed area is equal to or greater than 0.5 acres. (orig. 6-1-19; am. 12-6-22)
  - (2) Land disturbance activities with or in advance of a building permit with less than 0.5 acres of land disturbance, where the applicant is requesting relief of a regulatory requirement, including all performance standards related to grading, drainage and circulation. (orig. 6-1-19; am. 12-6-22; reloc. XX-XX-XX)
  - (3) 5,000 or more cubic yards of earthen material is stored on a property and the material is not actively being used on said property. An active use would be construction associated with an active building permit for a primary structure. (orig. 12-6-22)
- b. Land disturbance activities that require a Notice of Intent to be submitted with, or in advance of, a Building Permit application include the following: (orig. 10-12-04; am. 6-1-19; am. 12-6-22)
  - (1) Land disturbance associated with new start building permits for primary structures. (orig. 6-1-19)
  - (2) Land disturbance associated with access to detached living space where either the access does not exist or has not previously been approved as access to living space. (orig. XX-XX-XX)

This Notice of Intent process shall only apply to land disturbance activities that meet the regulatory requirements, including all performance standards related to grading, drainage and circulation. (orig. 6-1-19; am. 12-6-22; am. XX-XX-XX)

3. Activities exempt from the Requirement for a Grading Permit

Land disturbance activities that are exempt from Grading Permit requirements shall comply with the specific requirements, if any, listed in the applicable exemption provision below. In addition, land disturbance associated with activities listed within this exemption section must still be in compliance with the performance standards set forth in this section, unless specifically stated otherwise. The applicant, landowner and the contractor are responsible if land disturbance activity is not in accordance with these performance standards. The following land disturbance activities are permissible without obtaining a Grading Permit: (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 10-12-04; am. 4-20-10; am. 6-1-19; am. 12-6-22)

- a. Projects which involve less than 0.5 acres of disturbed area. Individual lots in subdivision developments under the same ownership, involving less than 0.5 acres of disturbed area, shall not be considered separate projects if they are contiguous or within 0.25 mile of each other. Any series of related projects or connected projects on one site, which together exceed the 0.5 acre limitation shall be considered a single project and shall be required to obtain a Grading Permit. (orig. 9-24-91; am. 12-17-02; am. 10-12-04; am. 7-12-05; am. 11-24-15; am. 6-1-19)
- b. Land disturbance work being done pursuant to and in conformance with an approved grading plan in conjunction with an approved recorded Plat, Site Development Plan, Minor Adjustment or Exemption from Platting. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 4-27-04; am. 10-12-04)
- c. Tillage of agricultural land is exempt from all permit requirements. Agricultural uses of land zoned agricultural, other than tillage, which disturb greater than 0.5 acres is exempt from the filing requirements, provided a conservation plan for the proposed grading activities using the United States Department of Agriculture Soil Conservation Service standards is approved by the Jefferson Conservation District. A copy of the conservation plan shall be submitted to Planning and Zoning prior to the commencement of grading activities. The County may enforce the conditions of the conservation plan under the enforcement provisions of this section. (orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 11-24-15; am. 6-1-19; am. 12-6-22)
- d. Trenching incidental to the construction, maintenance and installation of approved underground pipelines, electrical or communication facilities, and drilling or excavation for approved wells if the total area of land disturbance is less than one acre. Construction activities associated with the installation of the onsite wastewater treatment system (OWTS) shall not be exempt. Construction of access required to complete the trenching or for future maintenance shall not be exempt. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 10-12-04; am. 4-20-10; am. 11-20-12; am. 11-24-15; am. 12-6-22)
- e. Land disturbance for utility installation or maintenance within a County owned or County maintained Right-of-Way if the total area of land disturbance is less than one acre. These activities require a County Right-of-Way and Construction Permit. (orig. 8-8-95; am. 10-12-04; am. 11-20-12)
- f. Land disturbance or excavations in accordance with plans incorporated in a mining permit, reclamation plan or sanitary landfill approved by the County. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 10-12-04)
- g. County capital improvement or County maintenance projects within Right-of-Way or County property if the total area of land disturbance is less than one acre. (orig. 12-17-02; am. 10-12-04; am. 11-20-12; am. 12-6-22)
- h. Maintenance and cleaning of existing ditches, lakes, ponds, storm sewer system, and water storage reservoirs with a total area of land disturbance is less than one acre. (orig. 8-25-86; am. 10-12-04; am. 6-1-19)
- i. Land disturbance for culvert installation or maintenance within a County owned, public ROW or County maintained Right-of-Way if the total area of land disturbance is less than one acre and the culvert is intended to convey stormwater only. (orig. 6-1-19)
- j. Maintenance and resurfacing of existing streets/roads, runways, sidewalks/trail systems, parking lots/loading areas, and railroad beds. (orig. 9-24-91; am. 10-12-04)

- k. Performance of emergency work necessary to prevent or mitigate an immediate threat to life or property when an urgent necessity arises. The person performing such emergency work shall notify Planning and Zoning promptly of the problem and work required. If the emergency work would not otherwise be exempt from a Grading Permit, a Grading Permit shall be obtained as soon as possible. (orig. 8-25-86; am. 9-24-91, 8-8-95; am. 4-27-04; am. 10-12-04; am. 5-20-08)
- l. Enlargements to parking areas less than 0.5 acre larger than the original area of existing parking facilities for commercial, industrial and institutional uses. Stormwater detention and water quality must be provided for in accordance with the Storm Drainage Design and Technical Criteria Manual. (orig. 4-27-04; am. 10-12-04; am. 11-24-15; am. 6-1-19)
- m. Land disturbance for natural surface trails that are less than one acre are exempt. Land disturbance over one acre associated with the construction of natural surface trails shall follow the procedure outlined below prior to commencement of any trail construction. The land disturbance associated with the construction of natural surface trails shall conform with the performance standards of this section and the current Jefferson County Natural Surface Trail Guide. (orig. 4-20-10; am. 11-20-12; am. 11-24-15; am. 7-17-18)
  - (1) Plans are submitted showing the location and overall scope of the trail construction project, including a description of the proposed construction phasing. (orig. 4-20-10; am. 7-17-18)
  - (2) A detailed construction schedule is provided for each phase of the construction project. (orig. 4-20-10)
  - (3) The applicant proposes a construction guide that includes typical construction procedures that will be used during the construction of trails, including erosion and sediment control measures. (orig. 4-20-10)
  - (4) Planning and Zoning has reviewed the construction guide and has determined that the construction procedures will be sufficient to assure compliance with the grading performance standards of this section, and state or county erosion and sediment control standards. (orig. 4-20-10)
  - (5) The applicant shall stake the proposed trail alignment and shall coordinate a site visit with County Staff to review the alignment. If Staff identifies areas where trail alignment should be adjusted to assure conformance with the performance standards and the construction guide, then a new plan showing the new alignment shall be submitted. (orig. 4-20-10)
  - (6) The applicant agrees to implement the construction procedures identified within the guide and agrees that the county has the authority to inspect and require field alterations if the typical construction procedures identified in the guide are not being properly implemented. The applicant also agrees that failure to implement the construction standards of the guide or the field alterations directed by Planning and Zoning may result in the issuance of a zoning violation in accordance with this Resolution; and may result in the exemption from the grading permit requirements being revoked for future phases of the trail construction project. (orig. 4-20-10)
  - (7) The applicant submits the standard Grading Permit fee to cover the cost of the review and approval of the construction guide, and the inspection of each phase of the construction process. (orig. 4-20-10)

The procedures outlined in this section shall not apply to trail construction in special flood hazard areas that have been identified as a part of the Jefferson County Floodplain Overlay District. The appropriate floodplain development permit and grading permit will be required for construction activities occurring within special flood hazard areas. (orig. 4-20-10; am. 6-1-19)

- n. Any work within State or Federal lands including Rights-of-Way and/or permanent easements held by said agencies. This exemption does not relieve these entities from completing a floodplain development permit in accordance with the Floodplain Overlay District Section of this regulation. (orig. 7-17-18)
- o. Onsite disturbance through the Land Disturbance Permit may not be required for properties that are covered by a separate Municipal Separate Storm Sewer System (MS-4) permit through the State of Colorado, as determined by Planning & Zoning. (reloc. and am. 5-21-19)

#### 4. Exemptions, Waivers, Variances and/or Exclusions

Any exclusions, exemptions, waivers, and variances included in the regulatory mechanism must comply with the terms and conditions of the MS4 Permit (COR090000). (orig. 6-1-19)

5. Denial of other Permits

Building Permits or Certificate of Occupancy shall not be issued while an unresolved grading, drainage or floodplain violation is ongoing on the subject property or within a common plan of development. (orig. 8-25-86; am. 9-24-91, am. 8-8-95; am. 12-17-02; am. 7-17-18; am. 6-1-19; am. 12-6-22)

6. Permission of other Agencies or Owners

The issuance of a Grading Permit or the submission of a Notice of Intent shall not relieve the applicant of the responsibility for securing other permits or approvals required by any other division or agency of Jefferson County or other public agency or for obtaining any easements or authorization to work within an existing easement or for removing or transporting earth materials on property not owned by the applicant. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 10-12-04; am. 12-6-22)

7. Construction and Permits

For construction within County Right-of-Way, the Grading Permit or Notice of Intent must be accompanied by an Access Permit and/or a Right-of-Way Use and Construction Permit in accordance with plans approved by the County. For construction outside of County Right-of-Way, the Grading Permit must be accompanied by a Construction Permit in accordance with the plans approved by the County. The applicant shall obtain applicable permits from the County prior to commencing field work. All other applicable requirements shall be followed including the Transportation Design and Construction Manual. (orig. 8-8-95; am. 12-17-02; am. 10-12-04; am. 11-24-15; am. 7-17-18; am. 12-6-22)

8. Liability

Neither the issuance of a Grading Permit nor the submission of a Notice of Intent under the provisions of this section nor compliance with the provisions hereof or with any conditions imposed in this section shall relieve the applicant from responsibility for damage to any person or property or impose any liability upon the County for damage to any person or property. (orig. 8-25-86; am. 12-17-02; am. 10-12-04)

9. Restricted Activities

- a. No blasting, processing, crushing, or off-site hauling or other similar treatment of a commercial mineral deposit may occur in the permit area. (orig. 9-24-91; am. 10-12-04)
- b. Any activity to construct any street/road to be dedicated to the County shall be undertaken pursuant to the Land Development Regulation and the Transportation Design and Construction Manual and in accordance with plans approved by the County. (orig. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15)
- c. No Grading Permit shall be issued for any land disturbance activity which exceeds the minimal amount of grading necessary for the uses legally allowed at the time of permit application. Land disturbance activities for uses that require rezoning are unlawful. (orig. 8-8-95; am. 3-23-99; am. 10-12-04)
- d. When there is a grading plan approved in conjunction with a Plat, Site Development Plan, Minor Adjustment or an Exemption from Platting, it shall be unlawful to grade in a manner that is not consistent with the approved grading plan. (orig. 8-8-95; am. 3-23-99; am. 10-12-04; am. 7-17-18)
- e. Any construction or development activity in a drainage easement or tract must either be in compliance with the original approved drainage report or comply with the Storm Drainage Design and Technical Criteria. (orig. 10-12-04)

10. Grading Concurrent with Platting

- a. When a property is in a platting process, grading activities may commence prior to Plat approval by the Board of County Commissioners provided all of the following conditions are satisfied: (orig. 3-23-99; am. 10-12-04)
  - (1) The zoning is final and recorded. (orig. 3-23-99)
  - (2) The subdivision proposal has received approval by the Planning Commission or a recommendation of approval by the Planning Commission. (orig. 3-23-99; am. 10-12-04, am. 12-6-22)

- (3) The grading and sediment and erosion control plans have received staff approval, either through the Final or Preliminary and Final Plat process. The grading plans shall not include permanent facilities such as curb, gutter, sidewalk, asphalt, etc. The installation of drainage facilities is allowed as approved by Planning and Zoning. (orig. 3-23-99; am. 10-12-04; am. 11-24-15)
  - (4) The Final Plat application has been received and accepted as complete by staff or the Planning Commission has recommended approval of the Preliminary and Final Plat. (orig. 3-23-99; am. 10-12-04; am. 11-24-15)
  - (5) Grading within a Floodplain Overlay District may be permitted if a Floodplain Development Permit has been issued. (orig. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15; am. 7-17-18)
  - (6) No waivers or alternative standards/requirements or variances related to grading requirements are being requested or are necessary in conjunction with the Final or Preliminary and Final Plat application. (orig. 3-23-99; am. 10-12-04; am. 11-24-15)
  - (7) The applicant has submitted a letter to the County indicating a request to commence land disturbance activities prior to Final or Preliminary and Final Plat approval and acknowledging that grading prior to Platting is done at their own risk, that grading changes may be required upon Final or Preliminary and Final Plat approval, and that the County shall not be held responsible for changes emanating from or costs associated with any changes that may be required as a result of Final or Preliminary and Final Plat approval. (orig. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15)
  - (8) A Performance Guarantee has been accepted by the County in accordance with the Land Development Regulation. (orig. 10-12-04)
  - b. When grading activities are authorized prior to Plat approval by the Board of County Commissioners, the grading shall comply with the Land Development Regulation and with any previously approved grading plans. (orig. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15)
  - c. Any land disturbance activity permitted pursuant to this section may be subject to additional requirements or alterations depending on approval conditions imposed by the Board of County Commissioners during the Plat review. (orig. 3-23-99; am. 10-12-04)
11. Grading Concurrent with the Processing of a Site Development Plan or Minor Adjustment
- a. When a property is in a Site Development Plan or Minor Adjustment process, grading activities may commence prior to approval by Planning and Zoning provided all of the following conditions are satisfied: (orig. 11-24-15; am. 7-17-18)
    - (1) The zoning is final and recorded. (orig. 11-24-15)
    - (2) The grading and sediment and erosion control plans have received staff approval. The grading plans shall not include permanent facilities such as curb, gutter, sidewalk, asphalt, etc. The installation of drainage facilities is allowed as approved by Planning and Zoning. (orig. 11-24-15)
    - (3) Grading within a floodplain overlay district may be permitted if a Floodplain Permit has been issued. (orig. 11-24-15; am. 7-17-18)
    - (4) No alternate standards/requirements or variances related to grading requirements are being requested or are necessary in conjunction with the Minor Adjustment or Site Development Plan application. (orig. 11-24-15)
    - (5) The applicant has submitted a letter to the County indicating a request to commence land disturbance activities prior to Minor Adjustment or Site Development Plan approval and acknowledging that grading prior to approval is done at their own risk, that grading changes may be required upon Minor Adjustment or Site Development Plan approval, and that the County shall not be held responsible for changes emanating from or costs associated with any changes that may be required as a result of Minor Adjustment or Site Development Plan approval. (orig. 11-24-15)
    - (6) A Performance Guarantee has been accepted by the County in accordance with the Land Development Regulation. (orig. 11-24-15)
  - b. When grading activities are authorized prior to Minor Adjustment or Site Development Plan approval

by Planning and Zoning, the grading shall comply with the Land Development Regulation and with any previously approved grading plans. (orig. 11-24-15; am. 7-17-18)

- c. Any land disturbance activity permitted pursuant to this section may be subject to additional requirements or alterations depending on approval conditions imposed by Planning and Zoning during the Minor Adjustment or Site Development Plan review. (orig. 11-24-15; am. 7-17-18)

### **C. Submittal Requirements**

The following submittal documents are required for Land Disturbance Permit Applications. (orig. 8-25-86; am. 7-17-18; am. 6-1-19)

1. An application form signed by the fee simple owner of the property or by the lessee, licensee or easement holder if the activity is to be undertaken pursuant to that interest. Grading Permit, Notice of Intent, and Natural Surface Trail application forms are available from Planning and Zoning. (orig. 10-12-04; am. 5-20-08; am. 6-1-19)
2. A cover letter describing the proposed activities. Not Required for Notice of Intent Applications. (orig. 10-12-04; am. 5-20-08; am. 6-1-19)
3. A nonrefundable application fee in an amount established by the Board of County Commissioners. (orig. 8-25-86; am. 9-24-91; am. 5-3-94)
4. A copy of the recorded deed for the parcel, tract or lot. (orig. 12-6-22)
5. Proof of Access in accordance with the Access Standards in the General Provisions and Regulations Section of this Zoning Resolution. (orig. 6-1-19)
6. A grading, erosion and sediment control plan in accordance with the Plans and Specifications of this Section. (orig. 8-25-86; am. 6-1-19)
7. A geologic and/or soils investigation report in accordance with the Plans and Specifications of this Section is required if there are any geological hazards including highly erodible soils or commercial mineral deposits within or immediately adjacent to the grading site or when the final cut or fill slopes are proposed to be steeper than 2H:1V or if infiltration is a component of the drainage system. (orig. 8-25-86; am. 9-24-91, 8-8-95; am. 12-17-02; am. 10-12-04; am. 6-1-19; am. 12-6-22)
8. A drainage report or drainage letter in conformance with the requirements of the Storm Drainage Design and Technical Criteria. (orig. 10-12-04; am. 11-24-15; am. 6-1-19; am. 12-17-19)
9. Construction plans, details and supporting calculations for retaining walls, if applicable, in accordance with the Performance Standards of this Section. For Notice of Intent Applications, the applicant will need to apply for a separate miscellaneous permit for retaining walls greater than 36 inches high. (orig. 10-12-04; am. 6-1-19)
10. Drainage Easements may be required to be dedicated to the County for all permanent control measures. The applicant shall provide a legal description and exhibit (signed and stamped by a Professional Land Surveyor) when applicable. Not Required for Notice of Intent Applications. (orig. 12-17-19)
11. A cost and/or quantity estimate (Exhibit A) in accordance with the Improvement Security requirements of this Section, for all the work associated with the project. Reference the example Exhibit A on the Planning and Zoning website. Not Required for Notice of Intent Applications. (orig. 10-12-04; am. 7-12-05; am. 7-17-18; am. 6-1-19; am. 12-17-19; am. 12-6-22)

Note: An improvements security may be required in accordance with the Security requirements of this Section. The typical improvement security will be a letter of credit or cash escrow. If required the improvement security will need to be submitted prior to approval of the Land Disturbance application. (orig. 10-12-04; am. 7-17-18; am. 6-1-19; 12-17-19)

12. A completed N-1 Form stating that the proposed construction and grading are in conformance with the Land Disturbance requirements of this Section and, if applicable, the approved overall grading plan for the subdivision. Only Required for Notice of Intent Applications. (orig. 6-1-19)

Note: A completed N-2 Form is required prior to issuance of a Certificate of Occupancy. (orig. 6-1-19)

### **D. Procedures**

1. Notice of Intent Procedures: A Notice of Intent (NOI) shall be submitted with, or in advance of, a building permit application for a primary structure that depicts the phased grading, erosion and sediment control measures for that lot/parcel. The NOI shall certify that the Plans are in conformance with the Jefferson

County Zoning Resolution (ZR), the Land Development Regulation (LDR), the Storm Drainage Design and Technical Criteria (SDDTC), and The Transportation Design and Construction Manual (TDCM). Any requests for relief of these standards shall require the submittal of a Grading Permit. If applicable, the NOI shall state that the project will be in conformance with the approved construction documents with that subdivision. A completed Form Letter N-1 stating that the proposed construction and grading are in conformance with the approved overall grading plan and Land Disturbance Performance Standards shall be submitted to Planning & Zoning prior to issuance of the Building Permit. Form Letter N-1 shall be completed by a Colorado registered professional engineer. (orig. 6-1-19; am. 12-6-22)

Process Steps	Processing Time Frames	
Process from Plan Submittal to Acceptance of NOI		
Plan Submittal Intake	7 calendar days (Staff confirms the land disturbance permit qualifies as an NOI and required submittal items have been received)	Example timeframe: 19 Days to acceptance of NOI if processing time frames are met. May take longer if issues arise.
Applicant Action is Required	Varies, 5 calendar days used for example timeframe	
Plan Resubmittal and NOI Acceptance	7 calendar days (Staff confirms required submittal items have been received)	
Final Close Out		
Permit Monitoring until submittal of N-2	2 years maximum	

#### **Plan Submittal Intake**

##### **a. Sufficiency Review:**

The applicant shall electronically submit all the applicable documents identified in the Submittal Requirements of this Section as a complete package, and not in a fragmentary manner for review by the Case Manager. (orig. 12-6-22)

The Case Manager shall have 7 calendar days to review the submittal and either accept the application or respond to the applicant explaining any deficiencies in the submittal documents (including the appropriate application fees). A submittal that is not complete in terms of the type of documents required will not be accepted. (orig. 12-6-22)

Resubmittal Sufficiency Review (if required): The Case Manager shall have 7 calendar days to review the resubmittal and either accept the application or respond to the applicant explaining any deficiencies in the submittal documents. (orig. 12-6-22)

##### **Plan Resubmittal and NOI Acceptance:**

##### **b. The final documents shall be comprised of the Submittal Requirements of this Section. (orig. 12-6-22)**

The applicant shall have a maximum of 180 calendar days to respond to the comments from the case manager, or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180-calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause. (orig. 12-6-22)

##### **c. The Case Manager shall have 7 calendar days to review the resubmitted documents and shall accept the application if it is complete in form and has all the required information described in the Notice of Intent N-1 Form that provides certification from a Colorado registered professional engineer stating that the submitted plans are in conformance with the Jefferson County Zoning Resolution (ZR), the Land Development Regulation (LDR), the Storm Drainage Design and Technical Criteria (SDDTC), the Transportation Design and Construction Manual (TDCM), and the notes, restrictions and supporting documents of any associated approved Preliminary and Final Plat. The owner, contractor or engineer shall also certify that the specified control measures will be installed prior to land disturbance and that control measures will be adequately maintained throughout the process and shall sign the N-1 Form. (orig. 12-6-22)**

**Permit Monitoring:**

- d. Once the work associated with the accepted Notice of Intent is complete, the applicant shall submit a completed N-2 Form which provides certification from a Colorado registered professional engineer stating that all grading work was completed in conformance with the final accepted Grading, Erosion and Sediment Control (GESD) Plan, Drainage Report and N-1 submitted with the project application. If amendments to the accepted plans were made resulting in grading activities that were not completed in conformance with the final accepted plans, then the N-2 Form shall be submitted in conformance with the Amendments procedure of this Section. (orig. 12-6-22)

**Permit Limitations:**

- e. The permit shall be limited to work shown on the approved plans. Such plans shall contain guidelines, conditions, and/or restrictions as are necessary to comply with the performance standards. At any time during the plan review or in the event unforeseen conditions arise during completion of the project, the County may require revision of the plans as necessary to ensure compliance with the performance standards. (orig. 12-6-22)

**Amendments:**

- f. Modifications to the final accepted plans requires submittal of the revised plans and the completed N-2 Form which provides certification from a Colorado registered professional engineer stating that deviations from the accepted plans have occurred and that the revised plans and work has been completed in conformance with the Jefferson County Zoning Resolution (ZR), the Land Development Regulation (LDR), the Storm Drainage Design and Technical Criteria (SDDTC), the Transportation Design and Construction Manual (TDCM), and the notes, restrictions and supporting documents of any associated approved Preliminary and Final Plat. If the appropriate certification cannot be provided and the modifications to the plans do not conform to the Jefferson County Standards and Regulations for land disturbance permits described in this section, revised plans shall be submitted and reviewed by Planning & Zoning through an Administrative Review process where requests for relief from standards will be evaluated. (orig. 12-6-22)

**Validity:**

- g. The acceptance of plans and specifications by the County shall not be construed as an approval of any violation of the provisions of this section or of any other applicable laws, rules or regulations and shall not prevent the County from thereafter requiring the correction of errors in said plans and specifications or from preventing work being carried on thereunder in violation of this section or any other applicable law, rule or regulation. The issuance of a Land Disturbance Permit prior to any Plat approval shall in no way bind the Planning Commission or the Board of County Commissioners in the approval or denial of a Plat application, and the applicant's grading activities are at the applicant's risk. (orig. 12-6-22)

**Time Limits:**

- h. The work associated with the permit shall be completed within 2 years of the date of acceptance unless an extension has been granted by Planning and Zoning. A request for an extension shall be submitted in writing no later than 10 calendar days prior to the expiration of the permit. Planning and Zoning may grant an extension to the permit up to 1 year. Additional extensions may be granted by Planning and Zoning to allow the establishment of permanent erosion and sediment control measures. (orig. 12-6-22)
2. Grading Permit Procedures: If the applicant complies with all given time frames, submits a complete Grading Permit application and complies with all requirements of this regulation, the estimated time to reach the Determination Phase of the process is 66 calendar days from the date of the 1st referral, depending on the amount of disturbance for the proposed grading activity. (orig. 5-20-08; am. 7-17-18; am. 6-1-19; am. 12-6-22)

Process Steps	Processing Time Frames	
Steps prior to 1 <sup>st</sup> Referral		
Sufficiency Review and Referral Distribution or Deficiency Response	7 calendar days	
Resubmittal Sufficiency Review (if necessary)	7 calendar days	
Process from 1 <sup>st</sup> Referral to Determination		
1 <sup>st</sup> Referral and Staff Response	21 calendar days (14	Example timeframe: 66



	day referral, 7 days for Staff response)	Days to determination if processing time frames are met. May take longer if issues arise.
Applicant's Response to 1 <sup>st</sup> Referral	Varies, 14 calendar days used for example timeframe	
Sufficiency Review and Referral Distribution	7 calendar days	
2 <sup>nd</sup> Referral and Staff Response	14 calendar days (7 day referral, 7 days for Staff response)	
Submittal of Final Documents by applicant	Varies - 10 calendar days used for example timeframe	
Determination		
Determination	7 days	

If an applicant is going to request relief from a standard in the Regulations, then a request for relief of the standard may be submitted for consideration. In order to avoid processing delays, it is recommended that a request for relief from a standard be submitted early in the development process. Requests for relief of a standard are subject to different specific processing timeframes, which may add to the length to the processing of the development application. (orig. 5-20-08; am. 7-17-18; am. 6-1-19)

Notification is required at the time of the 1<sup>st</sup> Referral in accordance with the notification provisions of this section. (orig. 6-1-19)

Proof of Access: The Director of Planning and Zoning may allow the 1<sup>st</sup> Referral to be sent without meeting the access criteria proof of access requirements, if in his/her opinion the circumstances related to proving access should be finalized during the processing of the application. (orig. 4-20-10; am. 12-21-10; am. 6-1-19)

#### **Steps Prior to 1<sup>st</sup> Referral**

a. Sufficiency Review and Referral Distribution (1<sup>st</sup> Referral):

The applicant shall electronically submit all the applicable documents identified in the Submittal Requirements of this Section as a complete package, and not in a fragmentary manner for review by the Case Manager.

The Case Manager shall have 7 calendar days to review the submittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents (including the appropriate referral fees). A submittal that is not complete in terms of the type of documents required will not be sent out on referral. (orig. 7-17-18; am. 12-6-22)

Resubmittal Sufficiency Review (if required): The Case Manager shall have 7 calendar days to review the resubmittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents. (orig. 7-17-18; am. 12-6-22)

#### **Process from 1<sup>st</sup> Referral to Determination**

b. 1<sup>st</sup> Referral and Staff Response:

The referral agencies shall have 14 calendar days to respond in writing to the application. An extension of no more than 30 calendar days may be agreed to by the applicant. (orig. 5-20-08; am. 7-17-18; am. 6-1-19)

The Case Manager shall have 7 calendar days, after the end of the referral period, to provide the applicant with a Staff response inclusive of other referral responses. The response from the Case Manager will include an opinion as to whether the case should proceed forward to the Final Documents phase or if revised documents should be submitted for a subsequent referral process. (orig. 5-20-08; am. 7-17-18)

c. Applicant's Response to 1<sup>st</sup> Referral:

For the application to be processed in accordance with the example timeframe in the table above, the applicant shall have 14 Calendar days to address in writing any issues identified by the Case Manager or any referral agency and resubmit revised documents for the 2<sup>nd</sup> referral. (orig. 5-20-08; am. 7-17-18)

Regardless of the example timeframe, the applicant shall have a maximum of 180 calendar days to respond to the referral comments or the application will be considered withdrawn. The applicant will

then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180 calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause. (orig. 5-20-08; am. 12-21-10; am. 7-17-18)

d. Sufficiency Review and Referral Distribution (2<sup>nd</sup> Referral):

The Case Manager shall have 7 calendar days to review the submittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents. A submittal that is not complete in terms of the type of documents required will not be sent out on referral. All resubmittal documents shall be submitted as a complete package, and not sent in a fragmentary manner. (orig. 7-17-18; am. 12-6-22)

Resubmittal Sufficiency Review (if required): The Case Manager shall have 5 calendar days to review the resubmittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents. (orig. 7-17-18)

e. 2<sup>nd</sup> Referral and Staff Response:

The referral agencies shall have 7 calendar days to respond in writing to the 2<sup>nd</sup> referral. An extension of no more than 30 calendar days may be agreed to by the applicant. (orig. 5-20-08; am. 7-17-18)

The Case Manager shall have 7 calendar days after the end of the referral period to provide the applicant with a Staff response inclusive of referral agency responses. The response from the Case Manager will include an opinion as to whether the case should proceed forward to the Final Documents phase or if revised documents should be submitted for a subsequent referral process. (orig. 7-17-18)

f. Applicant's Response to 2<sup>nd</sup> Referral Comments:

The applicant shall have a maximum of 180 calendar days to respond to the referral comments, or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180 calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause. (orig. 5-20-08; am. 12-21-10; am. 7-17-18)

g. Additional Referrals and Responses:

For the 3<sup>rd</sup> Referral, and for any subsequent referrals thereafter, the processing of the application shall follow the same steps identified above in the Sufficiency Review and Referral Distribution (2<sup>nd</sup> Referral) process, the 2<sup>nd</sup> Referral and Staff Response process and the Applicant's Response to 2<sup>nd</sup> Referral process. (orig. 5-20-08; am. 7-17-18)

h. Final Documents:

The final documents shall be comprised of the stamped and signed grading plans and other final documents as identified by the Case Manager. In addition to submitting the final documents electronically, the applicant shall submit hard copies of the plans as specified in the case managers response to the last referral. (orig. 5-20-08; am. 6-1-19)

The applicant shall have a maximum of 180 calendar days to respond to the comments from the case manager, or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180-calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause.

i. Determination:

The Case Manager shall have 7 calendar days to review the Final Documents and shall approve, conditionally approve or deny the application. An application shall be approved if it is complete in form, has all required information, includes appropriate control measure for all stages of construction, including final stabilization, the control measures meet the requirements of the MS4 Permit and the provisions of this section. Otherwise, it shall be denied. Any approval or denial shall be in writing with the reasons for denial specifically identified. Annotations on the plans shall be considered sufficient detail of the reasons for denial. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 10-12-04; am. 6-1-19).

j. Request for Reconsideration:

If an application is denied or conditionally approved, the applicant may request in writing, within 21 calendar days after the decision, a reconsideration of the decision by Planning and Zoning. The request for reconsideration shall state specific reasons or changes for the reconsideration. Planning and Zoning shall act upon the request for reconsideration within 10 working days of its receipt. Failure to act shall constitute denial of the request for reconsideration. No appeal to the Board of Adjustment shall be permitted unless a request for reconsideration was previously filed and denied. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 5-20-08)

k. Appeals:

If Planning and Zoning denies the request for reconsideration, the applicant may submit a written appeal to the Board of Adjustment. The appeal must be received by the secretary of the Board of Adjustment within 30 calendar days of the date of denial. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 10-12-04; am. 12-14-04; am. 5-20-08)

l. Permit Limitations:

The permit shall be limited to work shown on the approved plans. Such plans shall contain guidelines, conditions, and/or restrictions as are necessary to comply with the performance standards. At any time during the plan review or in the event unforeseen conditions arise during completion of the project, the County may require revision of the plans as necessary to ensure compliance with the performance standards. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 5-20-08)

m. Amendments:

Modifications to the approved plans are subject to an Administrative Review process. Modifications shall comply with the Plans and Specifications requirements and the performance standards as outlined in this Section, unless relief is granted through the appropriate process. (orig. 8-25-86; am. 3-23-99; am. 10-12-04; am. 7-17-18; am. 6-1-19)

n. Validity:

The approval of plans and specifications shall not be construed as an approval of any violation of the provisions of this section or of any other applicable laws, rules or regulations and shall not prevent the County from thereafter requiring the correction of errors in said plans and specifications or from preventing work being carried on thereunder in violation of this section or any other applicable law, rule or regulation. The issuance of a Grading Permit prior to any Plat approval shall in no way bind the Planning Commission or the Board of County Commissioners in the approval or denial of a Plat application, and the applicant's grading activities are at the applicant's risk. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04)

2. Grading Permit Inspections

- a. Upon approval by Planning and Zoning, the approved plans will be referred to an Engineering Inspector for permit issuance. (orig. 10-12-04; am. 5-20-08; am. 4-20-10; am. 7-17-18)
- b. The County may inspect the site and perform any necessary tests from time to time to ensure compliance with the permit conditions. (orig. 7-17-18).
- c. Final inspections shall confirm that the completed structural and/or non-structural water quality control measure operates in accordance with the approved plans. (orig. 6-1-19)
- d. All applicable development sites must have operational permanent water quality control measures at the completion of the site. In the case where permanent water quality control measures are part of future phasing, the permittee must have a mechanism to ensure that all control measures will be implemented, regardless of completion of future phases or site ownership. In such cases, temporary water quality control measures must be implemented as feasible and maintained until removed or modified. All temporary water quality control measure must meet one of the design standards in the MS4 Permit. For the purpose of this section, completion of a site or phase shall be determined by the issuance of a certificate of occupancy, use of the completed site area according to the site plan, payment marking the completion of a site control measure, the nature of the selected control measure or equivalent determination of completion as appropriate to the nature of the site. (orig. 6-1-19)
- e. Time Limits: The work associated with the permit shall be completed within 2 years of the date of permit issuance, unless an extension has been granted by Transportation and Engineering. A

request for an extension shall be submitted in writing no later than 10 calendar days prior to the expiration of the permit. Transportation and Engineering may grant an extension to the permit up to 1 year. Additional extensions may be granted by Transportation and Engineering to allow the establishment of permanent erosion and sediment control measures. (orig. 8-25-86; am. 9-24-91; am. 8-8-94; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 5-20-08; am. 10-13-09; am. 7-17-18)

## **E. Plans and Specifications**

### **1. Grading, Erosion and Sediment Control Plan**

The proposed grading, erosion and sediment control plan and specifications shall demonstrate compliance with the performance standards and shall be prepared on sheets 24 inches by 36 inches, or as otherwise approved by Planning and Zoning, and stamped and signed by a Colorado registered professional engineer. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18; am. 6-1-19)

For graded areas between 0.5 and one acre, the County may waive the requirement for a topographic map and the requirement that the grading plans be prepared, stamped and signed by a Colorado registered professional engineer, where the applicant demonstrates an engineered grading plan and/or topographic map is not necessary to comply with the performance standards set forth herein. (orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04; am. 7-17-18; am. 6-1-19)

The grading, erosion and sediment control plan shall include the following unless waived or exempted by Planning and Zoning herein. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18; am. 6-1-19)

- a. A map which shows the items listed below. Acceptable map scales are 1 inch to 10, 20, 30, 40, 50, 60 or 100 feet. (orig. 8-25-86; am. 9-24-91; am. 10-12-04)
  - (1) A vicinity map (not to scale) indicating the location of the site relative to the principal roads, lakes or dams, and watercourses in the area. (orig. 8-25-86; am. 9-24-91)
  - (2) A title block which includes the title of the Grading Plan, purpose and nature of the grading project and, if applicable, states the use of earth material to be removed from the site. The name of the engineer who prepared the plans should also be included in the title block. (orig. 8-25-86; am. 9-24-91)
  - (3) The complete site boundary and locations of any easements and Rights-of-Way traversing and adjacent to the property, appropriately labeled and dimensioned. (orig. 8-25-86)
  - (4) The location of existing roads, buildings, wells, pipelines, watercourses and other structures, facilities and features of the sites, and the location of all improvements on adjacent land within 50 feet of the site's boundary. (orig. 8-25-86)
  - (5) The location and nature of known or suspected highly erodible soils or geologic hazard areas. (orig. 8-25-86; am. 9-24-91)
  - (6) A topographic map which shows the affected area. The map shall show affected areas outside the permit boundaries, such as drainages. Contour lines shall be at 5-foot intervals or at an interval of greater detail if necessary to accurately show topographic features and drainage patterns, and the configuration of the ground before and after grading. The existing and final contours shall be shown at 2-foot intervals for subdivisions within the plains area and contours at 5-foot intervals for subdivisions within the mountain areas including the method utilized to obtain all contour intervals. Contours shall be accurate to within one-half (1/2) contour interval and elevations shall be based on United States Geologic Survey (USGS) sea level datum. Except for access permits, USGS quad maps shall not be accepted as evidence for topographic contours. (orig. 8-25-86; am. 9-24-91; am. 3-23-99; am. 10-12-04; reloc. 12-6-22)
  - (7) The location, extent and finished surface slopes of all final cut and fill lines. (orig. 8-25-86)
  - (8) The 100-year flood plain boundaries. (orig. 8-25-86)
  - (9) The location of any existing or proposed flood control facilities, wells or Onsite Wastewater Treatment System in the vicinity of the permit area. Temporary access to the well and Onsite Wastewater Treatment System shall be depicted. (orig. 8-25-86; am. 9-24-91; am. 7-17-18; am. 6-1-19)
  - (10) The location where any earth materials and topsoil will be stockpiled. Include estimated stockpile volume. If the stockpile will reach into adjacent properties, approval from the property owner shall be required. (orig. 8-25-86; am. 9-24-91; am. 7-17-18)

- (11) The north arrow, the scale, and the date. (orig. 8-25-86)
- (12) The general location and character of vegetative cover on the site and the location of all major rock outcrops. (orig. 8-25-86; am. 9-24-91)
- b. Typical cross sections (not less than two) of all existing and proposed graded areas taken at intervals not exceeding 200 feet and at locations of maximum cuts and fills where such cuts and/or fills exceed 10 feet in height. (orig. 8-25-86; am. 9-24-91)
- c. A table of the volume of cut, volume of fill, volume of material to be exported offsite, the steepest proposed slopes, the total area of land disturbance, the existing impervious area, the proposed impervious area (total impervious area for the site) and the area of land disturbance treated by a water quality control measure per the SDDTC. An example of this table is shown below and the table shall be placed on page 1 of the plan set. (orig. 8-25-86; am. 9-24-91; am. 6-1-19; am. 12-6-22)

Total Area of Land Disturbance	acres
Volume of Cut	cy
Volume of Fill	cy
Volume of Material to be Exported Offsite	cy
Existing Impervious Area	acres
Proposed Impervious Area	acres
Area of Land Disturbance Treated by a Permanent Water Quality Control Measure	acres
Steepest Proposed Slope	H:V

- d. The projected schedule of operations, including the following dates. The schedule dates must correspond to the permitted construction timeframe following approval: (orig. 8-25-86; am. 12-6-22)
  - (1) Commencement of work, including days and hours of operation. (orig. 8-25-86; am. 9-24-91)
  - (2) Start and finish of rough grading. (orig. 8-25-86)
  - (3) Completion of work in any watercourse. (orig. 8-25-86)
  - (4) Completion of grading, erosion and sediment control measures (Best Management Practices, BMP's). (orig. 8-25-86; am. 10-12-04; am. 6-1-19; am. 12-6-22)
  - (5) Maintenance schedule for grading, erosion and sediment control BMP's. (orig. 9-24-91; am. 10-12-04; am. 6-1-19)
  - (6) Completion of any required landscaping. (orig. 8-25-86)
- e. The proposed grading, erosion and sediment control plan shall include permanent and, if applicable, temporary erosion and sediment control BMP's. The plans shall identify all structural and non-structural control measures for the applicable construction activities. The plan must contain installation and implementation specifications or a reference to the document with installation and implementation specifications for all structural control measures. A narrative description of non-structural control measures must be included in the plan. Revegetation plans shall include the seed mixture(s) including species and variety, type of seedbed preparation and method of seeding, seeding rates, seeding dates, type and application rates of fertilizer and mulch, and irrigation facilities and methods if applicable. Seed mix shall be based on the Jefferson Conservation District recommendations and/or a Planning and Zoning approved alternative. Seeding alone is not erosion control until vegetation is established. Seeding shall be combined with applicable erosion control structural BMP's until vegetation is established. (orig. 9-24-91; am. 10-12-04; am. 7-12-05; am. 7-17-18; am. 6-1-19)
- f. At a minimum, initial and final construction phases are required for all grading, erosion and sediment

control plans. (orig. 7-17-18)

- g. Clearly and legibly show BMPs on the plan and include standard notes and associated details for the BMPs shown on said plan. (orig. 7-17-18; am. 6-1-19)
- h. If a Grading Permit Application requires an Improvement Security, a detailed improvements list is required. If the Grading Permit Application does not require an Improvement Security, the quantity of each erosion and sediment control BMP shall be provided. (orig. 6-1-19; am. 12-17-19; am. 12-6-22)

2. Soil/Geologic Investigation Report

If a soils and/or geologic investigation report is required by the County, it shall be prepared and signed by a qualified professional geologist or Colorado registered professional engineer. The report shall contain all the following as they may be applicable to the subject site: (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04)

- a. A site map showing the topographic features of the site and locations of all soil borings and test excavations. (orig. 8-25-86)
- b. A classification of the soil types, laboratory test data, and consequent evaluation regarding the distribution and nature of existing soils. (orig. 8-25-86; am. 9-24-91)
- c. A description of the geology of the site and adjacent areas when pertinent to the site. (orig. 8-25-86)
- d. A suitably scaled map and cross sections showing all identified areas of historic or potential instability within and adjacent to the permit area. An evaluation of the stability of natural slopes and any proposed cut and fill slopes. (orig. 8-25-86; am. 9-24-91)
- e. A description of known or inferred groundwater or excessive moisture conditions. (orig. 8-25-86; am. 9-24-91)
- f. A description of the soil and geologic investigative techniques employed. (orig. 8-25-86)
- g. A log for each soil boring and test excavation showing elevation at ground level and the depth of each soil or rock strata. (orig. 8-25-86)
- h. Recommendations for grading procedures and specifications, including methods for excavation and subsequent placement of fill. (orig. 8-25-86)
- i. Recommendations for mitigation of geologic hazards and constraints. (orig. 8-25-86; am. 12-6-22)
- j. The time of year the field work was done and a list of references and other supportive data. (orig. 8-25-86)
- k. Soil parameters to be used in the design of retaining walls. (orig. 9-24-91; am. 12-6-22)
- l. Infiltration testing shall be completed for each control measure that utilizes infiltration. At least two tests per control measure are required. The testing shall be at an appropriate elevation and location to adequately evaluate the underlying strata. A Factor of Safety of 2 shall be applied to the final infiltration rate to account for infiltration degradation over time (orig. 12-6-22)

3. Materials Handling Plan

The proposed materials handling plan shall include BMP's for controlling waste and spill prevention and containment. (orig. 10-12-04)

**F. Performance Standards for All Land Disturbance Activities**

- 1. Control measures must prevent pollution or degradation of state waters. Control measures must also be appropriate for the specific construction activity, the applicable pollutant sources, and phase of construction. Appropriate control measures must be implemented prior to the start of construction activity, must control potential pollutants during each phase of construction, and must be continued through final stabilization. Appropriate structural control measures must be maintained in operational condition. (orig. 6-1-19)
- 2. Control measures must be selected, designed, installed, implemented, and maintained to provide control of all potential pollutants, such as but not limited to sediment, construction site waste, trash, discarded building materials, concrete truck washout, chemicals, sanitary waste, and contaminated soils in

discharges to the MS4 and/or waterways. At a minimum pollutant sources associated with the following activities (if part of the applicable construction activity) must be addressed: (orig. 6-1-19; am. 12-6-22)

- a. Land disturbance and storage of soils. (orig. 6-1-19)
- b. Vehicle tracking. (orig. 6-1-19)
- c. Loading and unloading operations. (orig. 6-1-19)
- d. Outdoor storage of construction site materials, building materials, fertilizers, and chemicals
- e. Bulk storage of materials. (orig. 6-1-19)
- f. Vehicle and equipment maintenance and fueling. (orig. 6-1-19)
- g. Significant dust or particulate generating processes. (orig. 6-1-19)
- h. Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, and oils. (orig. 6-1-19)
- i. Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment. (orig. 6-1-19)
- j. Dedicated asphalt and concrete batch plants. (orig. 6-1-19)
- k. Other areas or operations where spills can occur. (orig. 6-1-19)
- l. Other non-stormwater discharges including construction dewatering not covered under the Construction Dewatering Discharges general permit and wash water that may contribute pollutants to the MS4 and/or waterways. (orig. 6-1-19)

3. No Impedance to Natural Water Flow

- a. No work shall be done which may obstruct, impede or interfere with the flow of storm water in overland flows, natural drainageways, unimproved channels or watercourses, or improved ditches, channels or canals in such a manner as to cause flooding that adversely impacts adjacent and downstream properties. Any activity taking place in an area zoned Floodplain Overlay District shall meet the requirements of the Floodplain Overlay District section of this Zoning Resolution. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 7-17-18)
- b. Construction equipment shall be kept out of watercourses except when necessary to perform work on the approved plans. Where in-channel work is designated on approved plans, precautions shall be taken to stabilize the work area during construction to minimize erosion. The channel, including bed and banks, shall be stabilized immediately after in-channel work is completed. (orig. 9-24-91; am. 6-1-19)
- c. Where a drainageway will be crossed by construction vehicles regularly during construction, a temporary crossing shall be provided. A permit may be required from the U.S. Army Corps of Engineers and the Environmental Protection Agency prior to any disturbance in waters of the United States or federally regulated wetlands. (orig. 9-24-91; am. 12-17-02; am. 10-12-04)

4. Excavation

Excavations shall be constructed and/or protected so that they are stable and do not endanger life or property. (orig. 8-25-86; am. 9-24-91)

5. Excavation Slope

- a. The slope of cut surfaces of permanent excavations shall not be steeper than 2 horizontal to 1 vertical (approximately 25 degrees). Steeper slopes may be permitted for grading permits with the approval of the County, provided it can be adequately demonstrated in a soils/geologic report that such slopes are stable and will not undergo accelerated erosion. The County may require the excavation to be made with a cut face flatter in slope than 2 horizontal to 1 vertical (2H:1V) if soils/geologic information submitted shows that flatter slopes are necessary for stability, adequate revegetation or maintenance. Cut slopes shall be rounded into the existing terrain to produce a contoured transition from cut face to natural ground. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)
- b. The slope of cut surfaces which are 5 feet in height or less and are in competent bedrock may be steeper than 2H:1V, but shall be no steeper than 1 1/2H:1V. Steeper slopes may be permitted for grading permits with the approval of the County, provided it can be adequately demonstrated in a soils/geologic report that such slopes are stable and will not undergo accelerated erosion. (orig. 9-

24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)

6. Fill Placement

Completed fills shall be stable masses of well-integrated material bonded to adjacent materials and to the materials on which they rest. Proper drainage and other appropriate measures shall be taken to ensure continuing integrity of fills. Earth materials shall be used which have no more than minor amounts of organic substances. (orig. 8-25-86)

7. Fill Compaction

The County will require fills to be compacted to a minimum of 90 percent of maximum density as determined by ASTM D1557 unless prior approval by the County has been granted. ASTM D698 may be used for clays with a high plasticity index. The standard for fill compaction shall not apply to fills of less than 50 cubic yards which are placed on natural terrain with a slope flatter than 5H:1V, are less than 5 feet in depth, are not intended to support structures, and do not obstruct a drainage course. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04; am. 7-17-18)

8. Ground Preparation for Fill Placement

The ground surface shall be prepared to receive fill by removing vegetation, topsoil, and other unsuitable materials. (orig. 8-25-86)

9. Fill Slopes

The slope of all permanent fills shall not be steeper than 2H:1V. Steeper slopes may be permitted for grading permits with the approval of the County, provided it can be adequately demonstrated in a soils/geologic report that such slopes are stable and will not undergo accelerated erosion. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)

10. Driveways and Private Streets/Roads

a. All street, road and driveway construction shall meet the Transportation Design and Construction Manual standards. (orig. 12-17-02; am. 10-12-04; am. 11-24-15)

b. For private streets/roads and driveways including turnarounds the maximum allowable vertical disturbance from the toe of fill to the top of cut measured perpendicular to the existing contours shall be 25 feet in vertical height. Planning and Zoning may approve vertical disturbance heights greater than 25 feet for grading permits where it is determined that slopes shall be sufficiently stabilized and restored to be congruent with surrounding conditions to the maximum extent practicable and the alignment of the driveway has been placed in the optimal location to allow for minimal disturbance. (am. 7-17-18; am. 6-1-19)

Relief for grading permits will also be considered if the applicant demonstrates that the proposed grading plan results in less overall land disturbance and that the relief is necessary to comply with the Preservation of Existing Terrain and Vegetation and Impact Mitigation Standards below. In determining whether to approve or disapprove the request, all technical evaluations, relevant factors, standards specified in other sections, and whether the applicant has adequately addressed the provisions of this Zoning Resolution shall be considered. (orig. 8-8-95; am. 11-12-02; am. 12-17-02; am. 7-1-03; am. 10-12-04; am. 3-26-13; am. 11-24-15; am. 7-17-18; am. 6-1-19)

(1) Parking areas adjacent to building structures and drainage facilities not a part of the streets/roads will not be considered as vertical disturbance. (reloc. 7-17-18)

c. Widths (including shoulders) of driveways and private streets/roads shall conform to the Transportation Design and Construction Manual. (orig. 8-8-95; am. 11-12-02; am. 11-24-15)

11. Protection of Adjacent Structures

Foundations or flatwork which may be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against lateral movement. Fills or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by such fill or surcharge. (orig. 8-25-86)

12. Setbacks

a. Setbacks for all grading, erosion and sediment control activities shall be at least 7 feet from property boundaries and at least 25 feet from off-site occupied structures. Planning and Zoning may waive setback requirements for land disturbance provided it can be adequately demonstrated that activities



occurring within setback limitations will not adversely affect adjacent property or structures. A letter prepared by a Colorado registered professional engineer will be required that addresses the following:(orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 4-27-04; am. 5-20-08; am. 6-1-19; am. 12-6-22)

- i. Identify any potential issues caused by grading, erosion and sediment control activities relating to existing infrastructure, drainage patterns or visual and safety impacts. (orig. 12-6-22)
  - ii. Provide justification and rationale demonstrating that there will be no adverse impacts to adjacent property owners as a result of the proposed land disturbance. (orig. 12-6-22)
- b. Grading for streets/roads and driveways is exempt from setback requirements if it can be adequately demonstrated that grading activities will not adversely affect adjacent properties or structures in terms of, but not limited to, runoff and slope stability. (orig. 9-24-91; am. 7-17-18)

### 13. Stormwater

Any required drainage and infiltration structures and devices shall be designed and constructed in accordance with standards and criteria established in the Storm Drainage Design and Technical Criteria and as listed below. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 10-12-04; am. 7-17-18; am. 6-1-19)

- a. Drainage Structures and Devices: All drainage facilities shall be designed to carry surface and subsurface water to the nearest adequate street, storm drain, and natural watercourse or other juncture. (orig. 8-25-86)
- b. Water Accumulation: All finished areas shall be graded and drained such that water will not pond or accumulate except where the end use is a pond, reservoir infiltration area or structure or detention basin. Drainage shall be affected in such a manner that it will not cause erosion or endanger the stability of any cut or fill slope or any building or structure. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18)
- c. Protection of Adjoining Property: When surface drainage is discharged onto any adjoining property, it shall be discharged in such a manner that it will not cause an increased hazard to the stability of any cut and fill slope or any building or structure. (orig. 8-25-86; am. 9-24-91)
- d. Subsurface Drainage: Cut and fill slopes shall be provided with subsurface drainage as necessary for stability. (orig. 8-25-86)

### 14. Erosion and Sediment Control

The following shall apply to the control of erosion and sediment from land disturbance activities: (orig. 8-25-86; am. 10-12-04)

- a. To the maximum extent practicable and in conformance with F.1., above, implementation of the erosion and sediment control plan shall precede grading activities. (orig. 9-24-91; am. 10-12-04; am. 12-6-22)
- b. Upon completion of land disturbance activities, disturbed areas, except for rock cuts and fills, shall be stabilized by adequate vegetative cover consisting of at least 70% of pre-existing vegetation conditions or other permanent soil erosion control measures which prevent accelerated erosion. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18)
  - (1) Cuts and fills accomplished for all roads, driveways and other vehicular access shall be stabilized with adequate vegetative cover or other permanent soil erosion control measures which prevent accelerated erosion, unless the cut is in competent bedrock. (orig. 9-24-91)
  - (2) No project shall cause accelerated or increased off-site erosion. (orig. 9-24-91; am. 10-12-04)
- c. To the maximum extent practicable, sediment caused by accelerated soil erosion shall be removed from runoff water before leaving the site. (orig. 9-24-91; am. 10-12-04)
- d. All land disturbing activities shall be designed, constructed, and phased in such a manner as to minimize the exposure of disturbed areas and to prevent accelerated soil erosion to the maximum extent practicable. (orig. 9-24-91; am. 10-12-04)
- e. Cut and fill slopes shall be stabilized, and surface water damage to cut and fill slopes shall be prevented. (orig. 8-25-86)
- f. Fugitive dust emissions shall be controlled using the best available control technology as defined by

the Colorado Department of Public Health and Environment as of the date of permit issuance. (orig. 8-25-86; am. 9-24-91)

- g. All temporary and permanent soil erosion and sediment control practices shall be maintained and repaired as needed to assure continued performance of their intended function in accordance with the details in the approved grading plans. (orig. 9-24-91; am. 10-12-04; am. 7-17-18)
- h. All topsoil, where physically practicable, shall be salvaged and no topsoil shall be removed from the site except as set forth in the approved plans. Topsoil and overburden shall be segregated and stockpiled separately. Topsoil and overburden shall be redistributed within the graded area after rough grading to provide a suitable base for areas which will be seeded and planted. Runoff from the stockpiled area shall be controlled to prevent erosion and resultant sedimentation of receiving water. (orig. 8-25-86; am. 9-24-91)
- i. Runoff shall not be discharged from the site in quantities or at velocities substantially above those which occurred before land disturbance except into drainage facilities whose design has been specifically approved by the County prior to the permit approval. (orig. 8-25-86; am. 3-23-99; am. 12-17-02; am. 10-12-04)
- j. The landowner and/or contractor shall take reasonable precautions to ensure that vehicles do not track or spill earth materials on to streets/roads and shall immediately remove such materials if this occurs. (orig. 8-25-86; am. 12-17-02; am. 10-12-04)
- k. Should an increase in sediment discharge occur or become imminent, the landowner and/or contractor shall immediately take all necessary steps to control such discharge. The landowner and/or contractor shall take prompt action to resolve emergency problems. (orig. 8-25-86; am. 12-17-02; am. 10-12-04)
- l. Permanent or temporary soil stabilization measures shall be applied to disturbed areas within 14 days after final grade is reached on any portion of the site. Soil stockpiles shall be permanently or temporarily stabilized within 14 days if the stockpile is not being actively utilized for construction purposes. Soil stabilization measures shall be applied within 14 days to disturbed areas which may not be at final grade, but will be left dormant for longer than 60 days. (orig. 9-24-91; am. 7-17-18)

15. Geologic, Floodplain, Wildfire, and Dipping Bedrock Hazards

Any activity taking place in an area zoned Geologic Hazard Overlay District or Floodplain Overlay District, or Wildland Urban Interface Overlay District, or Dipping Bedrock Overlay District shall meet the requirements of the appropriate sections of this Zoning Resolution. Land disturbance activities shall not create or aggravate unstable slopes, rockfall, landslide, or subsidence hazards or increase the risk of wildfire, flooding, or dipping bedrock hazards. (orig. 8-8-95; am. 3-23-99; am. 10-12-04; am. 10-4-22)

16. Preservation of Existing Terrain and Vegetation and Impact Mitigation

- a. Grading for cut and fill slopes shall not result in a staircase effect, except that retaining walls are permitted per paragraph "e." below. The edges of graded areas shall blend into the surrounding natural terrain/topography and contour of the land. (orig. 8-8-95; am. 11-12-02)
- b. The proposed grading shall occur in such a manner that it avoids, to the extent practicable, all rock outcroppings, existing trees over 6 inches in caliper, vegetation over 8 feet in height, and riparian, wetland and critical wildlife areas. If from the original documentation and/or field investigation it appears that a less impactful alternative exists, the County may require the grading plan to be revised. (orig. 8-8-95; am. 12-17-02)
- c. Excess material shall be graded in a manner which is similar to the natural topography and shall not be cast over the side of cut or fill slopes. (orig. 8-8-95; am. 11-12-02)
- d. Cut slopes that are in rock and are intended to be left exposed shall be graded to obtain a natural looking appearance, to the extent possible, in form to blend with surrounding terrain. (orig. 8-8-95; am. 11-12-02; am. 10-12-04)
- e. Retaining walls shall not exceed a maximum height of twelve (12) feet and shall be faced with stone or constructed with textured earth colored material that is identified in the grading plan. If a series of retaining walls is required, the horizontal distance between walls shall be a minimum of 4 feet. The minimum distance between walls shall be increased to 6 feet if either wall exceeds 8 feet in height. Retaining walls greater than 36 inches in height shall be constructed in accordance with the design prepared by a Colorado registered professional engineer. The design may require consultation with

a geotechnical engineer, shall consider such factors as expansive soils, steep slopes and vehicles or structures near the walls, and shall include the following: (orig. 8-8-95; am. 11-12-02; am. 12-17-02; am. 7-1-03; am. 10-12-04; am. 7-17-18)

- (1) Construction plans indicating how the proposed wall height will vary along its length. (orig. 10-12-04)
  - (2) Details with elevations showing top and bottom of wall for critical points along the wall length. (orig. 10-12-04)
  - (3) Supporting calculations that demonstrate an adequate factor of safety (minimum 1.5) for bearing capacity, overturning, sliding, and internal stability, including surcharge loads due to sloping backfill, adjacent vehicles and structures. When global stability analysis is required the minimum factor of safety is 1.3 for both the temporary and permanent conditions. (orig. 10-12-04; am. 12-6-22)
- f. The site shall be designed to use existing topography and existing vegetation to screen site disturbance. (orig. 8-8-95; am. 10-12-04)
  - g. Revegetation plans shall be similar to existing vegetation and feature the prominent use of plants which are indigenous to the area or as approved by the County. Seeding methods such as hydroseeding, drilling, seeding and raking in, or other seeding method may be required when necessary to quickly and effectively establish a groundcover for areas where other types of seeding may be ineffective. (orig. 8-8-95; am. 11-12-02; am. 10-12-04)
  - h. Any permanent erosion control and drainage improvements that are installed, as a result of land disturbance activities shall be designed to complement and blend with the natural topography of the land. (orig. 8-8-95; am. 10-12-04)
  - i. Where possible, turnouts shall be provided with the narrowest permissible road to minimize the extent of land disturbance. (orig. 11-12-02; am. 10-12-04)
  - j. When the grading operations encounter remains of prehistoric people's dwelling sites, remains, or artifacts of historical, paleontological or archaeological significance, the operations shall be temporarily discontinued. The developer shall notify Planning and Zoning, and the developer shall promptly contact the proper authorities to determine the disposition thereof. If required by state or federal authorities, the developer shall preserve the area of historical, paleontological or archaeological significance for a maximum period of 30 days to allow authorities to excavate and recover the items of significance. (reloc. 12-6-22)
17. Materials handling BMP's are required. At a minimum, BMP's shall include controlling waste such as discarded building materials, concrete truck washout, chemicals, litter and sanitary waste, as applicable. In addition, spill prevention and containment BMP's for construction materials, waste and fuel shall be provided, as applicable. (orig. 10-12-04)
  18. Maximum allowable height of a temporary stockpile is 50 feet measured from existing grade. The setback of the stockpile measured from the abutting property line to the edge of the stockpile is 2 multiplied by the height of the stockpile. The edge of the stockpile shall be no closer than the grading setback (7 feet from the abutting property line). The slope shall not exceed 3H:1V unless otherwise approved by Planning and Zoning for grading permits based on existing site conditions and topographic constraints. The temporary stockpile shall remain in place no longer than two years unless otherwise approved by Planning and Zoning for grading permits based on site conditions and construction duration. (orig. 11-24-15; am. 7-17-18; am. 6-1-19; am. 12-6-22)

#### **G. Improvement Security**

1. As a condition for the issuance of a Grading Permit, the County may require an improvement security in an amount necessary to ensure compliance with the performance standards in the event of default on the part of the applicant or of denial of the case by the Board of County Commissioners. Grading Permits associated with single family attached, detached or duplex residential structures with an active building permit will not require an improvement security. An improvement security is required for improvements in the Right-Of-Way or for improvements which may affect Right-Of-Way. (orig. 8-25-85; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 7-1-03; am. 10-12-04; am. 10-13-09; am. 6-1-19; am. 12-17-19; am. 12-6-22)
  - a. Except for rough grading, the amount of the security shall be 100 percent of the cost of all grading

erosion and sediment control items plus 100% of the cost of the work required for public streets/roads and for private streets/roads. The amount of security for rough grading shall be 25 percent of the total cost of rough grading for all lands within the mountains and 10 percent for all lands within plains of the County. A contingency amount equivalent to 10 percent of the total cost of all work shall be added to the security amount. (orig. 3-23-99; am. 12-17-02; am. 7-17-18)

- b. The improvement security shall be in the form of cash escrow or a letter of credit. (am. 3-23-99)
  - c. The improvement security shall remain in effect until final inspections have been made, where required, and all grading work has been accepted by the County. Final acceptance of warranted Public Improvements shall conform to the Jefferson County Land Development Regulation. Upon final acceptance of improvements or warranted Public Improvements, securities will be released. (orig. 8-25-85; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 5-20-08)
2. Any letter of credit or deposit required pursuant to this section shall be payable to the Board of County Commissioners of Jefferson County and shall be for a minimum of 2 year. (orig. 8-25-86; am. 8-8-95; am. 10-12-04; am. 5-20-08)

#### **H. Permit Completion and Closeout**

- 1. Notice of Intent
  - a. A completed Form Letter N-2 stating that the final construction and grading are in conformance with the approved overall grading plan and Notice of Intent shall be submitted to Planning & Zoning prior to issuance of the Certificate of Occupancy. Form Letter N-2 shall be completed by a Colorado registered professional engineer. (orig. 6-1-19)
- 2. Grading Permit
  - a. The conditions of approval as specified in the approval letter and/or approved plan set. (orig. 8-25-86; am. 6-1-19)
  - b. Jefferson County staff confirms that the completed control measure operates in accordance with the approved site plan. (orig. 6-1-19)
  - c. The Certificate of Occupancy for residential structures will be issued once the Grading Permit certification is accepted and the Grading Permit is closed by Jefferson County staff. (orig. 6-1-19)

#### **I. Release of Security for Grading Permits**

- 1. Upon completion of the following, the improvement and/or maintenance securities will be released, and/or a Certificate of Compliance will be issued. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 7-17-18; am. 6-1-19)
  - a. Applicable provisions of this section. (orig. 8-25-86)
  - b. The conditions of approval of the Grading Permit. (orig. 8-25-86; am. 6-1-19)
  - c. Final stabilization of the site, which can include established vegetation, that will prevent accelerated erosion and other erosion control measures, where required. A uniform vegetative cover with a density of at least 70 percent of pre-disturbance levels shall be considered adequate vegetative cover for erosion control measures. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 7-1-03; am. 10-12-04)
  - d. Receipt of proof of compaction, where the compaction standard applies. Compaction tests shall be taken under the direct supervision of a geotechnical engineer. The geotechnical engineer or his designated representative shall observe grading activities on a full-time basis and shall take sufficient compaction test to enable the engineer to determine that the site is ready for the intended uses and shall so state on the compaction report. Compaction reports shall be signed and sealed and dated by a Colorado registered professional engineer. Compaction reports shall include the moisture density curves, location of test sites, soil types(s), density results, type of test and if a failing test, retesting of the site. The engineer shall provide a complete set of all test and observations and a report stating that the grading activities have been completed in substantial conformance with the approved grading plan, the requirements of this section, and the Land Development Regulation. (orig. 9-24-91; am. 3-23-99; am. 10-12-04)
- 2. An as-built plan is required by the County for the following:
  - a. Land disturbance activities that occur in a Floodplain Overlay District.

- b. Large fills (greater than 1000 cubic yards).
  - c. Retaining walls as designated on the approved plans.
  - d. The construction deviates from the approved plans.
  - e. Permanent non-structural and structural water quality control measures including dimensions, volume calculations and overall compliance with approved plans.
  - f. Other activities as required by Performance Guarantee and Warranty Section of the Land Development Regulation. (orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04; am. 7-17-18)
3. Upon completion and acceptance of all items listed on the list of improvements and associated costs, the project performance guarantee may be reduced to the amount shown on the Exhibit A for adequate revegetation and temporary erosion and sediment control. Revegetation means that a density of at least 70 percent of the pre-disturbance levels or equivalent permanent methods have been employed. (orig. 12-17-02; am. 10-12-04)
  4. However, upon failure to complete the work, failure to comply with all of the terms of the permit or failure of the erosion and sediment control measures to function properly, the County may perform the required work or cause it to be done and collect from the permittee or surety all costs incurred, including administrative and inspection costs. Any unused portion of a deposit shall be refunded to the permittee after deduction by the County of the cost of the work. (orig. 8-25-86; am. 10-12-04; am. 7-17-18)

## **J. Enforcement**

### **1. Inspections**

The County may inspect the site and perform any necessary tests from time to time to ensure compliance with the permit conditions. (orig. 9-24-91; am. 8-8-95; am. 3-23-99)

### **2. Suspension and Revocation of Permit**

The County may suspend, limit or revoke a permit for violation of any provision of this section, violation of the permit or misrepresentations by permit holder, his agents or his employees or independent contractors under contract with the permittee for a Notice of Intent or Grading Permit for an individual lot or within a common plan of development. The decision of the County to suspend, limit or revoke a permit may be appealed to the Board of Adjustment. No work shall be performed while an appeal is pending except as authorized by the County. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)

### **3. Enforcement Response**

- a. The escalation process for enforcement actions includes verbal warnings, written notifications, revocation of permits, denial of plan review, withholding of permits, withholding inspections, stop work orders, issuance of zoning violations (civil process), issuance of illicit discharge violations (civil process), fines associated with the illicit discharge violation and/or using the performance guarantee to hire a separate contractor to complete the work. The escalation process does not have to occur in that order. (orig. 6-1-19; am. 12-6-22)
- b. The escalation process for chronic and recalcitrant violators of control measure requirements includes verbal warnings, written notifications, revocation of permits, denial of plan review, withholding of permits, withholding inspections, stop work orders, issuance of zoning violations (civil process), issuance of illicit discharge violations (civil process), fines associated with the illicit discharge violation and/or using the performance guarantee to hire a separate contractor to complete the work. The escalation process does not have to occur in that order. (orig. 6-1-19; am. 12-6-22)

### **3. Court Action**

Nothing in this section shall be construed to prevent the Attorney's Office, at their discretion, from filing a court action based upon a violation or potential violation of this section. (orig. 3-23-99)

### **4. Right of Entry**

Whenever necessary to enforce the provisions of this section the County can enter the premises at all reasonable times to perform any duty imposed by this section. If such entry is refused, the County shall have recourse to every remedy provided by law to secure entry. If a Land Disturbance Permit is suspended or revoked, or if a Stop Work Order has been issued, the County shall have the right to enter the site to complete the work allowed under the grading permit. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 7-17-18)

5. Stop Work Orders

When any work is being performed which is not in compliance with an approved permit and/or the provisions of this section or any other applicable law, rule or regulation, the County can order the work stopped by serving written notice on any personnel engaged in performing the work. Such person shall immediately stop such work until authorized by the County to proceed. If there are no persons present on the premises, the notice may be posted in a conspicuous place and the notice shall state the nature of the violation. The notice shall not be removed until the violation has been vacated or authorization to remove the notice has been issued. Failure to comply with any Stop Work Order is a violation of the Zoning Resolution, the Grading Permit and/or the Notice of Intent. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 7-17-18)

6. Violations of Other Regulations

Violations of this section may also cause violations of other State and/or Federal regulations and result in additional fines and penalties. (am. 10-12-04)

# **STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA – CLEAN COPY**

# Jefferson County

## Storm Drainage Design & Technical Criteria

JEFFERSON COUNTY, COLORADO PLANNING AND ZONING DIVISION

### Revision Dates

The Storm Drainage Design and Technical Criteria was prepared by WRC Engineering, Inc. in May 1987 and was adopted by the Board of County Commissioners of Jefferson County, Colorado, and has since been amended on the following dates:

March 19, 1996

May 12, 1998

May 27, 2003

November 25, 2003

October 13, 2009

October 1, 2013 (Temporary Regulation Amendment)

April 1, 2014

November 24, 2015

July 17, 2018

June 1, 2019

December 17, 2019

XXXXXX XX, XXXX

Jefferson County Planning and Zoning Division

100 Jefferson County Parkway, Suite 3550, Golden, Colorado 80419

303-271-8700 • <http://planning.jeffco.us>



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# Chapter 1 - General Provisions

## 1.1 Short Title

These regulations together with all future amendments will be known as the “Jefferson County Storm Drainage Design and Technical Criteria” (hereafter called *CRITERIA*) as referenced in the Jefferson County Land Development Regulation (hereafter called *LDR*) and *Jefferson County Zoning Resolution* (hereafter called *ZR*).

## 1.2 Jurisdiction

These *CRITERIA* will apply to all land within the unincorporated areas of the County, including any public lands. These *CRITERIA* will apply to all facilities constructed on County ROW, easements dedicated for public use, and to all privately owned and maintained drainage facilities, including but not limited to detention ponds, water quality facilities, storm sewers, inlets, manholes, culverts, swales and channels.

## 1.3 Purpose and Effect

Presented in these *CRITERIA* are the minimum design and technical criteria for the analysis and design of storm drainage facilities. All subdivisions, rural clusters, rezonings, site development plans, site approvals, land disturbance permits or any other proposed development or construction submitted for approval under the provisions of the *LDR* will include adequate storm drainage system analysis and appropriate drainage system design. Such analysis and design will meet or exceed the criteria set forth herein. Options to the provisions of these *CRITERIA* may be suggested by the applicant. The applicant will have the burden of showing that the options are equal or better. Policies and technical criteria not specifically addressed in these *CRITERIA* will follow the provisions of the Mile High Flood District (hereafter called MHFD) “Urban Storm Drainage *Criteria Manual*” (hereafter called *Manual*). The applicant is also referred to the Colorado Department of Transportation Standard Plans for additional design details not covered in these *CRITERIA* or the *Manual*. Drainage facilities in place or under construction at the time of *CRITERIA* adoption will be accepted without regard to the provisions of these *CRITERIA*.

## 1.4 Enactment Authority

The *LDR* has been adopted pursuant to the authority conferred within: Article 28 of Title 30 (County Planning); Article 2 of Title 43 (State, County and City Highway Systems); Article 20 of Title 29 (Land Use Control and Conservation); and other applicable sections of the CRS, as amended. As part of the authority provided by which the County promulgates the *LDR*, these *CRITERIA* are adopted by resolution.

The *LDR* refers to these *CRITERIA* being the source of County policy, guidelines, criteria and submittal requirements for storm water management issues during the development process.

## 1.5 Amendment and Revisions

These policies and criteria may be amended as new technology is developed and/or if experience gained in the use of these *CRITERIA* indicates a need for revision. Amendments and revisions will be made by resolution.

## 1.6 Enforcement Responsibility

It will be the duty of the Board of County Commissioners acting through Planning and Zoning to enforce the provisions of these *CRITERIA*.

## 1.7 Review and Approval

The County will review all drainage submittals for general compliance with these *CRITERIA*. An approval by the County does not relieve the owner, engineer or designer from responsibility of ensuring that the calculations, plans, specifications, construction and record drawings comply with these *CRITERIA*.

Per Colorado Revised Statute 32-11-221, improvements in or improvements that directly outfall to drainageways within the MHFD boundary must meet the requirements of MHFD’s Maintenance Eligibility Program. Where this is the case, the County will refer submittals to MHFD and design, construction and revegetation must be approved by MHFD.

## 1.8 Alternative Standard Requests & Minor Variation Requests

Alternative Standard Requests of these *CRITERIA* will be reviewed and approved in accordance with the applicable sections in the *LDR* and *ZR*. Any exclusions, exemptions, waivers, and variances shall comply with the terms and conditions of the MS4 permit.

## 1.9 Interpretation

In the interpretation and application of the provisions of these *CRITERIA*, the following will govern:

1.9.1 In its interpretation and application, the provisions will be regarded as the minimum requirements for the protection of the public health, safety, comfort, convenience, prosperity and welfare of the residents of the County.

1.9.2 Whenever a provision of these *CRITERIA* and any other provisions of the *LDR* or any provision in any law, ordinance, resolution, rule or regulation of any kind, contain any restriction covering any of the same subject matter, whichever restrictions are more restrictive or impose higher standards of requirements will govern.

1.9.3 These *CRITERIA* will not abrogate or annul any permits or approved drainage reports, construction plans, easements or covenants issued before the effective date of these *CRITERIA*.

## 1.10 Relationship to Other Standards

These *CRITERIA* are consistent with the MHFD criteria. If special districts impose a more stringent criteria, this difference is not considered a conflict. If the State or Federal Government imposes stricter criteria, standards or requirements, these will be incorporated into the County's requirement after due process and public hearing(s) needed to modify the County's regulations and standards.

## 1.11 Abbreviations

As used in these *CRITERIA*, the following abbreviations will apply:

ASP	Aluminized Steel Pipe
BMPs	Best Management Practice(s)
CDOT	Colorado Department of Transportation
CRS	Colorado Revised Statute
CMP	Corrugated Metal Pipe
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch
CUHP	Colorado Urban Hydrograph Procedure
EURV	Excess Urban Runoff Volume
FEMA	Federal Emergency Management Agency
FHAD	Flood Hazard Area Delineation
FIRM	Flood Insurance Rate Map
HDPE	High Density Polyethylene Pipe
HP	High Performance Polypropylene Pipe
JCD	Jefferson Conservation District
MDCIA	Minimized Directly Connected Impervious Area
MHFD	Mile High Flood District
MPLD	Mountain Porous Landscape Detention
NOAA	National Oceanic and Atmospheric Administration
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
USDCMUSDC	Urban Storm Drainage Criteria Manual (Manual)

# Chapter 2 - Drainage Planning Submittal Requirements

## 2.1 Introduction

Drainage reports and plans, construction drawings, specifications and as-built information will be submitted and approved as required by the *LDR* and Building Permit Procedure. All submitted reports will be clearly and cleanly reproduced. Photostatic copies of charts, tables, nomographs, calculations or any other referenced material will be legible. Washed out, blurred or unreadable portions of the report are unacceptable and could warrant resubmittal of the report. The submittal will include a declaration of the type of report submitted (i.e., Phase-I, Phase-II or Phase-III). Incomplete or absent information may result in the report being rejected for review.

A pre-application consultation is suggested of all applicants for all processing steps of the *LDR*. The applicant will consult with Planning and Zoning for general information regarding regulations, required procedures, possible drainage problems and specific submittal requirements.

## 2.2 Phase I Drainage Report

For development processes that require the submittal of a Phase I Drainage Report, a Phase I Report which complies with the requirements of Section 2.2 must be submitted by the developer or owner.

This report will review at a conceptual level the feasibility and design characteristics of the proposed development. The Phase I Drainage Report will be in accordance with the following outline and contain the applicable information listed:

### 2.2.1 Phase I Report Contents

The following is an outline of the minimum Phase I Drainage Report requirements.

#### I. General Location and Description

##### A. Location

1. Vicinity map
2. City, County, State Highway and local streets within and adjacent to the site or the area to be served by the drainage improvements
3. Township, range, section, 1/4 section
4. Major drainageways and facilities
5. Names of surrounding developments

##### B. Description of Property

1. Area in acres
2. Ground cover (type of ground cover and vegetation)
3. Major drainageways
4. Existing major irrigation facilities such as ditches and canals
5. Proposed land use
6. Floodplains delineated by FHAD studies or on FEMA FIRM maps
7. Significant geologic features

#### II. Drainage Basins and Sub-Basins

##### A. Major Basin Description

1. Reference and include maps of major drainageway planning studies such as FHAD reports, major drainageway planning reports and FIRMs.
2. Major basin drainage characteristics, existing and planned land uses within the basin, as defined by Planning and Zoning
3. Identification of all nearby irrigation facilities which will influence or be influenced by the local drainage

##### B. Sub-Basin Description

1. Discussion of historic drainage patterns of the property in question
2. Discussion of on-site and off-site drainage flow patterns and impact on development under existing and fully developed

basin conditions as defined by Planning and Zoning

### III. Drainage Facility Design

#### A. General Concept

1. Discussion of concept and typical drainage patterns
2. Discussion of compliance with off-site runoff considerations
3. Discussion of anticipated and proposed drainage patterns
4. Discussion of the content of tables, charts, figures, plates or drawings presented in the report

#### B. Specific Details (Optional Information)

1. Discussions of drainage problems encountered and solutions at specific design points
2. Discussion of detention storage and outlet design
3. Discussion of maintenance and access aspects of the design
4. Discussion of impacts of concentrating the flow on the downstream properties

#### C. Specific Details (Required for any proposed modifications to the Floodplain Overlay District)

1. Discussion on whether the floodplain modification will affect off-site property
2. Discussion of the design of the modified watercourse, in conformance with MHFD and County requirements
3. Discussion of the location of the modified watercourse and reason for modifications
4. Discussion of any State and Federal permits that are required for the modification of the watercourse
5. Hydraulic and hydrologic calculations for the 100-year storm demonstrating that the modified watercourse will maintain the flood carrying capacity
6. Discussion of the maintenance requirements and identification of the organization responsible for maintenance
7. A developer and engineer's certifications as required for a Phase III Drainage Report

### IV. References

Reference all criteria, master plans and technical information used in support of concept.

#### 2.2.2 Phase I Drawing Contents

(a) General Location Map: Drawings may be 24" x 36" or 22" x 34". A map will be provided in sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns. The map should be at a scale of 1" = 1000' to 1" = 4000' and show the path of all drainage from the upper end of any off-site basins to the defined major drainageways. The map should identify any major facilities from the property (i.e., development, irrigation ditches, existing detention facilities, culverts, storm sewers) along the flow path to the nearest major drainageway.

Basins and divides are to be identified and topographic contours are to be included.

(b) Floodplain Information: A copy of applicable FHAD and/or FIRM maps showing the location of the subject property will be included with the report as outlined in Section 2.2.1. All major drainageways (see Section 3.2.5) will have the floodplain defined and shown on the report drawings.

(c) Drainage Plan: Map(s) of the proposed development at a scale of 1" = 20' to 1" = 100' on a 24" x 36" or 22" x 34" drawing will be included. The plan should show the following:

1. Existing topographic contours at 2-foot maximum intervals. In mountain areas, the maximum interval is 5 feet. The contours should extend a minimum of 100 feet beyond the property lines
2. All existing drainage facilities
3. Approximate flooding limits based on available information
4. Conceptual major drainage facilities including detention basins, storm sewers, swales, riprap and outlet structures in the detail consistent with the proposed development plan
5. Major drainage boundaries and sub-boundaries
6. Any off-site feature influencing development

7. Proposed flow directions and, if available, proposed contours
8. Legend to define map symbols
9. Title block in lower right corner

### 2.3 Phase II Drainage Report

The purpose of the Phase II Drainage Report is to identify and/or refine conceptual solutions to the problems which may occur on-site and off-site as a result of the development. For development processes that require the submittal of a Phase II Drainage Report, a Phase II Drainage Report which complies with the requirements of Section 2.3 must be submitted by the developer or owner. The report will be prepared by or supervised by an engineer licensed in Colorado. The report will contain a certification sheet as follows:

"This report (*plan*) for the Phase II drainage design of (*name of Development*) was prepared by me (*or under my direct supervision*) in accordance with the provisions of Jefferson County Storm Drainage Design and Technical Criteria and was designed to comply with the provisions thereof. I understand that Jefferson County does not and will not assume liability for drainage facilities designed by others."

---

Registered Professional Engineer

State of Colorado No. \_\_\_\_\_

(Affix Seal)

### 2.4 Phase III Drainage Report

The purpose of the Phase III Drainage Report is to provide final drainage design for a project including design details for drainage facilities.

For development processes that require the submittal of a Phase III Drainage Report, a Phase III Report which complies with the requirements of Sections 2.3 and 2.4 must be submitted by the developer or owner. If applicable, the Phase III Drainage Report must address comments made during review of the Phase II Report.

The report will be prepared by or under the direction of an engineer licensed in Colorado, certified as shown below in for the Phase III report. The report must contain a developer and engineer certification sheet as follows:

"This report (*plan*) for the Phase III drainage and water quality design of (*name of Development*) was prepared by me (*or under my direct supervision*) in accordance with the provisions of Jefferson County Storm Drainage Design and Technical Criteria and was designed to comply with the provisions thereof. I understand that Jefferson County does not and will not assume liability for drainage facilities designed by others."

---

Registered Professional Engineer

State of Colorado No. \_\_\_\_\_

(Affix Seal)

"(Owner/Applicant) hereby certifies that the drainage facilities for (*Name of Development*) will be constructed according to the design presented in this report. I understand that Jefferson County does not and will not assume liability for drainage facilities designed or reviewed by my engineer. I also understand that Jefferson County relies on the representations of others to establish that drainage facilities are designed and built in compliance with applicable guidelines, standards or specifications. Review by Jefferson County can therefore in no way limit or diminish any liability which I or any other party may have with respect to the design or



construction of such facilities.”

(Owner/Applicant)\_\_\_\_\_

By: \_\_\_\_\_

Date \_\_\_\_\_

The Phase III Drainage Report will be prepared in accordance with the outline shown in Section 2.4.1. The report drawings will follow the requirements presented in Section 2.4.2 below.

Three (3) signed and stamped original copies of the approved Phase III Drainage Plan and Report will be submitted to the County for signature and retention in their files.

#### 2.4.1 Phase II and Phase III Report Contents

The Report will be in accordance with the following outline and contains the applicable information listed:

##### I. General Location and Description

###### A. Location

1. Vicinity map
2. Township, range, section, 1/4 section
3. Local streets within and adjacent to the subdivision with ROW width shown
4. Major drainageways, facilities and easements within and adjacent to the site
5. Names of surrounding developments

###### B. Description of Property

1. Area in acres
2. Ground cover (type of trees, shrubs, vegetation, general soil conditions, topography and slope)
3. National Resources Conservation Service (NRCS) soils classification map and discussion
4. Major drainageways
5. General project description
6. Irrigation facilities
7. Proposed land use

##### II. Drainage Basins and Sub-Basins

###### A. Major Drainage Basins

1. On-site and off-site major drainage basin characteristics and flow patterns and paths
2. Existing and proposed land uses within the basins if known
3. Discussion of all drainageway planning or floodplain delineation studies that affect the major drainageways, such as FHAD Studies and Outfall System Planning studies
4. Discussion of the condition of any channel within or adjacent to the development, including existing conditions, need for improvements and impact on the proposed development
5. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions
6. Identification of all irrigation facilities within the basin which will influence or be influenced by the local drainage

###### B. Sub-Drainage Basins

1. On-site and off-site minor drainage basin characteristics and flow patterns and paths under historic and developed conditions
2. Existing and proposed land uses within the basins
3. Discussion of irrigation facilities that will influence or be impacted by the site drainage
4. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions

##### III. Drainage Design Criteria

- ###### A. Regulations: Discussion of the optional provisions selected or the deviation from the *CRITERIA*, if any, and its justification

B. Development Criteria Reference and Constraints

1. Discussion of previous drainage studies (i.e., project master plans) for the site in question that influence or are influenced by the drainage design and how the plan will affect drainage design for the site
2. Discussion of the effects of adjacent drainage studies
3. Discussion on drainageways and storage facilities and how they interrelate to water rights
4. Discussion of the drainage impact of site constraints such as streets, utilities, light rail rapid transit, existing structures and development or site plan

C. Hydrological Criteria

1. Identify design rainfall
2. Identify runoff calculation method
3. Identify detention discharge and storage calculation method
4. Identify design storm recurrence intervals
5. Discussion and justification of other criteria or calculation methods used that are not presented in or referenced by these *CRITERIA*

D. Hydraulic Criteria

1. Identify various capacity references
2. Discussion of other drainage facility design criteria used that are not presented in the *CRITERIA*

E. Waivers from CRITERIA

1. Identify provisions by section number for which a waiver is requested
2. Provide justification for each waiver requested

IV. Drainage Facility Design

A. General Concept

1. Discussion of concept and typical drainage patterns
2. Discussion of compliance with off-site runoff considerations
3. Discussion of the content of tables, charts, figures, plates or drawings presented in the report
4. Discussion of anticipated and proposed drainage patterns. Discuss how runoff is conveyed off-site to nearest adequate drainage facility. Discuss flow path and downstream capacity

B. Specific Details

1. Discussion of drainage problems encountered and solutions at specific design points
2. Discussion of detention storage and outlet design
3. Discussion of storm water quality facilities
4. Discussion of maintenance access and aspects of the design
5. Discussion of easements and tracts for drainage purposes, including the conditions and limitations for use

C. Stormwater Storage Facilities

1. Discuss detention pond designs, including release rates, storage volumes and water surface elevations for the EURV and emergency overflow conditions, outlet structure design, emergency spillway design, etc
2. Discuss pond outfall locations and design, including method of energy dissipation
3. Discuss how runoff is conveyed from all pond outfalls and emergency spillways to the nearest major drainageway, including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway
4. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater storage purposes

D. Water Quality Enhancement BMPs

1. Discuss the design of all structural water quality BMPs, including tributary areas, sizing, treatment volumes, design features, etc.
2. Discuss how runoff is conveyed from all pond outfalls to the nearest adequate drainage facility, including a discussion of the flow path and capacity downstream
3. Discuss the operation and maintenance aspects of the design and easements and tracts that are required for stormwater quality enhancement purposes

E. Additional Permitting Requirements

1. Section 404 of the Clean Water Act
2. The Endangered Species Act
3. Other local, state or federal requirements

#### V. Conclusions

##### A. Compliance with Standards

1. *CRITERIA*
2. Major Drainageway Planning Studies
3. *Manual*

##### B. Drainage Concept

1. Effectiveness of drainage design to control damage from storm runoff
2. Influence of proposed development on the Major Drainageway Planning Studies recommendation(s)

#### VI. References

Reference all criteria and technical information used.

#### VII. Appendices

##### A. Hydrologic Computations

1. Land use assumptions regarding adjacent properties
2. Initial and major storm runoff at specific design points
3. Historic and fully developed runoff computations at specific design points
4. Hydrographs at critical design points
5. Time of concentration and runoff coefficients for each basin

##### B. Hydraulic Computations

1. Open channel design
2. Detention area/volume capacity and outlet capacity calculations; depths of detention basins
3. Water Quality Capture Volume Calculations which may include grass swale and buffer calculations (Required for Phase III)
4. Downstream/outfall system capacity (including design storm) to major drainage system. Include a solution to mitigate downstream capacity problems from the development. See Section 3.3.3 for more information
5. Downstream/outfall system capacity for internal, adjoining and connecting major drainageways. Include a solution to mitigate downstream capacity problems from within and adjoining the development. See Section 3.3.3 for more information
6. Emergency spillway sizing calculations
7. Stabilization and grade control improvements and calculations for ditches and drainageways.
8. Energy dissipation at pipe outfalls
9. Culvert capacities (*Required for Phase III*)
10. Storm sewer capacity, including energy grade line (EGL) and hydraulic grade line (HGL) elevations (*Required for Phase III*)
11. Actual street capacity as calculated using the MHFD Spreadsheet. Compare with allowable depths listed in Chapter 10 (*Required for Phase III*)
12. Storm inlet capacity including inlet control rating at connection to storm sewer (*Required for Phase III*)
13. Check and/or channel drop design (*Required for Phase III*)

#### 2.4.2 Phase II and Phase III Drawing Contents

A. Historic Drainage Conditions Plan: All drawings will be 24" x 36" or 22" x 34" in size. The plan should include the following:

1. A map in sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns. The map should be at a scale of 1" = 1000' to 1" = 4000' and show the path of all drainage from the upper end of any off-site basins to the defined major drainageways (see Drainage Policy). The map will identify any major construction (i.e., development, irrigation ditches, existing detention facilities, culverts, storm sewers) along the entire path of drainage. Basins and divides are to be identified and topographic contours are to be included.
2. Boundary of the proposed development at a scale of 1" = 20' to 1" = 100'

3. Existing floodplain limits for all major drainageways (see Section 3.2.3)
  4. Existing contours at 2-foot maximum intervals. In mountain areas, a maximum interval of 5 feet may be used if approved by Planning and Zoning. The contours should extend a minimum of 100 feet beyond the property lines
  5. Property lines and easements with purposes noted
  6. Existing drainage facilities and structures, including irrigation ditches, street/roadside ditches, crossspans, drainageways, gutter flow directions and culverts. All pertinent information such as material, size, shape, slope and location should also be included
  7. Overall historic drainage area boundary and drainage sub-area boundaries
  8. Definition of flow path leaving the development through the downstream properties ending at a major drainageway or adequate drainage facility
  9. Legend to define map symbols (*see Table 201 for symbol criteria*)
  10. Title block in lower right hand corner
- B. Developed Drainage Conditions Plan: Map(s) of the proposed development at a scale of 1" = 20' to 1" = 100' on a 24" x 36" or 22" x 34" drawing will be included. The plan will show the following:
1. Boundary of the proposed development at a scale of 1" = 20' to 1" = 100'.
  2. Existing and proposed contours at 2-foot maximum intervals. In mountain areas, the maximum interval is 5 feet. The contours should extend a minimum of 100 feet beyond the property lines.
  3. Property lines and easements with purposes noted.
  4. Streets, indicating ROW width, flowline width, curb type, sidewalk and approximate slopes.
  5. Existing drainage facilities and structures, including irrigation ditches, street/roadside ditches, crossspans, drainageways, gutter flow directions and culverts. All pertinent information such as material, size, shape, slope and location will also be included.
  6. Overall drainage area boundary and drainage sub-area boundaries.
  7. Proposed type of street flow (i.e., vertical or combination curb and gutter), street/roadside ditch, gutter, slope and flow directions and crossspans.
  8. Proposed storm sewers and open drainageways, including inlets, manholes, culverts and other appurtenances, including riprap protection.
  9. Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
  10. Proposed storm water quality facilities.
  11. Routing and accumulation and flows at various critical points for the initial storm runoff listed on the drawing using the format shown in Table 201.
  12. Routing and accumulation of flows at various critical points for the major storm runoff listed on the drawing using the format shown in Table 201.
  13. Volumes and release rates for detention storage facilities and information on outlet works.
  14. Location and elevations of all existing and proposed floodplains affecting the property.
  15. Location and (if known) elevations of all existing and proposed utilities affected by or affecting the drainage design.
  16. Routing of on-site and off-site drainage flow through the development.

17. Definition of flow path leaving the development through the downstream properties ending at a major drainageway or adequate drainage facility.
18. Legend to define map symbols (see Table 201 for symbol criteria).
19. Title block in lower right hand corner.
20. Detention Pond Summary as shown in Table 201.

## **2.5 Abridged Drainage Report**

When an application is under the threshold to require stormwater detention, Planning and Zoning will accept an abridged drainage report in lieu of a Phase III Drainage Report. The Abridged Drainage Report shall include the following:

1. The standard engineer's and developer's certifications in Section 2.4.
2. Calculations demonstrating that the site meets the requirements in Section 3.3.6 and 3.3.7 to not require stormwater detention and water quality.
3. Narrative and supporting calculations (as needed) demonstrating that the project will be designed to carry surface and subsurface water to the nearest adequate street/roadside ditch, storm drain and/or natural watercourse.
4. Hydraulic and hydrologic calculations for any required and existing drainage structures to demonstrate that they meet the relevant provisions in these *CRITERIA*. If no drainage structures are proposed, information shall be included stating as such.
5. Calculations for any drainageways that impact the property and determination of the required easement width and location.
6. Any other Phase III Drainage Report requirements that impact the property as necessary.

## **2.6 Drainage Letter**

When the application is under the threshold to require stormwater detention, and no stormwater features are proposed, Planning and Zoning will accept a Drainage Letter in the following format.

1. Narrative of the proposed land disturbance activity to include lot size, total impervious area and the proposed use.
2. Statement that all performance standards and applicable regulations are being met.
3. Letter signed and stamped by a Professional Engineer

## **2.7 Exception to the Requirement for a Drainage Report**

Planning Engineering will accept a letter from the applicant stating that there will be no new construction in lieu of a drainage report if all of the following conditions are met:

1. No increase in impervious area and no new construction.
2. The existing facilities on the site were constructed legally.
3. There are no drainageways that impact the property.

## **2.8 Construction Plans**

Where drainage improvements are to be constructed, the final construction plans (24" x 36" or 22" x 34") will be submitted with the Phase III Drainage Report. Approval of the final construction plans by Planning and Zoning is a condition of issuing the construction permits. Four (4) copies of the approved plans will be submitted to the County for file. The plans for the drainage improvements will include but are not limited to:

1. Storm sewers, inlets, outlets and manholes with pertinent elevations, dimensions, type and horizontal control indicated.

2. Culverts, end sections and inlet/outlet protection with dimensions, type, elevations and horizontal control indicated.
3. Channels, ditches and swales (including side/rear yard swales) with lengths, widths, cross-sections and erosion control (i.e. riprap, concrete, grout) indicated.
4. Checks, channel drops, erosion control facilities.
5. Detention pond grading, trickle channels, outlets, forebay, micropool, overflow weir and landscaping.
6. Water Quality/Detention pond cross-section including a 100-year water surface elevation, EURV elevations, micropool, forebay, outlet structure and 1-foot freeboard.
7. Stormwater quality facilities.
8. Other drainage related structures and facilities (including, alternative water quality BMP's, underdrains and sump pump lines).
9. Maintenance access considerations.
10. Overlot grading and erosion and sedimentation control plan (refer to the ZR, Land Disturbance).
11. The hydraulic grade line and energy grade line for all storm sewers will be shown on the profile sheets and calculation included in the Phase III Drainage Report.

The information required for the plans will be in accordance with sound engineering principles, these *CRITERIA* and the County requirements for subdivision designs. Construction documents will include geometric, dimensional, structural, foundation, bedding, hydraulic, landscaping and other details as needed to construct the storm drainage facility. The approved Phase III Drainage Plan will be included as part of the construction documents for all facilities affected by the drainage plan. Construction plans will be signed by a registered professional engineer as being in accordance with the County approved drainage report/drawings.

## **2.9 As-Built Drawings and Final Acceptance Certificate**

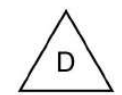
As-built drawings for drainage facilities and grading will be submitted in accordance with the Development Agreements, Warranties and Guarantees Section of the *LDR*.

Table 201  
**Drawing Symbol Criteria and Hydrology**


Review Table



A = Basin Designation  
B = Area in Acres  
C = Composite Runoff Coefficients



D = Design Point Designation



Basin Boundary

**Summary Runoff Table**  
*(To be placed on drainage plan)*

Design Point	Contributing Area (Acres)	Runoff 5 year (CFS)	Peak 100 year (CFS)
XX	XX • XX	XX • X	XX • X

**Detention Pond Summary**

Pond Number	5-year Detention Volume	100 year Detention Volume	Water Quality Volume	Total Volume	5-Year Release Rate	100-year Release Rate	100-Year Water Elevation
1	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X
2	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X
3	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X
4	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X

# Chapter 3 - Drainage Policy

## 3.1 Introduction

The provisions for adequate drainage are necessary to preserve and promote the general health, welfare and economic wellbeing of the County. Drainage is a regional feature that affects all governmental jurisdictions and all parcels of property. This characteristic of drainage makes it necessary to formulate a program that balances both public and private involvement. Overall coordination and master planning must be provided by the governmental units most directly involved, but drainage must be integrated at a regional level.

When planning drainage facilities, certain underlying principles provide direction for the effort. These principles are made operational through this set of policy statements. The application of the policy in turn is facilitated by technical criteria and data.

## 3.2 Basic Principles

### 3.2.1 Multi-Purpose Resource

*The county encourages the use of stormwater runoff as a multi-purpose resource and to require space allocation for appropriate drainage facilities in the planning of new developments.*

Stormwater runoff is a resource that is a subsystem of urbanization. This subsystem should be multi-purpose to satisfy the demands placed on water within urban development. The stormwater resource has the potential for a beneficial use if it is compatible with adjacent land uses and Colorado Water Law. Examples of beneficial use include groundwater infiltration and use in landscape features.

The planning of drainage facilities must be included in the development process. The provision for adequate drainage becomes a competing use for space along with other land uses. If adequate provision is not made in a land use plan for the drainage requirements, storm water runoff will conflict with other land uses and will result in water damages and will impair or even disrupt the functioning of other urban systems.

Drainage facilities can fulfill other purposes aside from just drainage. Facilities that are not typically designed for drainage, such as recreational areas and parking lots, can frequently be designed to provide water quantity and quality benefits.

Elimination or reduction in the size of detention and/or retention facilities is preferred where acceptable groundwater infiltration methods are used.

### 3.2.2 Water Rights

*The county requires that analysis of impacts on water rights be included in the planning and design of proposed drainage facilities.*

When the drainage sub-system interferes with existing water rights, the value and use of the water rights are affected. Drainageways and storage facilities frequently interrelate with water rights, which must be addressed when planning new facilities to preserve their integrity.

### 3.2.3 Major Drainageway

*The county defines a major drainageway as any drainage flow path with a tributary area of 130 acres or more.*

## 3.3 Regional and Local Planning

### 3.3.1 Post Development Flow Conditions

*The county encourages infiltration and for post development flow conditions to be in a manner and quantity (flow rate) as to not do more harm than the predevelopment flow within the drainage basin, unless the owner/developer can obtain approval and/or easements from the affected property owner(s).*

Colorado follows the modified civil law rule that the owner of upstream property possesses a natural easement on land downstream for drainage of surface water flowing in its natural course. Natural drainage conditions can be altered by the owner of the upstream land provided the water is not sent down in a manner or quantity to do more harm to the downstream land than formerly. During the development process, if water is allowed to flow into the development in its historic manner and quantity and is discharged in the historic manner and quantity, the alterations are generally acceptable. When the development alters the natural drainage into the development in a manner



or quantity that results in more harm to the downstream land, it may violate the modified civil law rule. Likewise, if the development does not return the drainage to the natural drainage conditions or does so in a manner or quantity that results in more harm, it may violate the modified civil law rule. Development proposals that violate the modified civil law rule will not be approved unless the owner/developer obtains approvals and/or easements from the affected property owner(s).

### 3.3.2 Master Planning

*The county requires that new developments comply with adopted regional drainage master plans.*

As set forth in Section 3.2.1, drainage planning is required for all new developments. In recognition that drainage boundaries are non-jurisdictional, the County participates in the preparation of regional basin-wide master plans. These plans define major drainage facilities, including those that are required public improvements for new developments.

### 3.3.3 Drainage Problem Areas

*The county requires offsite analysis and drainage facilities for development in a drainage problem area. A drainage problem area is an area where there is no downstream outfall to a street, roadside ditch, open channel or storm sewer that meets the relevant requirements in these CRITERIA. The offsite analysis will address downstream conditions at every point along the project site boundaries where storm-water runoff will exit the property.*

*The county allows stormwater retention in drainage problem areas only if there is no other viable option, in the opinion of Planning and Zoning, available to resolve the drainage impact from the development. Stormwater retention facilities must be designed to meet these CRITERIA (storage).*

There are areas within the County where significant drainage problems exist. Any new development in those areas may compound the existing drainage problems. Depending on specific details of the drainage problem, the following techniques for reducing or eliminating negative impacts have been used successfully:

- Over-detention with reduced release rates
- Downstream improvements to the drainage system
- Reduction of impervious area
- Infiltration water quality BMPs
- Stormwater retention

### 3.3.4 Public Improvements

*The county requires the construction of improvements to the local drainage system and the major drainageway as defined by the approved Phase III Drainage Report and plan for all development.*

Public improvements associated with drainage may include improvements to both the local drainage system and the major drainageway. The local drainage system consists of curb and gutter, inlets and storm sewers, culverts, bridges, swales, ditches, channels, detention/retention areas and other drainage facilities required to convey the minor and major storm runoff to the major drainageway. The major drainageway system consists of channels, storm sewers, bridges, detention/retention areas and other facilities serving more than the development or property in question, that may be impacted by the development.

### 3.3.5 Basin Transfer

*The county does not allow the inter-basin transfer of storm drainage runoff and to maintain the historic drainage path within the drainage basin. The transfer of drainage from basin to basin is a viable alternative only in certain instances and will be reviewed on a case-by-case basis. When basin transfer is permitted, the plan must achieve historic flow conditions at the confluence of the basins and meet the requirements of post development flow conditions.*

Colorado drainage law recognizes the inequity of transferring the burden on managing storm drainage from one location or property to another. Liability questions also arise when the historic drainage continuum is altered. The diversion of storm runoff from one basin to another should be avoided unless specific and prudent reasons justify and dictate such a transfer. Prior to selecting a solution, alternatives should be reviewed. Planning and design of stormwater drainage systems should not be based on the premise that problems can be transferred from one location to another.

### 3.3.6 Stormwater Runoff Detention

*The county requires that stormwater detention and/or retention be provided for all developments except as described below. The required minimum volume and maximum release rates will be determined in accordance with the requirements of these CRITERIA. Detention/retention volumes may be reduced with the incorporation of impervious area reduction methods identified in the stormwater quality section. Regional detention and/or retention ponds may be used in satisfying storage requirements only if it can be demonstrated that the pond(s) has adequate storage capacity and that the pond(s) has been designed and constructed in accordance with the requirements of these CRITERIA.*

*When an application is under the threshold to require stormwater detention, Planning and Zoning will accept an Abridged Drainage Report or Drainage Letter in lieu of a Phase III Drainage Report. The thresholds are as follows:*

1. For single family residential development with lot sizes less than 2.5 acres, cumulative impervious areas including the structures, streets/roads/driveways (paved or unpaved) and parking areas, will not total more than 10,000 square feet. The development proposal will restrict the allowable impervious area at the time of building permit issuance so that the maximum impervious area established is not exceeded.
2. For other residential development, with lot sizes greater than 2.5 acres, cumulative impervious areas including the structures, streets/roads/driveways (paved or unpaved) and parking areas, will not total more than 20,000 square feet. The development proposal should restrict the allowable impervious area at the time of building permit issuance so that the maximum impervious area established is not exceeded.
3. For residential lots adjacent to or abutting a drainageway, detention is not required if it can be proven to have no adverse effect to downstream property owners and have sufficient capacity to handle the additional flows. At a minimum, water quality shall be addressed in accordance with this regulation.
4. For all other development with lot sizes less than 2.5 acres, cumulative impervious areas including the structures, streets/roads/driveways (paved or unpaved) and parking areas, will not total more than 10,000 square feet. The development proposal will restrict the allowable impervious area at the time of building permit issuance so that the maximum impervious area established is not exceeded.
5. For existing Roadway projects where improvements are limited due to vacant land.
6. For all Trail projects.

If the proposal is meeting these thresholds, the applicant must submit an Abridged Drainage Report or Drainage Letter as identified in Sections 2.5 and 2.6 of these CRITERIA. The Abridged Drainage Report must address water quality as specified in the Stormwater Quality section below.

### 3.3.7 Stormwater Quality

*The county requires BMPs to reduce stormwater quality pollution caused by development, unless it meets the criteria as noted in the procedure below. Regional water quality facilities may be used in satisfying the BMP requirements only if it can be demonstrated that the facility provides the required water quality capture volume and that the facility has been designed and constructed in accordance with the requirements of these CRITERIA.*

Land development and human activities affect both the quantity and the quality of stormwater discharged to receiving waters. Development increases the volume of stormwater and the pollutants leaving the project property. To remove pollutants, the collection and conveyance infrastructure must be supplemented with collection and infiltration BMPs. The increase in impermeable areas such as rooftops, parking lots and paved areas decreases the opportunity for stormwater to infiltrate and percolate into the ground, and the absence of vegetation allows for increased flow velocity and sediment erosion.

To mitigate the negative effects of land development on stormwater quality, stormwater quality improvement BMPs are required. Refer to the *Manual* for BMPs and design specifications.

A project shall not be required to provide a Step 1 and/or Step 2 BMP per the Stormwater Quality Management Chapter of this CRITERIA if the following are met:

1. Detention and/or retention is not required per Section 3.3.6.
2. The project disturbs less than one acre of ground or 1 acre per mile for linear projects.

3. The project is not part of a larger common plan of development or sale.

A common plan of development or sale is a site where multiple separate and distinct construction activities may be taking place at different times on different schedules, but still under a single plan. Examples include:

1. Phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contracts or by separate owners (e.g., a development where lots are sold to separate builders).
2. A development plan that may be phased over multiple years but is still under a consistent plan for long-term development.
3. Projects in a contiguous area, up to 1/4 mile, that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility.

Requests for relief of permanent water quality control measures for projects within the Jefferson County MS4 area will not be considered for projects that include land disturbance of one acre or greater except as listed below as an exclusion.

#### MS4 Exclusion Procedure:

Planning and Zoning may grant an administrative exclusion of the requirement for permanent water quality control measures associated with projects if one of the following apply:

(A) "Pavement Management Sites": Sites, or portions of sites, for the rehabilitation, maintenance, and reconstruction of roadway pavement, which includes roadway resurfacing, mill and overlay, white topping, black topping, curb and gutter replacement, concrete panel replacement, and pothole repair. The purpose of the site must be to provide additional years of service life and optimize service and safety. The site also must be limited to the repair and replacement of pavement in a manner that does not result in an increased impervious area and the infrastructure must not substantially change. The types of sites covered under this exclusion include day-to-day maintenance activities, rehabilitation, and reconstruction of pavement. "Roadways" include roads and bridges that are improved, designed or ordinarily used for vehicular travel and contiguous areas improved, designed or ordinarily used for pedestrian or bicycle traffic, drainage for the roadway, and/or parking along the roadway. Areas primarily used for parking or access to parking are not roadways.

(B) Excluded Roadway Redevelopment: Redevelopment sites for existing roadways, when one of the following criteria is met:

- 1) The site adds less than 1 acre of paved area per mile of roadway to an existing roadway, or
- 2) The site does not add more than 8.25 feet of paved width at any location to the existing roadway.

(C) Excluded Existing Roadway Areas: For redevelopment sites for existing roadways, only the area of the existing roadway is excluded from the requirements of an applicable development site when the site does not increase the width by two times or more, on average, of the original roadway area. The entire site is not excluded from being considered an applicable development site for this exclusion. The area of the site that is part of the added new roadway area is still an applicable development site.

(D) Aboveground and Underground Utilities: Activities for installation or maintenance of underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity. This exclusion includes, but is not limited to, activities to install, replace, or maintain utilities under roadways or other paved areas that return the surface to the same condition.

(E) Non-Residential and Non-Commercial Infiltration Conditions: This exclusion does not apply to residential or commercial sites for buildings. This exclusion applies to applicable development sites for which post-development surface conditions do not result in concentrated stormwater flow during the 80th percentile stormwater runoff event. In addition, post-development surface conditions must not be projected to result in a surface water discharge from the 80th percentile stormwater runoff events. Specifically, the 80th percentile event must be infiltrated and not discharged as concentrated flow. For this exclusion to apply, a study specific to the site, watershed and/or MS4 must be conducted. The study must show rainfall and soil conditions present within the permitted area; must include allowable slopes, surface conditions, and ratios of impervious area to pervious area; and the permittee must accept such study as applicable within its MS4 boundaries.

(F) Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped: Jefferson County may exclude sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped.

(G) Stream Stabilization Sites: Jefferson County may exclude stream stabilization sites.

(H) Trails: Jefferson County may exclude bike and pedestrian trails. Bike lanes for roadways are not included in this exclusion, unless attached to a roadway that qualifies under another exclusion in this section.

### 3.3.8 Floodplain Management

*The county requires developments that impact floodplains to comply with the floodplain regulations of the ZR and LDR.*

Although in many circumstances it may be desirable to leave the floodplain in its natural state, it is evident that development in areas encumbered by floodplains often results in alterations within the floodplain limits. The County has adopted floodplain regulations as part of its ZR and the LDR. These regulations should be referenced when alterations within floodplains are proposed.

### 3.3.9 Operations and Maintenance

*The county requires that maintenance access be provided to all storm drainage facilities to assure continuous operational capability of the system. The property owner is responsible for the maintenance of all drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures and detention basins located on their land unless modified by the development improvements agreement. Should the owner fail to adequately maintain said facilities, the county will have the right to enter said land for the purposes of operations and maintenance. All such maintenance costs will be assessed to the property owner. Where floodplains or major drainageway improvements, are in whole or in part within the MHFD boundary, the approval by MHFD is required to assure MHFD maintenance eligibility.*

An important part of all storm drainage facilities is the continued maintenance of the facilities to ensure they will function as designed. Maintenance responsibility lies with the owner of the land, except as modified by specific agreement. Maintenance responsibility will be delineated on Plats and Final Development Plans. Maintenance access for detention ponds must be adequate for maintenance and be shown on the Plats and Final Development Plans.

### 3.3.10 Drainage Easement Requirements

*Drainage easements are required for all onsite drainage facilities and for offsite drainage facilities in accordance with Section 3.3.1. All drainage easements must be dedicated to Jefferson County in a form acceptable to the County Attorney's office and must be shown on plats and/or final development plans. The county has the right to access drainage easements, and the right, but not the obligation, of construction and/or maintenance within drainage easements. Drainage easements will be kept clear of obstructions by the property owner/homeowners association/owners association or equivalent entity to the flow and/or obstructions to maintenance access.*

The easement requirements are indicated on the following table.

	Drainage Facility	Drainage Easement Width
1.	Storm Sewer/Subsurface Groundwater Collection System Mains /Interceptor	
	(a) Underdrains less than 36" dia.	20'
	(b) Underdrains equal to or greater than 36" dia.	Twice the pipe invert depth with sewer placed within the middle third of the easement (minimum width = 20')
2.	Open Channel/Swales	
	(a) $Q_{100}$ less than 1 cfs	5' minimum
	(b) $Q_{100}$ greater than or equal to 1 cfs and/or less than or equal to 20 cfs	15' minimum
	(c) $Q_{100}$ greater than 20 cfs	15' minimum (must accommodate $Q_{100}$ plus one foot of freeboard and required access)
3.	Detention/Retention/Water Quality Ponds/MPLDs/water quality features	As required to contain storage or encompass the water quality feature and associated facilities plus adequate maintenance access to the pond or feature and around perimeter.
4.	Along Side Lot Lines for Single-family Residential Subdivisions as required.	5' minimum, centered on the lot line.

### 3.3.11 Storage Facilities

*The policy of the county is to:*

- 1. Restrict development to areas outside of the reservoir's high-water line created by the design flood for the emergency spillway.*
- 2. Restrict development to areas outside of the high-water line created by the breach of a dam (excepting existing Class 1 classified dams). If the development proposal is to improve the existing dam to a Class 1 classification, plans must be approved by the reservoir owner and dam safety branch of the Colorado Division of Water Resources. The improvements to the dam must be completed, inspected*

*and approved prior to any building permit within the boundary of the plat. All construction plans required to improve a dam to a class 1, as indicated above, is the responsibility of the developer*

*3. Require developments downstream of a Class 2 dam to have the dam safety branch of the Colorado Division of Water Resources determine if the proposed development is within the high-water line created by the breach of dam. For developments downstream of a Class 3 or Class 4 dam, a breach of dam study may be required to determine the limits of the breach of dam if the dam safety branch of the Colorado Division of Water Resources does not have the information available. The dam safety branch of the Colorado Division of Water Resources must approve the required study.*

*4. Restrict development to areas outside emergency spillway paths, beginning at the dam and proceeding to the point where the flood water returns to the natural drainage course.*

The problem of dam safety and the related hazard of the emergency spillways has been brought to the attention of the public by nationwide dam failures, and is the subject of a National Dam Safety Program by the federal government. Jurisdictional dams are classified by the State Engineer as high, moderate, low or Class 1 to Class 4 structures depending on conditions downstream. Dams are classified as high hazard or Class 1 structures when, in the event of failure, there is a potential loss of life. Dams presently rated as low to moderate or Class 2 to Class 4 hazard structures may be changed to higher hazard rating if development occurs within the potential path of flooding due to a dam breach. In this case, the reservoir owners would be liable for the cost of upgrading the structure to meet the higher hazard classification.

### 3.3.12 Inadvertent Detention Storage

*The county does not assume any reduction in peak flows for inadvertent stormwater storage created by embankments with undersized culverts when calculating downstream flows, unless such detention is covered by agreement with the county and is designed and constructed in accordance with these CRITERIA.*

*The county does not assume any reduction in peak flows for inadvertent stormwater storage due to privately owned non-flood-control reservoirs. For publicly owned water storage reservoirs, with the approval of the owner, only detention storage above the spillway crest can be used in the calculation of downstream flows.*

### 3.3.13 Irrigation Facilities

*The policies of the county are as follows:*

*1. To require development to direct storm runoff into historic and natural drainageways and avoid discharging into irrigation ditches, unless the discharge is approved by the ditch company or equivalent entity.*

*2. Whenever development will alter patterns of the storm drainage into irrigation ditches by increasing flow rates, volumes or changing points of concentration, the written consent from the ditch company or equivalent entity is required.*

*3. The discharge of runoff into the irrigation ditch will be approved only if such discharge is consistent with an adopted master drainage plan and is in the best interest of the county.*

*4. Whenever irrigation ditches cross major drainageways within the developing area, the developer is required to design and construct the appropriate structures to separate storm runoff from ditch flows subject to the condition noted in Policy 3 above.*

*5. Whenever physical modifications and/or relocation of irrigation ditches are proposed in conjunction with development, written consent from the ditch company or equivalent entity will be submitted. Relocated irrigation ditches will not be placed in public Rights-of-Way except for crossings of public Right-of-Way that are at right angles or as close to right angles as possible.*

*6. If storm water is carried within an irrigation ditch, a drainage easement will be dedicated to the county and will meet the easement width set forth in Section 3.3.10 of these CRITERIA. An irrigation ditch easement will be dedicated within the development boundary at the discretion of the ditch company or equivalent entity. The irrigation ditch easement agreement will address the relinquishment of any irrigation ditches that will be abandoned within the development boundary.*

*7. If an irrigation ditch is abandoned or terminated by the ditch company or equivalent entity, said ditch is deemed to be a natural drainageway. Modifications or alterations to the abandoned or terminated ditch are only allowed subject to approval by Jefferson County in accordance to these CRITERIA.*

*8. To assume that an irrigation ditch does not intercept the storm runoff from the upper basin and that the upper basin is tributary to the basin area downstream of the ditch. The physical aspects of a bermed irrigation ditch structure within a development will be analyzed to*

*determine any drainage impacts of new development.*

There are many irrigation ditches and reservoirs in the county area. The ditches and reservoirs have historically intercepted the storm runoff from the rural and agricultural type basins, generally without major problems. With urbanization of the basins, however, the storm runoff has increased in rate, quantity and frequency, as well as changes in water quality. The irrigation facilities can no longer be utilized indiscriminately as drainage facilities and, therefore, policies have been established to achieve compatibility between urbanization and the irrigation facilities.

In evaluating the interaction of irrigation ditches with a major drainageway for the purpose of basin delineation, the ditch should not be utilized as a basin boundary due to the limiting flow capacity of the ditch. The ditches will generally be flowing full or near full during major storms; therefore, the tributary basin runoff would flow across the ditch.

Irrigation ditches are designed with flat slopes and limited carrying capacity, which decreases in the downstream direction. As a general rule, irrigation ditches cannot be used as an outfall point for the storm drainage system because of these physical limitations. In addition, certain ditches are abandoned after urbanization and could not be successfully utilized for storm drainage.

In certain instances, irrigation ditches have been successfully utilized as outfall points for the initial drainage system, but only after a thorough hydrological and hydraulic analysis. Since the owner's liability from ditch failure increases with the acceptance of storm runoff, the responsibility must be clearly defined before a combined system is approved.

### **3.4 Planning and Design**

#### **3.4.1 Minor and Major Drainage System**

*The county requires that all development include the planning, designing and implementation for both the minor and major drainage systems.*

*The county requires that all minor drainage systems be sized without accounting for peak flow reductions from on-site detention, unless otherwise approved by Planning and Zoning.*

Every urban area has two separate and distinct drainage systems, whether or not they are actually planned or designed. One is the Minor Drainage System and the other is the Major Drainage System, which are combined to form the Total Drainage System.

The Major Drainage System is designed to convey runoff from the 100-year recurrence interval flood to minimize health and life hazards, damage to structures and interruption to traffic and services. Major storm flows can be carried in the urban street system (within acceptable depth criteria), channels, storm sewers and other facilities.

The Minor Drainage System is designed to transport the runoff from five-year frequency events with a minimum disruption to the urban environment. Minor storm drainage can be conveyed in the curb and gutter area of the street or street/roadside ditch (subject to street classification and capacity) by storm sewer, channel or other conveyance facility.

#### **3.4.2 Storm Runoff**

*The county allows storm runoff to be determined by either the Rational method or the Colorado Urban Hydrograph Procedure (CUHP), within the limitations as set forth in these CRITERIA. For basins larger than 160 acres, the peak flows and volumes will be determined by CUHP.*

#### **3.4.3 Streets**

*The county allows the use of streets for drainage within certain limitations as defined in these CRITERIA.*

Streets are an integral part of the urban drainage system and may be used for transporting storm runoff up to design limits. The engineer should recognize that the primary purpose of streets is for traffic, and therefore the use of streets for storm runoff must be restricted.

#### **3.4.4 Floodproofing Existing Structures**

*The county encourages the floodproofing of existing structures not in conformance with the adopted floodplain regulations by utilizing the criteria presented in the "Homeowners Guide to Retrofitting, FEMA".*

Floodproofing can be defined as those measures which reduce the potential for flood damages to existing properties within a floodplain. The floodproofing measures can range from elevating structures to intentional flooding of noncritical building spaces to minimize structural

damages. Floodproofing measures are only a small part of good floodplain management which encourages wise floodplain development to minimize the adverse effects of floods.

## Chapter 4 - Floodplain Regulations

As set forth in the Floodplain Overlay District of the ZR and the *LDR*, the regulation of floodplains is necessary to preserve and promote the general health, welfare and economic well-being of the region.



# Chapter 5 - Rainfall

## 5.1 Introduction

Presented in this section are the design rainfall data to be used with the CUHP and the Rational Method. All hydrological analysis within the jurisdiction of these *CRITERIA* will utilize the rainfall data presented herein for calculating storm runoff.

The design storms and time intensity frequency curves for the County were developed using the rainfall data and procedures presented in the *Manual* and are presented herein for convenience.

## 5.2 Jefferson County Rainfall Zones

### 5.2.1 Description of the Zones

A review of the isopluvial maps presented in the NOAA Atlas 14 for Colorado shows that Jefferson County can be divided into four rainfall zones. Within each zone, the precipitation values for various return periods and duration storms up to 0.4 inch within a small area of the County. These zones are delineated on Figure-501 and are discussed below:

- Zone 1: Covers the area from the east Jefferson County line to the 6000-foot contour at the foothills boundary. The point rainfall values in this zone vary less than 0.4 inch for return periods from 2-year to 100-year and for storm durations from 1 hour to 6 hours.
- Zone IIA: Covers the area from the 6000-foot contour to the 7500-foot contour and generally represents the foothills of the front range. The point rainfall values in this zone decrease from east to west by less than 0.3 inch for the storm durations and return periods noted.
- Zone IIB: Covers the area from the 7500-foot contour to a line defined by the South Platte drainage basin tributary to the town of South Platte. The point rainfall values in this zone decrease from east to west by less than 0.4 inch.
- Zone III: Covers the area tributary to the South Platte River at the town of South Platte and is bounded on the south and west by the County lines. The point rainfall values in this zone vary by less than 0.4 inch.

### 5.2.2 Selecting the Rainfall Zone

Since some of the drainage basins will include areas from more than one zone, the following criteria will be used to select the design rainfall and intensity date. Basin area refers to the actual basin or sub-basin for which storm runoff information is being calculated and not necessarily the entire watershed area.

- a. If 50 percent or more of the basin area lies in a given zone, the data for that zone will be used.
- b. For those basins within three rainfall zones, the zone data with the largest basin area will be used.

## 5.3 Colorado Urban Hydrograph Procedure Design Storms

For drainage basins less than five square miles, a two-hour storm distribution without area adjustment of the point rainfall values will be used for the CUHP. For drainage basins between five and ten square miles, a two-hour storm distribution is used but the incremental rainfall values are adjusted for the large basin area in accordance with suggested procedures in the NOAA Atlas 14 for Colorado. The adjustment is an attempt to relate the average of all point values for a given duration and frequency within a basin to the average depth over the basin for the same duration and frequency. For drainage basins between ten and twenty square miles, a three-hour storm duration with adjustment for area will be used. The distribution for the last hour was obtained by uniformly distributing the difference between the two and three-hour point rainfall values. The adjustment for area was obtained from the NOAA Atlas for Colorado. The incremental rainfall distributions for all basin areas up to 20 square miles are presented in Table 502A through Table 502D.

## 5.4 Time-Intensity-Frequency Curves

The Time-Intensity-Frequency curves for each zone were developed by distributing the one-hour point rainfall values (Table 501) using the factors obtained from the NOAA Atlas 14 presented below:

Factors for Durations of Less Than One Hour

Duration (minutes)	5	10	15	30
Ratio to one-hour depth	0.29	0.45	0.57	0.79

Source: NOAA Atlas 2, Volume III, Colorado 1973

The point values were then converted to intensities and plotted on Figure 502. The data are also presented in Table 503.

Table 501

**Design Point Rainfall Values**

One-Hour Point Rainfall (In.)					
County Zone	2-Year	5-Year	10-Year	50-Year	100-Year
Jefferson I	1.02	1.42	1.68	2.32	2.66
Jefferson IIA	0.95	1.33	1.57	2.17	2.48
Jefferson IIB	0.85	1.19	1.39	1.93	2.20
Jefferson III	0.73	1.06	1.26	1.79	2.06

Table 502A

**CUHP Design Storm for Zone I - Incremental Rainfall Depth/Return Period**

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
10	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08
15	0.09	0.12	0.14	0.12	0.12	0.09	0.12	0.14	0.12	0.12	0.09	0.12	0.14	0.12	0.12
20	0.16	0.22	0.25	0.19	0.21	0.16	0.21	0.24	0.19	0.21	0.15	0.20	0.23	0.19	0.21
25	0.26	0.36	0.42	0.35	0.37	0.24	0.35	0.40	0.34	0.36	0.23	0.32	0.38	0.32	0.33
30	0.14	0.18	0.20	0.58	0.67	0.14	0.17	0.19	0.56	0.64	0.13	0.16	0.18	0.52	0.60
35	0.06	0.08	0.09	0.28	0.37	0.06	0.08	0.09	0.24	0.36	0.06	0.08	0.09	0.25	0.33
40	0.05	0.06	0.07	0.19	0.21	0.05	0.06	0.07	0.19	0.21	0.05	0.06	0.07	0.19	0.21
45	0.03	0.05	0.06	0.12	0.16	0.03	0.05	0.06	0.12	0.16	0.03	0.05	0.06	0.12	0.16
50	0.03	0.05	0.05	0.12	0.13	0.03	0.05	0.05	0.12	0.13	0.03	0.05	0.05	0.12	0.13
55	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11
60	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11
65	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11
70	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05
75	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05
80	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03
85	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.02	0.02	0.03	0.03
130											0.01	0.02	0.02	0.03	0.03
135											0.01	0.02	0.02	0.03	0.03
140											0.01	0.02	0.02	0.02	0.03
145											0.01	0.01	0.02	0.02	0.03
150											0.01	0.01	0.01	0.02	0.02
155											0.01	0.01	0.01	0.02	0.02
160											0.01	0.01	0.01	0.01	0.02
165											0.01	0.01	0.01	0.01	0.02
170											0.01	0.01	0.01	0.01	0.01
175											0.01	0.01	0.01	0.01	0.01
180											0.01	0.01	0.01	0.01	0.01
Total	1.17	1.61	1.89	2.68	3.05	1.15	1.58	1.85	2.61	3.00	1.25	1.69	1.98	2.79	3.16

\* Time in minutes

\*\* Rainfall in inches

Table 502B

**CUHP Design Storm for Zone IIA - Incremental Rainfall Depth/Return Period**

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02
10	0.04	0.05	0.06	0.08	0.07	0.04	0.05	0.06	0.08	0.07	0.04	0.05	0.06	0.08	0.07
15	0.08	0.12	0.13	0.11	0.11	0.08	0.12	0.13	0.11	0.11	0.08	0.12	0.13	0.11	0.11
20	0.15	0.20	0.24	0.17	0.20	0.14	0.20	0.23	0.17	0.20	0.14	0.18	0.21	0.17	0.20
25	0.24	0.33	0.39	0.33	0.35	0.23	0.32	0.38	0.31	0.33	0.22	0.30	0.35	0.29	0.32
30	0.13	0.17	0.19	0.54	0.62	0.12	0.17	0.18	0.52	0.60	0.12	0.15	0.17	0.49	0.56
35	0.06	0.08	0.09	0.26	0.35	0.06	0.08	0.09	0.25	0.33	0.06	0.08	0.09	0.23	0.31
40	0.05	0.06	0.07	0.17	0.20	0.05	0.06	0.07	0.17	0.20	0.05	0.06	0.07	0.17	0.20
45	0.03	0.05	0.06	0.11	0.15	0.03	0.05	0.06	0.11	0.15	0.03	0.05	0.06	0.11	0.15
50	0.03	0.05	0.05	0.11	0.12	0.03	0.05	0.05	0.11	0.12	0.03	0.05	0.05	0.11	0.12
55	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10
60	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10
65	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10	0.02	0.04	0.05	0.07	0.10
70	0.02	0.04	0.05	0.05	0.05	0.02	0.04	0.05	0.05	0.05	0.02	0.04	0.05	0.05	0.05
75	0.02	0.03	0.05	0.05	0.05	0.02	0.03	0.05	0.05	0.05	0.02	0.03	0.05	0.05	0.05
80	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03
85	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.02	0.02	0.02	0.02
130											0.01	0.01	0.02	0.02	0.02
135											0.01	0.01	0.01	0.02	0.02
140											0.01	0.01	0.01	0.02	0.02
145											0.01	0.01	0.01	0.02	0.02
150											0.01	0.01	0.01	0.02	0.02
155											0.01	0.01	0.01	0.01	0.02
160											0.01	0.01	0.01	0.01	0.02
165											0.00	0.01	0.01	0.01	0.01
170											0.00	0.01	0.01	0.01	0.01
175											0.00	0.00	0.01	0.01	0.01
180											0.00	0.01	0.00	0.01	0.01
Total	1.12	1.55	1.83	2.516	2.86	1.09	1.54	1.80	2.46	2.80	1.15	1.59	1.87	2.57	2.93

\* Time in minutes

\*\* Rainfall in inches

Table 502C

**CUHP Design Storm for Zone IIB - Incremental Rainfall Depth/Return Period**

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
10	0.03	0.04	0.05	0.07	0.07	0.03	0.04	0.05	0.08	0.07	0.03	0.04	0.05	0.07	0.07
15	0.07	0.10	0.11	0.10	0.10	0.07	0.10	0.11	0.12	0.10	0.07	0.10	0.11	0.10	0.10
20	0.14	0.18	0.21	0.15	0.18	0.13	0.17	0.20	0.19	0.18	0.12	0.16	0.19	0.15	0.18
25	0.21	0.30	0.35	0.28	0.31	0.20	0.29	0.33	0.34	0.30	0.19	0.27	0.31	0.26	0.28
30	0.12	0.15	0.17	0.46	0.55	0.11	0.15	0.16	0.56	0.53	0.11	0.14	0.15	0.43	0.50
35	0.05	0.07	0.08	0.22	0.31	0.05	0.07	0.08	0.24	0.30	0.05	0.07	0.08	0.21	0.28
40	0.04	0.05	0.06	0.15	0.18	0.04	0.05	0.06	0.19	0.18	0.04	0.05	0.06	0.15	0.18
45	0.03	0.04	0.05	0.10	0.14	0.03	0.04	0.05	0.12	0.14	0.03	0.04	0.05	0.10	0.14
50	0.03	0.04	0.04	0.10	0.11	0.03	0.04	0.04	0.12	0.11	0.03	0.04	0.04	0.10	0.11
55	0.03	0.04	0.04	0.06	0.09	0.03	0.04	0.04	0.07	0.09	0.03	0.04	0.04	0.06	0.09
60	0.03	0.04	0.04	0.06	0.09	0.03	0.04	0.04	0.07	0.09	0.03	0.04	0.04	0.06	0.09

65	0.03	0.04	0.04	0.06	0.09	0.03	0.04	0.04	0.07	0.09	0.03	0.04	0.04	0.06	0.09
70	0.02	0.04	0.04	0.05	0.04	0.02	0.04	0.04	0.06	0.04	0.02	0.04	0.04	0.05	0.04
75	0.02	0.03	0.04	0.05	0.04	0.02	0.03	0.04	0.06	0.04	0.02	0.03	0.04	0.05	0.04
80	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.03	0.03
85	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.03	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.01	0.02	0.02	0.02
130											0.01	0.01	0.02	0.02	0.02
135											0.01	0.01	0.02	0.02	0.02
140											0.01	0.01	0.01	0.02	0.02
145											0.01	0.01	0.01	0.01	0.02
150											0.01	0.01	0.01	0.01	0.01
155											0.01	0.01	0.01	0.01	0.01
160											0.00	0.01	0.01	0.01	0.01
165											0.00	0.01	0.01	0.01	0.01
170											0.00	0.00	0.01	0.01	0.01
175											0.00	0.00	0.01	0.01	0.01
180											0.00	0.00	0.01	0.01	0.01
Total	1.03	1.40	1.60	2.21	2.60	1.00	1.38	1.56	2.61	2.56	1.05	1.43	1.67	2.31	2.66

\* Time in minutes

\*\* Rainfall in inches

Table 502D

**CUHP Design Storm for Zone III - Incremental Rainfall Depth/Return Period**

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.02	0.02
10	0.03	0.04	0.05	0.06	0.06	0.03	0.04	0.05	0.06	0.06	0.03	0.04	0.05	0.06	0.06
15	0.06	0.09	0.10	0.19	0.09	0.06	0.09	0.10	0.09	0.09	0.06	0.09	0.10	0.09	0.09
20	0.12	0.16	0.19	0.14	0.16	0.11	0.16	0.18	0.14	0.16	0.11	0.14	0.17	0.14	0.16
25	0.18	0.27	0.32	0.27	0.29	0.18	0.26	0.31	0.26	0.28	0.16	0.24	0.29	0.24	0.26
30	0.10	0.14	0.15	0.45	0.52	0.10	0.13	0.14	0.43	0.50	0.09	0.13	0.14	0.41	0.47
35	0.05	0.06	0.07	0.21	0.29	0.05	0.06	0.07	0.20	0.28	0.05	0.06	0.07	0.19	0.26
40	0.04	0.05	0.05	0.14	0.16	0.04	0.05	0.05	0.14	0.16	0.04	0.05	0.05	0.14	0.16
45	0.02	0.04	0.05	0.09	0.13	0.02	0.04	0.05	0.09	0.13	0.02	0.04	0.05	0.09	0.13
50	0.02	0.04	0.04	0.09	0.10	0.02	0.04	0.04	0.09	0.10	0.02	0.04	0.04	0.09	0.10
55	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08
60	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08
65	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08
70	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04
75	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04
80	0.01	0.02	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.02
85	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
90	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
95	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
100	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
105	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
110	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
115	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
120	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02
125											0.01	0.01	0.01	0.01	0.02
130											0.01	0.01	0.01	0.01	0.01
135											0.01	0.01	0.01	0.01	0.01
140											0.01	0.01	0.01	0.01	0.01
145											0.01	0.01	0.01	0.01	0.01
150											0.01	0.01	0.01	0.01	0.01

155											0.01	0.01	0.01	0.01	0.01
160											0.01	0.01	0.01	0.01	0.01
165											0.01	0.01	0.01	0.01	0.01
170											0.00	0.00	0.01	0.01	0.01
175											0.00	0.00	0.00	0.01	0.01
180											0.00	0.00	0.00	0.00	0.01
Total	0.80	1.23	1.44	2.09	2.32	0.79	1.21	1.41	2.05	2.28	0.85	1.26	1.48	2.11	2.34

\* Time in minutes

\*\* Rainfall in inches

Table 503

**Time-Intensity-Frequency Tabulation**

Duration		5 Min		10 Min		15 Min		30 Min		60 Min	
Duration Factors		0.29		0.45		0.57		0.79		1.00	
County Zone	Frequency	Depth**	Intensity*	Depth**	Intensity*	Depth**	Intensity*	Depth**	Intensity*	Depth**	Intensity*
Jefferson I	2-Yr	0.30	3.55	0.46	2.75	0.58	2.33	0.81	1.61	1.02	1.02
	5-Yr	0.41	4.94	0.64	3.83	0.81	3.24	1.12	2.24	1.42	1.42
	10-Yr	0.49	5.85	0.76	4.54	0.96	3.83	1.33	2.65	1.68	1.68
	50-Yr	0.67	8.07	1.04	6.26	1.32	5.29	1.83	3.67	2.32	2.32
	100-Yr	0.77	9.26	1.20	7.18	1.52	6.06	2.10	4.20	2.66	2.66
Jefferson IIA	2-Yr	0.28	3.31	0.43	2.57	0.54	2.17	0.75	1.50	0.95	0.95
	5-Yr	0.39	4.63	0.60	3.59	0.76	3.03	1.05	2.10	1.33	1.33
	10-Yr	0.46	5.46	0.71	4.24	0.89	3.58	1.24	2.48	1.57	1.57
	50-Yr	0.63	7.55	0.98	5.86	1.24	4.95	1.71	3.43	2.17	2.17
	100-Yr	0.72	8.63	1.12	6.70	1.41	5.65	1.96	3.92	2.48	2.48
Jefferson IIB	2-Yr	0.25	2.96	0.38	2.30	0.48	1.94	0.67	1.34	0.85	0.85
	5-Yr	0.35	4.14	0.54	3.21	0.68	2.71	0.94	1.88	1.19	1.19
	10-Yr	0.40	4.84	0.63	3.75	0.79	3.17	1.10	2.20	1.39	1.39
	50-Yr	0.56	6.72	0.87	5.21	1.10	4.40	1.52	3.05	1.93	1.93
	100-Yr	0.64	7.66	0.99	5.94	1.25	5.02	1.74	3.48	2.20	2.20
Jefferson III	2-Yr	0.21	2.54	0.33	1.97	0.42	1.66	0.58	1.15	0.73	0.73
	5-Yr	0.31	3.69	0.48	2.86	0.60	2.42	0.84	1.67	1.06	1.06
	10-Yr	0.37	4.38	0.57	3.40	0.72	2.87	1.00	1.99	1.26	1.26
	50-Yr	0.52	6.23	0.81	4.83	1.02	4.08	1.41	2.83	1.79	1.79
	100-Yr	0.60	7.17	0.93	5.56	1.17	4.70	1.63	3.25	2.06	2.06

\* Depth in Inches

\*\* Intensity/hour



Figure 501  
**Rainfall Zones in  
 Jefferson County**

Rainfall Zone III extends to the southern  
 boundary of Jefferson County.



# Time-Intensity Frequency Curves

Figure 502A  
**Zone I**

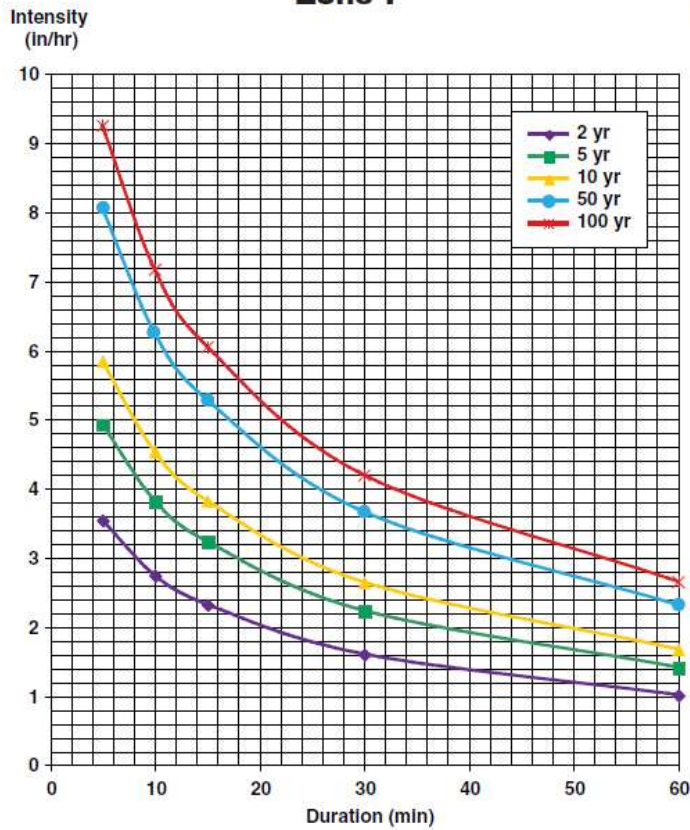


Figure 502B  
**Zone IIA**

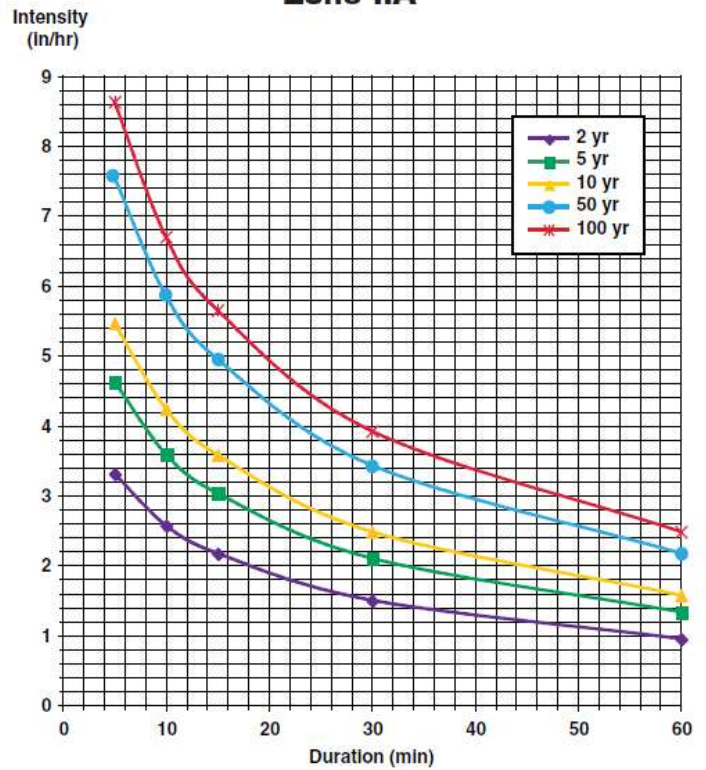


Figure 502C  
**Zone IIB**

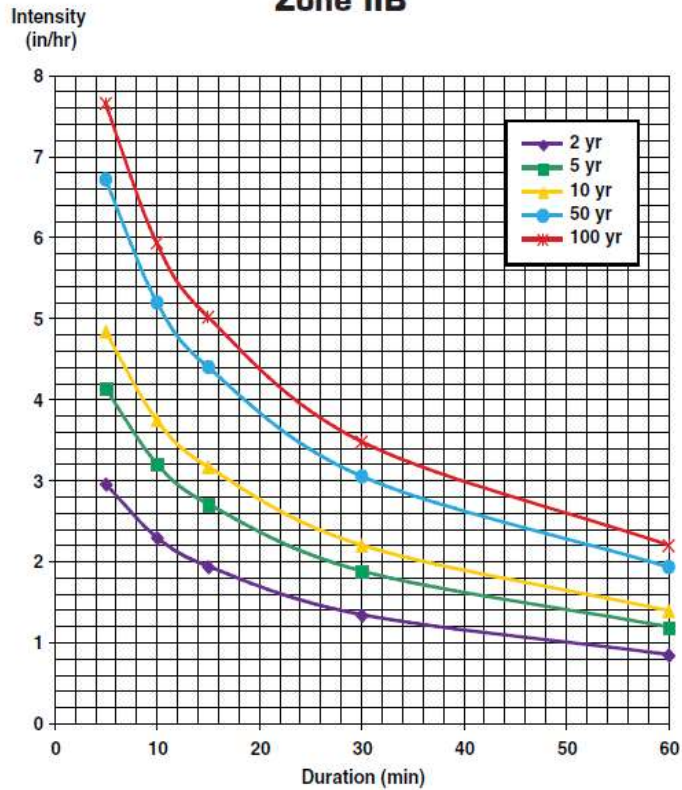
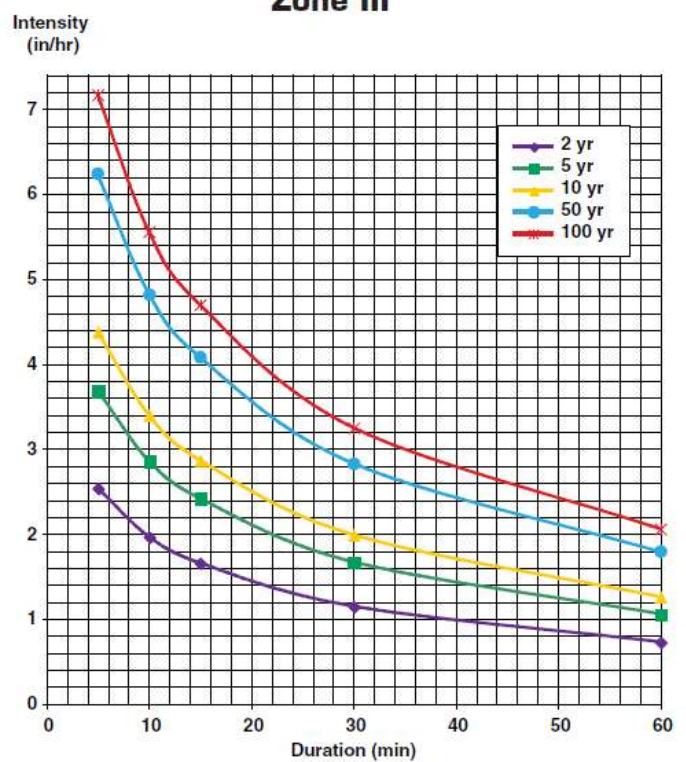


Figure 502D  
**Zone III**



# Chapter 6 - Runoff

## 6.1 Introduction

This chapter presents the criteria and methodology for determining the storm runoff design peaks and volumes to be used in the County in the preparation of storm drainage studies, plans and facility design. The details of the rainfall/runoff models are presented in the *Manual*. The specific input data requirements and modifications to the procedures are presented in this chapter.

## 6.2 Rational Method

The Rational Method, in widespread use in the Denver Region, will continue to be utilized for the sizing of storm sewers and for determining runoff magnitude from unsewered areas. The limit of application of the Rational Method is approximately 160 acres. It has been concluded that, for tributary basins in excess of 160 acres, the cost of the drainage works justifies significantly more study, thought and judgment on the part of the engineer than is permitted by the Rational Method. When the urban drainage basin exceeds 160 acres, the CUHP method represents better practice and must be used.

The procedures for the Rational Method, as explained in the *Manual*, Volume 1, "Runoff", must be followed in the preparation of drainage reports and storm drainage facility designs in the County.

Standard forms and spreadsheets are available in the *MHFD Manual*. The most current versions of these software programs may be obtained through the District's web site ([www.udfcd.org](http://www.udfcd.org)).

## 6.3 Colorado Urban Hydrograph Procedure

CUHP was originally developed for the Denver area at the time the *Manual* was prepared. The method may be used for basins as small as five acres. However, CUHP is required for watershed areas larger than 160 acres. The procedures for CUHP, as explained in the *Manual* will be followed in the preparation of drainage reports and storm drainage facility designs in the County. The design storms to be used with the CUHP method are presented in Tables 502A-D.

## 6.4 Storm Flow Analysis

When determining the design storm flows, the engineer should follow criteria and guidelines to assure that minimum design standards and uniformity of drainage solutions are maintained throughout the County. The information presented herein will be used by the engineer in the development of design storm runoff.

### 6.4.1 Onsite Flow Analysis

When analyzing the flood peaks and volumes, the engineer should use the proposed fully developed land use plan to determine runoff coefficients. In addition, the engineer should take into consideration the changes in flow patterns (from the undeveloped site conditions) caused by the proposed street alignments. When evaluating surface flow times, the proposed lot grading will be used to calculate the time of concentration or the CUHP parameters.

### 6.4.2 Offsite Flow Analysis

The analysis of offsite runoff is dependent on the development status and whether the tributary offsite area lies within a major drainageway basin as defined in Section 3.2.3. In all cases, the minor system is designed for the fully developed minor storm runoff (Section 3.4.1) without the benefits of onsite detention. In some cases, credit is given for detention for the design of the major system (Section 3.3.12).

#### 6.4.2.1 Tributary Area Within a Major Drainageway Basin

(a) Where the offsite area is undeveloped, the runoff will be calculated assuming the basin is fully developed as defined by Planning and Zoning. If this information is not available, then the runoff will be calculated using the coefficients defined in the runoff chapter of the *Manual*. The most current versions of these software programs may be obtained through the District's web site ([www.udfcd.org](http://www.udfcd.org)).

(b) Where the offsite area is fully or partially developed, the storm runoff will be based upon the existing platted land uses and topographic features. No credit will be given for onsite detention in the offsite area for any design frequency.

#### 6.4.2.2 Tributary Area Not Within a Major Drainageway Basin



(a) Where the offsite area is undeveloped, the minor system runoff will be calculated assuming the basin is fully developed as defined by Planning and Zoning. If this information is not available, then the runoff will be calculated using the coefficients defined in the runoff chapter of the *Manual*. The most current versions of these software programs may be obtained through the District's web site ([www.ud-fcd.org](http://www.ud-fcd.org)). The major system runoff (i.e., 10-year and 100-year) may be calculated assuming the historic runoff rates computed in accordance with procedures described in Chapter 14 of these *CRITERIA*.

(b) Where the offsite area is fully or partially developed, the storm runoff will be based on the existing platted land uses and topographic features, unless onsite detention in the offsite area has been constructed and accepted by the County. However, no credit will be given for onsite detention in the offsite area for the minor system design, unless otherwise approved by Planning and Zoning.

# Chapter 7 - Open Channels

## 7.1 Introduction

This chapter addresses the technical criteria for the hydraulic evaluation and hydraulic design of open channels in the County. The information presented herein is considered to be a minimum standard. In many instances, special design or evaluation techniques will be required. Except as modified herein, all open channel criteria will be in accordance with the *Manual and Open Channel Hydraulics*, Chow, Ven T., McGraw-Hill, Inc., New York, New York, 1959

## 7.2 Channel Types

The channels in the County area are defined as natural or artificial. Natural channels include all water courses that have occurred naturally by the erosion process such as Clear Creek, Bear Creek, South Platte River, Ralston Creek, Dutch Creek, Van Bibber Creek, Big Dry Creek and Lena Gulch. Artificial channels are those constructed or developed by human effort.

### 7.2.1 Natural Channels

The hydraulic properties of natural channels vary along the channel reach and can be either controlled to the extent desired or altered to meet given requirements. The initial decision to be made regarding natural channels is whether or not the channel is to be protected from erosion due to high velocity flows or protected from excessive silt deposition due to low velocities.

Many natural channels in urbanized and to-be-urbanized areas have mild slopes, are reasonably stable and are not in a state of serious degradation or aggradation. However, if a natural channel is to be used for carrying storm runoff from an urbanized area, the altered nature of the runoff peaks and volumes from urban development will cause erosion. Detailed hydraulic analysis will be required for natural channels in order to identify the erosion tendencies. Some onsite modifications of the natural channel, such as grade control structures, may be required to assure a stabilized condition.

The investigations necessary to assure that the natural channels will be adequate are different for every waterway. The engineer must prepare cross sections of the channel, define the water surface profile for the minor and major design flood, investigate the bed and bank material to determine erosion tendencies and study the bank slope stability of the channel under future conditions of flow. Supercritical flow does not normally occur in natural channels, but calculations must be made to assure that the results do not reflect supercritical flow.

### 7.2.2 Grass Lined Channels

Grass lined channels are the most desirable of the artificial channels. The grass will stabilize the body of the channel, consolidate the soil mass of the bed, check the erosion on the channel surface and control the movement of soil particles along the channel bottom. The channel storage, the lower velocities and the greenbelt multiple-use benefits obtained create significant advantages over other artificial channels.

The presence of grass in channels creates turbulence which results in loss of energy and increased flow retardance. Therefore, the designer must give full consideration to sediment deposition and to scour, as well as hydraulics. Unless existing development within the County restricts the availability of ROW, only channels lined with grass will be considered acceptable for major drainageways.

For the purposes of these *CRITERIA*, sandy soils are defined as non-cohesive sands classified as SW, SP or SM in accordance with the Unified Soil Classification System.

### 7.2.3 Composite Channels

Composite channels are a type of grass-lined channel with a distinct low-flow channel that is vegetated with a mixture of wetland and riparian species. Design of composite channels will be in accordance with the *Manual*.

### 7.2.4 Bioengineered Channels

Bioengineered channels are a type of grass-lined channel that utilize vegetative components and other natural materials in combination with structural measures to construct natural-like channels that are stable and resistant to erosion. Design of bioengineered channels will be in accordance with the *Manual*.

### 7.2.5. Concrete Lined Channels

Concrete lined channels for major drainageways will be permitted only where ROW restrictions within existing development prohibit grass

lined channels or any other channel lining type. The lining must be designed to withstand the various forces and actions which tend to overtop the bank, deteriorate the lining, erode the soil beneath the lining and erode unlined areas, especially for the supercritical flow conditions.

If the project constraints suggest the use of a concrete channel for a major drainageway, the applicant will present the concept with justification to Planning and Zoning for consideration of a waiver from these *CRITERIA*.

A Design Report is required for approval of a concrete lined channel. The contents of such report will be determined by Planning and Zoning. On the as-built drawings, the engineer will be required to certify that the concrete used in the lining was tested and meets the accepted specifications.

#### 7.2.6. Rock Lined Channels

Riprap lined channels are generally discouraged and will be permitted only in areas of existing development where ROW for major drainageways is limited and such limitation prohibits the use of grass lined channels. The advantage of rock lining a channel is that a steeper channel grade and steeper side slopes can be used. Rock linings (i.e., revetments) are permitted as a means of controlling erosion for natural channels. The disadvantages are the large initial cost of construction and the high maintenance costs due to vandalism.

If the project constraints suggest the use of riprap lining for a major drainageway, then the engineer must present the concept, with justification, to Planning and Zoning for consideration of a waiver from these *CRITERIA*. The design of rock-lined channels will be in accordance with the *Manual*.

### 7.3 Flow Computation

Uniform flow and critical flow computations will be in accordance with the *Manual*.

### 7.4 Design Standards for Major Drainageways

These standards cover the design of major drainageways as defined by the policy of Section 3.2.3. The design standards for open channels cannot be presented in a step-by-step fashion because of the wide range of design options available to the design engineer. Certain planning and conceptual design criteria are particularly useful in the preliminary design of a channel. These *CRITERIA*, which have the greatest effect on the performance and cost of the channel, are discussed below.

#### 7.4.1 Natural Channels

The design criteria and evaluation techniques for natural channels are:

1. The channel and overbank areas will have adequate capacity for the 100-year storm runoff.
2. Natural channel segments shall be designed to have a calculated Froude number of 0.6 for non-cohesive soils or those with poor vegetation and a maximum of 0.8 for vegetated cohesive soils for the 100-year flood peak.
3. The water surface profiles will be defined so that the floodplain can be zoned and protected.
4. Filling of the Floodplain Overlay District reduces valuable channel storage capacity and tends to increase downstream runoff peaks.
5. Roughness factors ( $n$ ), which are representative of unmaintained channel conditions, will be used for the analysis of water surface profiles.
6. Roughness factors ( $n$ ), which are representative of maintained channel conditions, will be used to determine velocity limitations.
7. Structures may be required to control erosion for both the major and the minor storm runoff and should appear as natural features by imitating surrounding vegetation and natural materials. Where possible, locate structures at principal grade changes to minimize cost of retaining structures, reduce perceived scale and appearance of mass and bulk and use existing land forms of the site. All check drops, dams or structures should, whenever feasible, use natural materials to integrate with natural landscape characteristics.
8. Plan and profile drawings of the floodplain will be prepared. Appropriate allowances for known future bridges or culverts, which can raise the water surface profile and cause the floodplain to be extended, will be included in the analysis. The applicant will contact Planning and Zoning for information on future bridges and culverts.

9. Preserve, maintain or enhance natural waterway channel boundaries and alignment in their natural condition as landscape and visual amenities, focal points for development projects and to help define “edges” in and around communities. Preserve vegetation groups, rock outcroppings, terrain form, soil, waterways and bodies of water.

With most natural waterways, erosion control structures should be constructed at regular intervals to decrease the thalweg slope and to control erosion. However, these channels should be left in as near a natural condition as possible. For that reason, extensive modifications should not be undertaken unless they are found to be necessary to avoid excessive erosion with subsequent deposition downstream.

The usual rules of freeboard depth, curvature and other rules which are applicable to artificial channels, do not apply for natural channels. All structures constructed along the channel will be elevated a minimum of one foot above the 100-year water surface. There are significant advantages which may occur if the designer incorporates into his planning the overtopping of the channel and localized flooding of adjacent areas which are laid out and developed for the purpose of being inundated during the major runoff peak.

If a natural channel is to be utilized as a major drainageway for a development, then the applicant will meet with Planning and Zoning to discuss the concept and to obtain the requirements for planning and design documentation. Approval of the concept and design will be made in accordance with the requirements of Chapter 2 of these *CRITERIA*.

#### 7.4.2 Grass Lined Channels

Key parameters in grass lined channel design include velocity, slopes, roughness coefficients, depth, freeboard, curvature, cross section shape and lining materials. Other factors such as water surface profile computation, erosion control, drop structures and transitions also play an important role. A discussion of these parameters is presented below.

##### 1. Flow Velocity

The maximum normal depth velocity for the 100-year flood peak will not exceed 5.0 feet per second for grass lined channels. The Froude number (turbulence factor) will be less than 0.8 for grass lined channels. Grass lined channels having a Froude number greater than 0.8 are not permitted. The minimum velocity, wherever possible, will be greater than 2.0 feet per second for the minor storm runoff.

##### 2. Longitudinal Channel Slopes

Grass lined channel slopes are dictated by velocity and Froude number requirements. Where the natural topography is steeper than desirable, drop structures will be utilized to maintain design velocities and Froude numbers.

##### 3. Freeboard

Except where localized overflow in certain areas is desirable for additional ponding benefits or other reasons, the freeboard for the 100-year flow will be as follows:

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$$\text{HFB} = 0.5 + \frac{V^2}{2g}$$

where

HFB = freeboard height (feet)

V = average channel velocity (fps)

g = acceleration of gravity = 32.2 ft/sec<sup>2</sup>

The minimum freeboard will be 1.0 foot.

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##### 4. Curvature (Horizontal)

The center line curvature will have a radius twice the top width of the design flow but not less than 100 feet.

## 5. Roughness Coefficient

The variation of Manning's "n" with the retardance and the product of mean velocity and hydraulic radius, as presented in Figure 701, will be used in the capacity computation.

Retardance curve C will be used to determine the channel capacity, since a mature channel (i.e., substantial vegetation with minimal pervious maintenance) will have a higher Manning's "n" value. However, a recently constructed channel will have minimal vegetation and the retardance will be less than the mature channel. Therefore, retardance curve D will be used to determine the limiting velocity in a channel.

## 6. Cross Sections

The channel shape may be almost any type suitable to the location and to the environmental conditions. Often the shape can be chosen to suit open space and recreational needs. The limitations within which the design must fall for the major storm design flow include:

### a. Trickle Channel

The base flow will be carried in a trickle channel except for sandy soils (see Section 7.2.2). The minimum capacity will be 1.0 percent to 3.0 percent of the 100-year flow but not less than 1 cfs. Trickle channels will be constructed of concrete or other approved materials to minimize erosion, to facilitate maintenance and to aesthetically blend with the adjacent vegetation and soils. Recommended trickle channel sections are presented on Figure 703. The minimum trickle channel width will be four feet.

An alternative trickle channel treatment is of greater capacity with natural bottom and appropriate riparian vegetation types and mix along edges to reduce erosion and create wetland area. Channel alignment should vary in character with a meandering quality. Drop structures should be included where necessary and appear as natural features.

### b. Main Channel

A main channel is required for sandy soils. The side slopes must be 4:1 or flatter. The depth of the main channel is not included in the normal depth limitation. A main channel can also be used for non-sandy soils.

### c. Bottom Width

The minimum bottom width will be consistent with the maximum depth and velocity criteria. The minimum bottom width will be four feet or the trickle channel width when trickle channel is required.

### d. Easement/ROW Width

The minimum easement/ROW width will include freeboard and a 12-foot wide maintenance access road.

### e. Flow Depth

The maximum design depth of flow (outside the trickle channel area and main channel area for sandy soils) for the 100-year flood peak will be limited to 5.0 feet in grass lined channels.

### f. Maintenance Access Road

A maintenance access road will be provided along the entire length of all major drainageways with a minimum width of 12 feet. The County may require the road to be surfaced with six inches of Class 2 road base or concrete slab.

### g. Side Slopes

Main channel side slopes will be 4 (horizontal) to 1 (vertical) or flatter.

## 7. Vegetation

The grass lining for channels will be in accordance with the *Manual*.

Vegetation and landform variations are encouraged to enhance the aesthetic quality within channels as long as the functional factors mentioned below are not compromised. It is recognized that channel capacity will be increased to accommodate an increase in plant

material types and densities and variation of landform. Overstory canopy trees are allowed outside of high hazard areas.

If extensive modification or disruption is necessary, rehabilitate channel corridor to conform to or improve upon predevelopment conditions. The stream form and vegetative character should appear as it would occur under long-term natural processes. Alternative techniques that can be used to achieve these include: varying the slope and edge of channel; the use of river rock for riprap; replanting appropriately sized riparian vegetation; and introducing meandering character on flat areas and pools and rocks in steeper areas. A concentration of plant materials should be included where drainages intersect arterial streets, when feasible, to maintain and enhance visual access from roadways.

The distance on each side of any flowing or intermittent stream channel should be large enough to ensure its use as an active and passive recreational and visual amenity.

## 8. Erosion Control

The requirements for erosion control for grass lined channels will be as defined in the *Manual*. The design of conduit outlet structures will be in accordance with the *Manual*.

## 9. Water Surface Profiles

Computation of the water surface profile will be presented for all open channels utilizing standard backwater methods, taking into consideration losses due to changes in velocity of channel cross section, drops, waterway openings or obstructions. The energy gradient will be shown on all drawings.

### 7.5 Design Standards for Small Drainageways

These standards cover the design of channels that are not classified as a major drainageway in accordance with the policy of Section 3.2.3. Additional flexibility and less stringent standards are allowed for small drainageways.

#### 7.5.1 Natural Channels

The design criteria and evaluation techniques for natural channels are:

1. The channel and overbank areas will have adequate capacity for the 100-year storm runoff.
2. Natural channel segments shall be designed to have a calculated Froude number of 0.6 for non-cohesive soils or those with poor vegetation and a maximum of 0.8 for vegetated cohesive soils for the 100-year flood peak.
3. Roughness factors ( $n$ ), which are representative of unmaintained channel conditions, will be used for the analysis of water surface profiles.
4. Roughness factors ( $n$ ), which are representative of maintained channel conditions, will be used to determine velocity limitations.
5. Erosion control structures, such as check drops or check dams, may be required to control flow velocities, including the minor storm runoff.
6. Plan and profile drawings will be prepared showing the 100-year water surface profile, floodplain and details of erosion protection, if required.

#### 7.5.2 Grass Lined Channels

Key parameters in grass lined channel design include velocity, slopes, roughness coefficients, depth, freeboard, curvature, cross section shape and lining materials. Other factors such as water surface profile computation, erosion control, drop structures and transitions also play an important role. A discussion of these parameters is presented below.

##### 1. Flow Velocity

The maximum normal depth velocity for the 100-year flood peak will not exceed 7.0 feet per second for grass lined channels (see Section 7.2.2). The Froude number (turbulence factor) will be less than 0.8 for grass lined channels. Grass lined channels having a Froude number greater than 0.8 are not permitted. The minimum velocity, wherever possible, will be greater than 2.0 feet per second for the minor storm runoff.

## 2. Longitudinal Channel Slopes

Grass lined channel slopes are dictated by velocity and Froude number requirements. Where the natural topography is steeper than desirable, drop structures will be utilized to maintain design velocities and Froude numbers.

## 3. Freeboard

A minimum freeboard of 1 foot will be included in the design for the 100-year flow. For swales (i.e., small drainageways with a 100-year flow less than 20 cfs), the minimum freeboard requirements are 6 inches.

## 4. Curvature (Horizontal)

The centerline curvature will have a minimum radius twice the top width of the design flow but not less than 50 feet. The minimum radius for channels with a 100-year runoff of 20 cfs or less will be 25 feet.

## 5. Roughness Coefficient

The variation of Manning's "n" with the retardance (curve "C") and the product of mean velocity and hydraulic radius, as presented in Figure 701, will be used in the computation of capacity and velocity.

## 6. Cross Sections

The channel shape may be almost any type suitable to the location and to the environmental conditions. The section may also be simple V-Section for swales (i.e., Q100 less than 20 cfs). The limitations on the cross section are as follows:

### a. Trickle Channel

The base flow (except for swales) will be carried in a trickle channel for non-sandy soils. The minimum capacity will be from 1.0 percent to 3.0 percent of the 100-year flow but not less than 1 cfs. The trickle channel can be constructed of concrete, rock, cobbles or other suitable materials. For sandy soils, a main channel is required in accordance with Section 7.4.2.6(b). Factors to be considered when establishing the need for trickle channels are: drainage slope, soil type and upstream impervious area. For 100-year runoff peaks of 20 cfs or less, trickle channel requirements will be evaluated for each case. Trickle channels help preserve swales crossing residential property.

### b. Easement/ROW Width

The minimum easement/ROW width will include freeboard and should include a maintenance access.

### c. Flow Depth

The maximum design depth of flow (outside the trickle channel area and main channel area for sandy soils) for the 100-year flood peak will be limited to 5 feet in grass lined channels.

### d. Side Slopes

Main channel side slopes will be 4 (horizontal) to 1 (vertical) or flatter. Side slopes for channels with 100-year runoff peaks of 20 cfs or less will be 3 (horizontal) to 1 (vertical) or flatter.

## 7. Grass Lining

The grass lining for channels will be in accordance with the *Manual*.

## 8. Erosion Control

The requirements for erosion control for grass lined channels will be as defined in the *Manual*. The design of conduit outlet structures will be in accordance with the *Manual*.

## 9. Hydraulic Information

Calculations of the capacity, velocity and Froude numbers will be submitted with the construction drawings.

## 10. Design Example

Grass-lined channel for a watershed area under 130 acres in area.

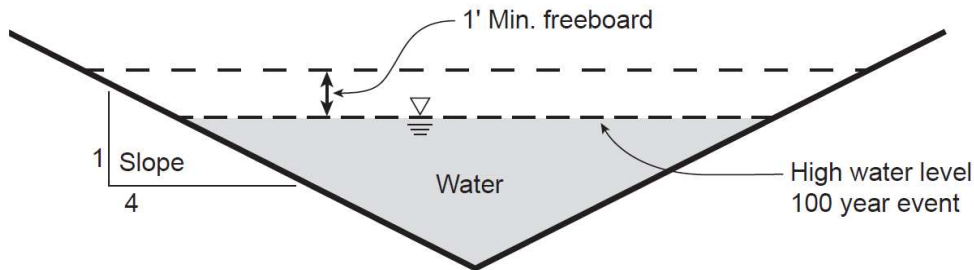
100-year flow = 30 cfs

Slope = 2%

Side Slopes = 4:1

Find the minimum easement width and the required open channel cross-section.

### Channel Cross Section



Step 1: (Determine Manning's  $n$  for both the (C) and (V) curves)

To determine the Manning's  $n$ , Figure 701 will be used. To find the  $V \cdot R$ -value, an estimated value will have to be used to start the process. We will estimate that  $V \cdot R$  is about 2, which would give us a Manning's  $n$  of .05. If this estimated number is not between the (V) and (C) curves, the calculations will need to be run with the Manning's  $n$  that is computed from the graph. Using the Manning's equation  $Q = 1.49/n (AR^{2/3}S^{1/2})$ , the following information is obtained:

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Normal Depth = 1.49'

Velocity (V) = 3.38 feet/sec

Hydraulic Radius (R) = .722

$V \cdot R = 2.44$

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Manning's  $n$  (V) = .043

Manning's  $n$  (C) = .051

(From Figure 701)

Our estimate for the Manning's  $n$  was .050, which is in-between the actual (V) and (C) values; therefore, no further iterations are necessary.

Step 2: (Check limiting velocity and Froude Number with the Manning's  $n$  value from the (V) curve).

Using a Manning's  $n$  of .043, the following information is calculated from the Manning's equation:

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Normal depth = 1.41'



Velocity = 3.79 ft/sec (under 5 ft/sec OK)

Hydraulic Radius (R) = .722

Flow cross-sectional area (A) = 7.92 ft<sup>2</sup>

Top Width (T) = 11.26'

Hydraulic Depth (D) = A/T = .7033'

Calculate the Froude Number from the equation  $Fr = V/(G \cdot D)^{.5}$

V = average velocity (ft/sec)

G = acceleration of gravity = 32.2 ft/sec<sup>2</sup>

D = Hydraulic Depth = A/T

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The Froude number is calculated to be .796, which is under the maximum of .8.

Step 3: Use the channel capacity design curve (C curve to determine how wide the drainage easement has to be).

Using the Manning's equation with a Manning's n of .051 from the previously calculated C curve, the following were calculated:

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Depth = 1.50'

Depth with required freeboard = 2.5'

Required width of channel = 20'

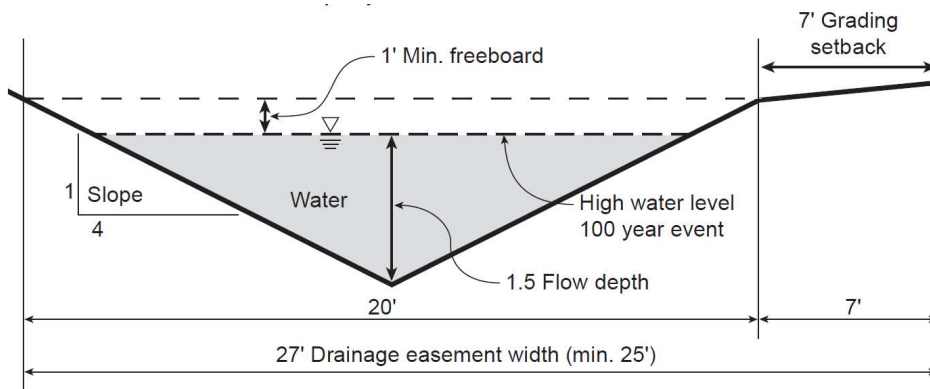
Minimum easement width for maintenance = must accommodate Q100 plus one foot of freeboard and required access

Setback from property line as defined in the ZR

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The cross-section shown below would be acceptable:

Channel Cross Section Near Property Line



### 7.5.3 Concrete Lined Channels

The criteria for the design and construction of concrete lined channels is presented below:

## 1. Hydraulics

### a. Freeboard

Adequate channel freeboard above the designed water surface will be provided and will not be less than that determined by the following:

---

$$HFB = 2.0 + 0.025 V (d)^{1/3}$$

where

HFB = freeboard height (feet)

V = velocity (fps)

d = depth of flow (feet)

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Freeboard will be in addition to superelevation, standing waves and/or other water surface disturbances. These special situations are to be addressed in a Design Report to be submitted with the construction drawings and specifications (Section 2.7).

Concrete side slopes will be extended to provide freeboard.

### b. Superelevation

Superelevation of the water surface will be determined at all horizontal curves, and design of the channel section adjusted accordingly.

### c. Velocities

Flow velocities will not exceed 18 fps during the 100-year flood.

## 2. Concrete Materials

A Design Report will be prepared as stated in Section 7.2.5. The minimum concrete material specifications are as follows:

- a. Cement type: sulphate resistant.
- b. All concrete will meet CDOT Class B specifications.
- c. Maximum water-cement ratio: 0.50 (six gals. per sack).
- d. Admixtures: All proposed admixtures will be discussed in the Design Report.

## 3. Concrete Lining Section

- a. All concrete lining will have a sufficient thickness to withstand the structural and hydraulic loads.
- b. The side slopes will be a maximum of 2 (vertical) to 1 (horizontal), or a structurally reinforced wall if steeper.

## 4. Concrete Joints

- a. Expansion/contraction joints will be installed where new concrete lining is connected to a rigid structure or to existing concrete lining which is not continuously reinforced.
- b. Longitudinal joints, where required, will be constructed on the sidewalls at least one foot vertically above channel invert.
- c. All joints will be designed to prevent differential movement.

d. Construction joints are required for all cold joints and where the lining thickness changes.

#### 5. Concrete Finish

The surface of the concrete lining will be provided with a wood float finish. Excessive working or wetting of the finish will be avoided.

#### 6. Concrete Curing

All concrete will be cured by the application of a liquid membrane-forming curing compound (white pigmented) upon completion of the concrete finish.

#### 7. Reinforcement steel (where used)

- a. Steel reinforcement will be minimum grade-40 deformed bars. Wire mesh will not be used.
- b. Ratio of longitudinal steel area to concrete cross sectional area will be greater than 0.005.
- c. Ratio of transverse steel area to concrete cross sectional area will be greater than 0.0025.
- d. Additional steel as needed if a retaining wall structure is used.

#### 8. Earthwork

The following areas will be compacted to a least 95 percent of maximum density as determined by ASTM D-698 (Standard Effort):

- a. The 12 inches of subgrade immediately beneath concrete lining (both channel bottom and side slopes).
- b. Top 12 inches of maintenance road.
- c. Top 12 inches of earth surface within 10 feet of concrete channel lip.
- d. All fill material.

#### 9. Bedding

Provide six inches of granular bedding equivalent in gradation to 3/4" concrete aggregate (*Standard Specifications for Road & Bridge Construction*, CDOT, Current printing, Section 703.02, No. 67) under channel bottom and side slopes.

#### 10. Underdrain

Longitudinal underdrains will be provided on 10-foot centers and will daylight at the check drops. A check valve or flap gate will be provided at the outlet to prevent backflow into the drain. Weep holes will be provided in vertical wall sections of the channel.

#### 11. Safety Requirements

- a. A fence will be installed, as approved by Planning & Zoning, to prevent access wherever the 100-year channel flow depths exceed three feet.

#### 7.5.4 Riprap Lined Channels

The criteria for the design and construction of riprap lined channels will be in accordance with the *Manual*.

Riprap lined channels will be designed for a turbulence factor (Froude number) less than 0.8 for the 100-year flood peaks. The riprap will be designed and constructed in accordance with Section 12.2, "Conduit Outlet Structures" of these *CRITERIA*. Freeboard requirements will be in accordance with the standards for grass lined channels defined in Section 7.4.2.3 of these *CRITERIA*.

### 7.6 Street/Roadside Ditches

The criteria for the design of street/roadside ditches is similar to the criteria for grass lined channels with modifications for the special purpose of minor storm drainage. The criteria is as follows (refer to Figure 702):

## 1. Capacity

Street/Roadside ditches will have adequate capacity for the minor storm runoff peaks. Capacity will be as defined in Table 701. Where the storm runoff exceeds the capacity of the ditch, a storm sewer system will be required.

## 2. Flow Velocity

The maximum velocity for the major storm flood peak will not exceed 5 feet per second

## 3. Curvature

The minimum radius of curvature will be 25 feet.

## 4. Roughness Coefficient

Manning's "n" values presented in Figure 701 will be used in the capacity computation for street/roadside ditches.

## 5. Grass Lining

The grass lining will be in accordance with the *Manual*. Alternative seed mixes may be required by Planning and Zoning as recommended by the JCD.

## 6. Cross Culvert Location

The surface drainage in a street/roadside ditch will not be carried in excess of 500 feet before being discharged into a natural drainageway. Grade changes of greater than 2% will require a cross culvert. The final location of culverts may be slightly altered by existing field conditions encountered during installation. Culverts will be installed at the slope of the natural terrain.

## 7. Major Drainage Capacity

The capacity of street/roadside ditches for major drainage flow is restricted by the maximum flow depth allowed at the street crown (Section 3.4.4). However, the flow spread should not extend outside the street ROW.

# 7.7 Channel Rundowns

A channel rundown is used to convey storm runoff from the bank of a channel to the invert of an open channel or drainageway. The purpose of the structure is to minimize channel bank erosion from concentrated overland flow. The design criteria for channel rundowns is as follows:

### 7.7.1 Cross-Sections

Typical cross-sections for channel rundowns are presented in Figure 704.

### 7.7.2 Design Flow

The channel rundown will be designed to carry a minimum of the minor storm runoff or 1 cfs, whichever is greater.

### 7.7.3 Flow Depth

The maximum depth at the design flow will be 12 inches. Due to the typical profile of a channel rundown beginning with a flat slope and then dropping steeply into the channel, the design depth of flow will be the computed critical depth for the design flow.

### 7.7.4 Outlet Configuration

The channel rundown outlet will enter the drainageway at the trickle channel flowline. Erosion protection of the opposite channel bank will be provided by a 24-inch layer of grouted Type-L riprap. The width of this riprap erosion protection will be at least three times the channel rundown width or pipe diameter. Riprap protection will extend up the opposite bank to the minor storm flow depth in the drainageway or 2 feet, whichever is greater.

Table 701

## Street/Roadside Ditch Capacities

Ditch Slope	Ditch Type 1		Ditch Type 2		Ditch Type 3 (Private Road Only)	
	Capacity CFS	Velocity FPS	Capacity CFS	Velocity FPS	Capacity CFS	Velocity FPS
2%	26	4.2	36	4.16	1.9	0.95
2.50%	31	5	42	4.89	2.5	1.25
3.00%	32	5	40	5	3.2	1.6
3.50%	30	5	37	5	4	2
4.00%	28	5	33	5	4.8	2.4
5.00%	21	5	26	5	6	3.1
6.00%	17	5	22	5	8	4
7.00%	15	5	19	5	8	5
8.00%	13	5	16	5	7	5
10.00%	11	5	13	5	6	5
12.00%	9	5	11	5	5	5

... Permitted on all mountain roads and local and collector streets

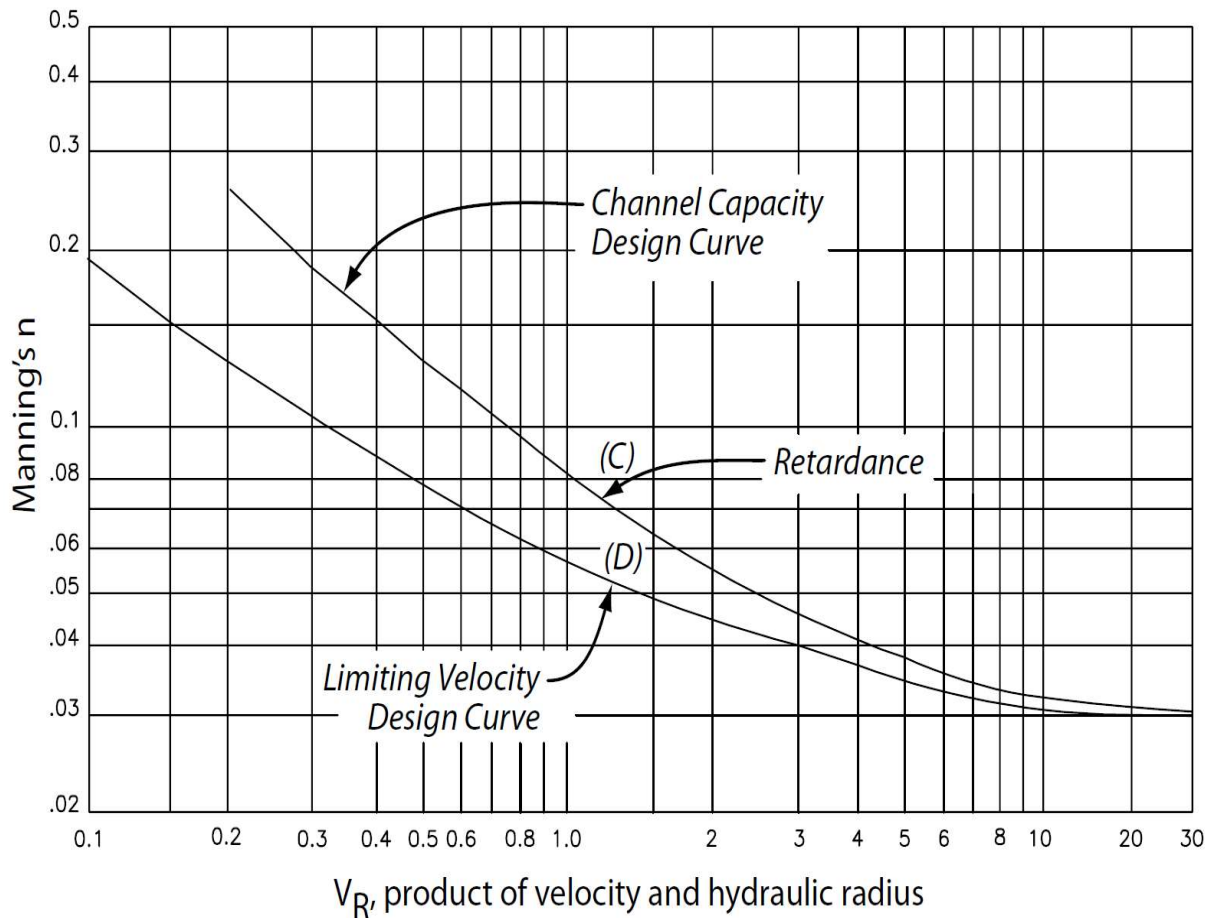
... Only permitted on private and public roads in the mountains

... Only permitted on private roads in the mountains

... Only permitted on private roads where the natural terrain bears between south 60 east and south 45 west

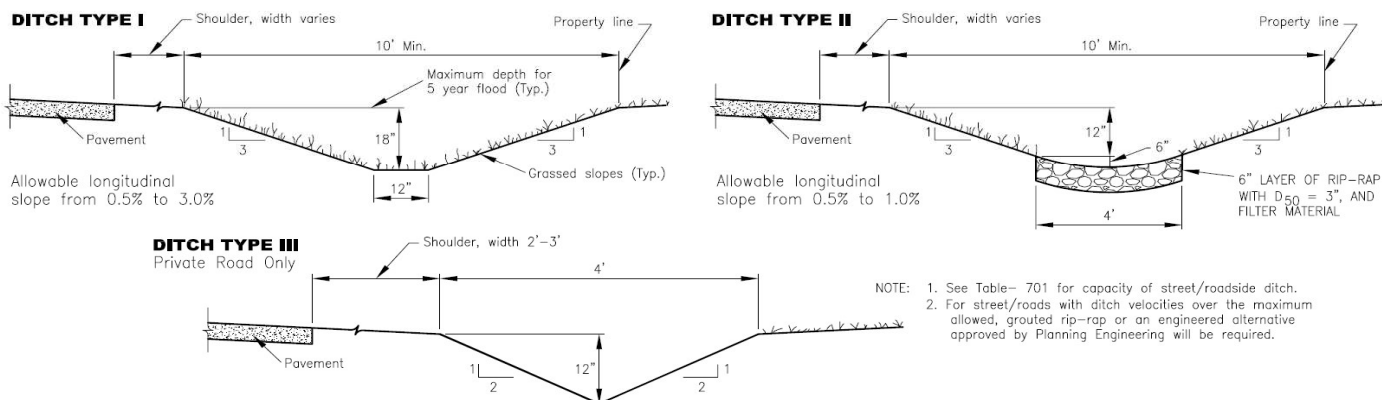
Figure 701

## Roughness Coefficients for Grassed Channels

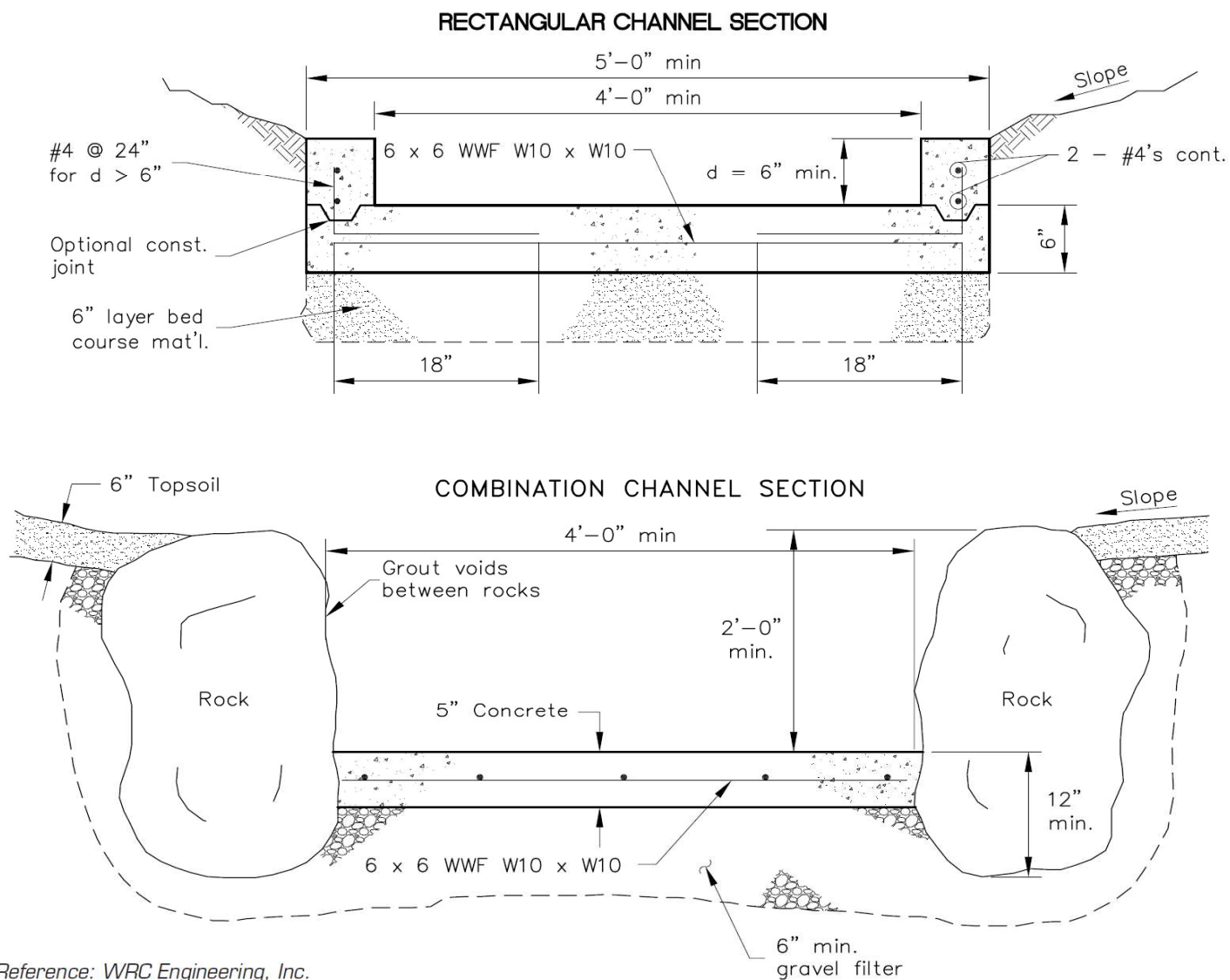


Reference: Handbook of Channel Design for Soil and Water Conservation, U.S. Department of Agriculture, Soils Conservation Service, No. SCS-TP-61 March, 1947, Rev. June, 1954.

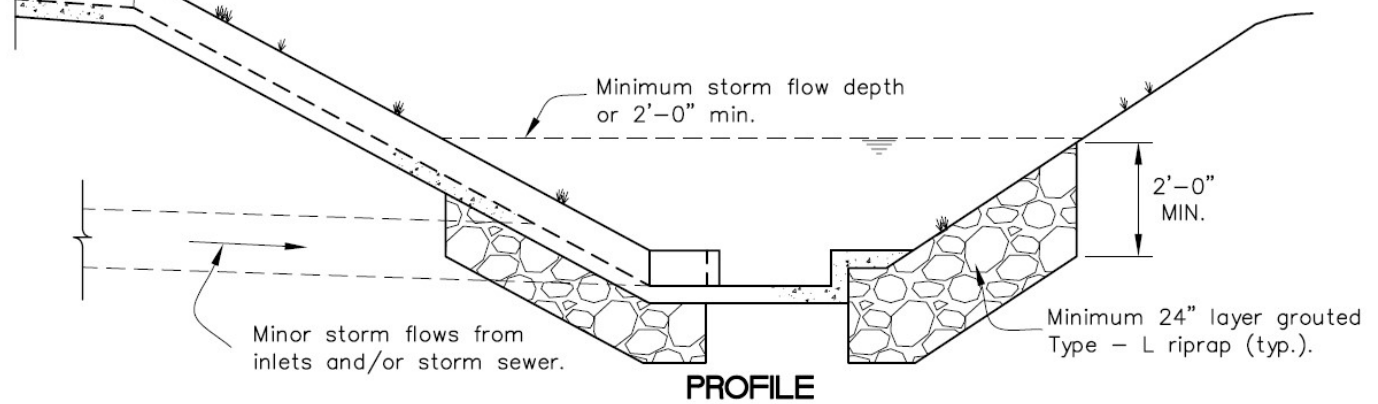
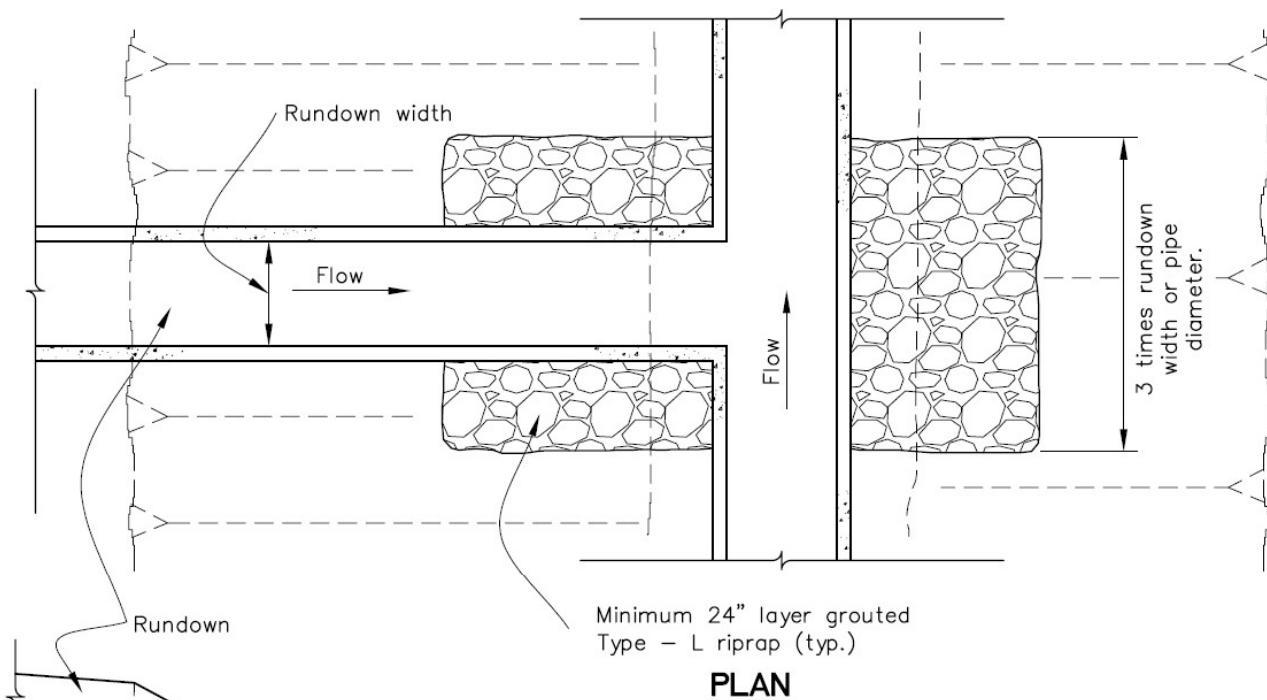
**Figure 702**  
**Street / Roadside Ditch Sections**



**Figure 703**  
**Trickle Channel Details**



Reference: WRC Engineering, Inc.



# Chapter 8 - Storm Sewers

## 8.1 Introduction

Storm sewers are a part of the Minor Drainage System, and are required when the other parts of the minor system, primarily curb, gutter and street/roadside ditches no longer have capacity for additional runoff.

Except as modified herein, the design of storm sewers will be in accordance with the "Streets, Inlets and Storm Drain" Chapter of the *Manual*. The user is referred to the *Manual* and other references cited for additional discussion and basic design concepts.

Stormwater Quality Considerations: The use of grass swales to promote infiltration is highly encouraged; since replacing storm sewer with grass swales is not always reasonable, storm sewer is still an integral part in many drainage system designs.

A number of Excel-based workbook tools are offered by UDFCD on their website ([www.UDFCD.org](http://www.UDFCD.org)).

## 8.2 Construction Materials

RCP, in accordance with ASTM C76-03, C506-02 or C507-02, and HP Pipe, in accordance with manufacturer specifications, are the only materials acceptable for use in storm sewer construction within County ROW. The minimum class of pipe will be Class II; however, the actual depth of cover, live load and field conditions may require structurally stronger pipe. CSP and HDPE pipe, in accordance with manufacturer's specifications, are only permitted in privately owned and maintained installations.

## 8.3 Hydraulic Design

Storm sewers will be designed to convey the minor storm flood peaks without surcharging the sewer. The design of the storm sewer must be checked to show that the hydraulic grade line is below the ground elevation during the major storm. To ensure that this objective is achieved the hydraulic and energy grade line calculated by accounting for pipe friction losses and pipe form losses. Total hydraulic losses will include friction, expansion, contraction, bend and junction losses. The methods for estimating these losses are presented in the following sections. The final energy grade line must be at or below the proposed ground surface if the major storm exceeds the allowable street capacity.

### 8.3.1 Pipe Friction Losses

The Manning's "n" values to be used in the calculation of storm sewer capacity and velocity are presented below:

Pipe Roughness Coefficients

Manning's n-value		
Sewer Type	Capacity Calculation	Velocity Calculation
RCP	0.015	0.011
CSP	0.026	0.021
HDPE/HP	0.012	0.010

### 8.3.2 Pipe Form Losses

Generally, between the inlet and outlet structures of the storm sewer system, the flow encounters a variety of configurations in the flow passageway such as changes in pipe size, branches, bends, junctions, expansions and contractions. These shape variations impose losses in addition to those resulting from pipe friction. Form losses are the result of fully developed turbulence and can be expressed as follows:

---

$$HL = K \frac{V^2}{2g}$$

where

HL = head loss (feet)

K = loss coefficient

V = average flow velocity (feet per second)

g = gravitational acceleration (32.2 ft/sec<sup>2</sup>)

---



The following is a discussion of a few of the common types of form losses encountered in sewer system design.

## 1. Bend Losses

The head losses for bends, in excess of that caused by an equivalent length of straight pipe, may be expressed by the relation

$$HL = K_b \frac{V^2}{2g}$$

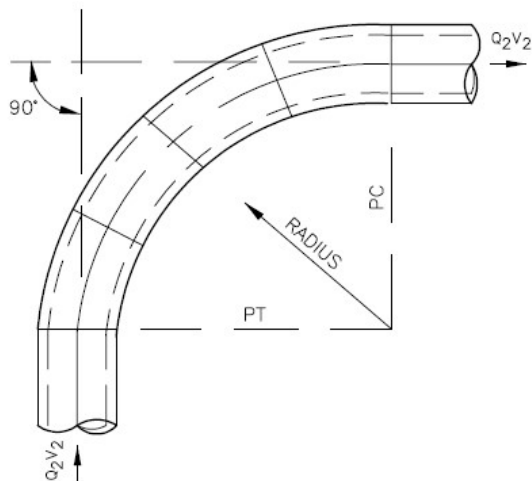
in which  $K_b$  is the bend coefficient. The bend coefficient has been found to be a function of, (a) the ratio of the radius of curvature of the bend to the width of the conduit, (b) deflection angle of the conduit, (c) geometry of the cross section of flow, and (d) the Reynolds number and relative roughness. A table showing the recommended bend loss coefficient is presented below.

### Energy Loss Coefficients - Bends

Case I-Conduit on 90 degree curves	
$\theta$	$K_b$
90	0.25
60	0.20
45	0.18
30	0.14

Note 1: Head loss applied at P.C. for length

Note 2: Applies only to pipe 48" or greater



## 2. Junction and Manhole Losses

The loss coefficient  $K_b$  for bends at manholes is presented in Table 802. A junction occurs where one or more branch sewers enter a main sewer, usually at manholes. The hydraulic design of a junction is in effect the design of two or more transitions, one for each flow path. Allowances should be made for head loss due to the impact and junctions. The head loss for a straight through manhole or at an inlet entering the sewer is calculated from the following equation. The head loss at a junction can be calculated from:

$$HL = \frac{V_2^2}{2g} - K_j \frac{V_1^2}{2g}$$

where  $V_2$  is the outfall flow velocity and  $V_1$  is the inlet velocity. The loss coefficient,  $K_j$ , for various junctions is presented in Table 803.

### 8.3.3 Storm Sewer Outlets

When the storm sewer system discharges into the Major Drainageway System (usually an open channel), additional losses occur at the outlet in the form of expansion losses. For a headwall and no wingwalls, the loss coefficient  $K_e = 1.0$  for a flared-end section the loss coefficient is approximately 0.5 or less.

### 8.3.4 Partially Full Pipe Flow

When a storm sewer is not flowing full, the sewer acts like an open channel, and the hydraulic properties can be calculated using open channel techniques (refer to Chapter 7). For convenience, charts for various pipe shapes have been developed for calculating the hydraulic properties (Figures 801, 802, 803). The data presented assumes that the friction coefficient, Manning's "n" value, does not vary throughout the depth.

## 8.4 Vertical Alignment

The sewer grade will be such that a minimum cover is maintained to withstand AASHTO HS-25 loading on the pipe. The minimum cover depends upon the pipe size, type and class and soil bedding condition, but will be not less than 1 foot at any point along the pipe.

The minimum clearance between storm sewer and water main, either above or below, will be 12 inches. Concrete encasement of the water line will be required for clearance of 12 inches or less.

The minimum clearance between storm sewer and sanitary sewer, either above or below, will also be 12 inches. In addition, when a sanitary sewer main lies above a storm sewer, or within 18 inches below, the sanitary sewer will have an impervious encasement or be constructed of structural sewer pipe for a minimum of 10 feet on each side of where the storm sewer crosses.

## 8.5 Horizontal Alignment

Storm sewer alignment may be curvilinear for pipe with diameters of 48 inches or greater but only when approved in writing by Planning & Zoning. The applicant must demonstrate the need for a curvilinear alignment. The limitations on the radius for pulled-joint pipe are dependent on the pipe length and diameter, and amount of opening permitted in the joint. The maximum allowable joint pull will be  $\frac{3}{4}$  inches. The minimum parameters for radius type pipe are shown in Table 801. The radius requirements for pipe bends are dependent upon the manufacturer's specifications.

## 8.6 Pipe Size

The minimum allowable pipe size for storm sewers is dependent upon a practical diameter from the maintenance standpoint. The length of the sewer also affects the maintenance and, therefore, the minimum diameter. Table 801 presents the minimum pipe size for storm sewers.

## 8.7 Manholes

Manholes or maintenance access ports will be required whenever there is a change in size, direction, elevation, grade or where there is a junction of two or more sewers. A manhole may be required at the beginning and/or at the end of the curved section of storm sewer. The maximum spacing between manholes for various pipe sizes will be in accordance with Table 801. The required manhole size will be as follows:

### Manhole Size

Sewer Diameter	Manhole Diameter
15" to 18"	4'
21" to 42"	5'
48" to 54"	6'
60" and larger	CDOT M-604-20, Page 2 of 3

Larger manhole diameters or a junction structure may be required when sewer alignments are not straight through or more than one sewer line goes through the manhole.

## 8.8 Checklist

To aid the designer and reviewer, the following checklist has been prepared:

1. Calculate energy grade line (EGL) and hydraulic grade line (HGL) for all sewers and show on the construction drawings or on a separate copy of the plans submitted with the construction drawings.
2. Account for all losses in the EGL calculation including outlet, form, bend, manhole and junction losses. Refer to Water Surface and Energy Grade Line Calculations for a Storm Sewer - Worksheet 801.
3. Provide adequate erosion protection at the outlet of all sewers into open channels.
4. Check for minimum pipe cover.
5. Check for adequate clearance with other utilities.

Table 801

### Storm Sewer Alignment and Size Criteria

#### Minimum Pipe Diameter

Type	Minimum Pipe Diameter	Minimum Cross-sectional area
Main trunk	18 inch	1.77 sq. feet
Lateral from the inlet	15 inch	1.23 sq. feet

Note: Minimum size of the lateral will also be based upon a water surface inside the inlet at a minimum distance of 1 foot below the grate or throat.

Diameter of Pipe	Maximum Allowable Distance between Manholes and/or Cleanouts
15" to 36"	400 feet
42" and larger	500 feet

#### Minimum Radius for Radius Pipe

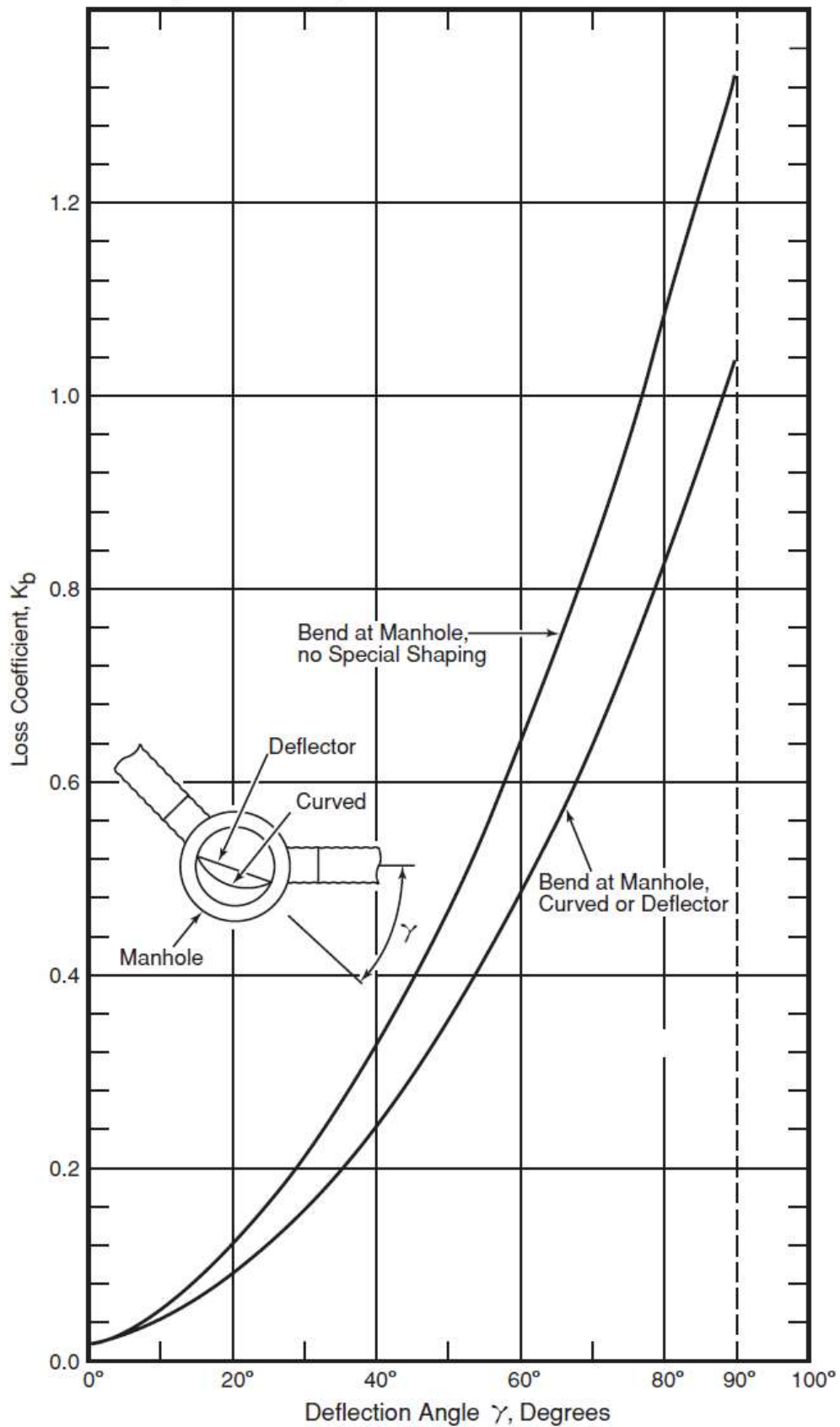
Diameter of Pipe	Minimum Radius of Curvature
48" to 54"	28.5 feet
57" to 72"	32.0 feet
78" to 108"	38.0 feet

Reference: Urban Storm Drainage Criteria Manual, *DRCOG*, 1969

Table 802

## Energy Loss Coefficients - Bends at Manholes

Reference: Modern Sewer Design, AISI, Washington D.C., 1980



Note: Head loss applied at outlet of manhole.

Table 803

**Manhole and Junction Losses**

Reference: APWA Special Report No. 49, 1981

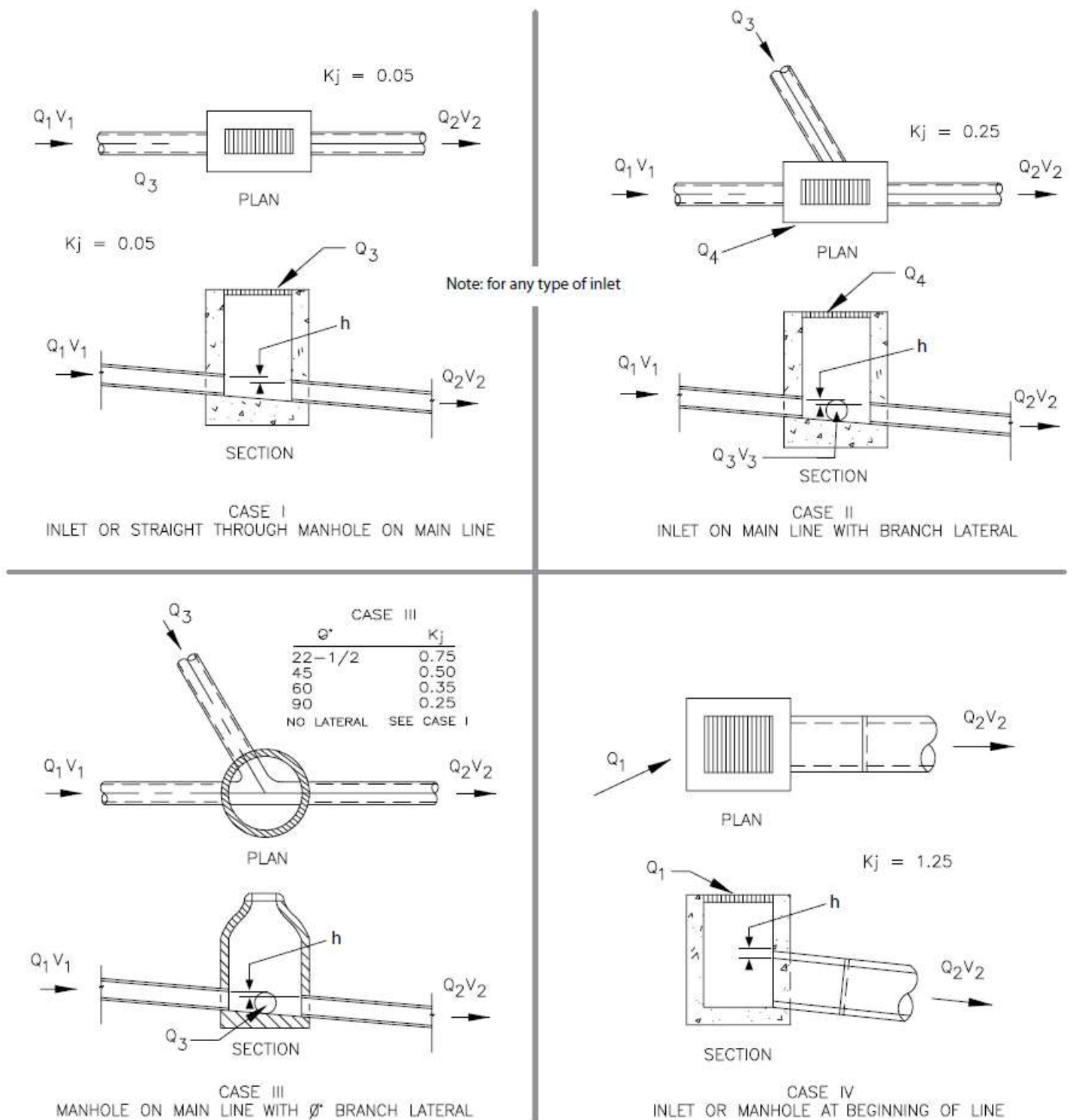


Figure - 801

## Hydraulic Properties of Circular Pipe

Reference: Concrete Pipe Design Manual ACPA, 1970

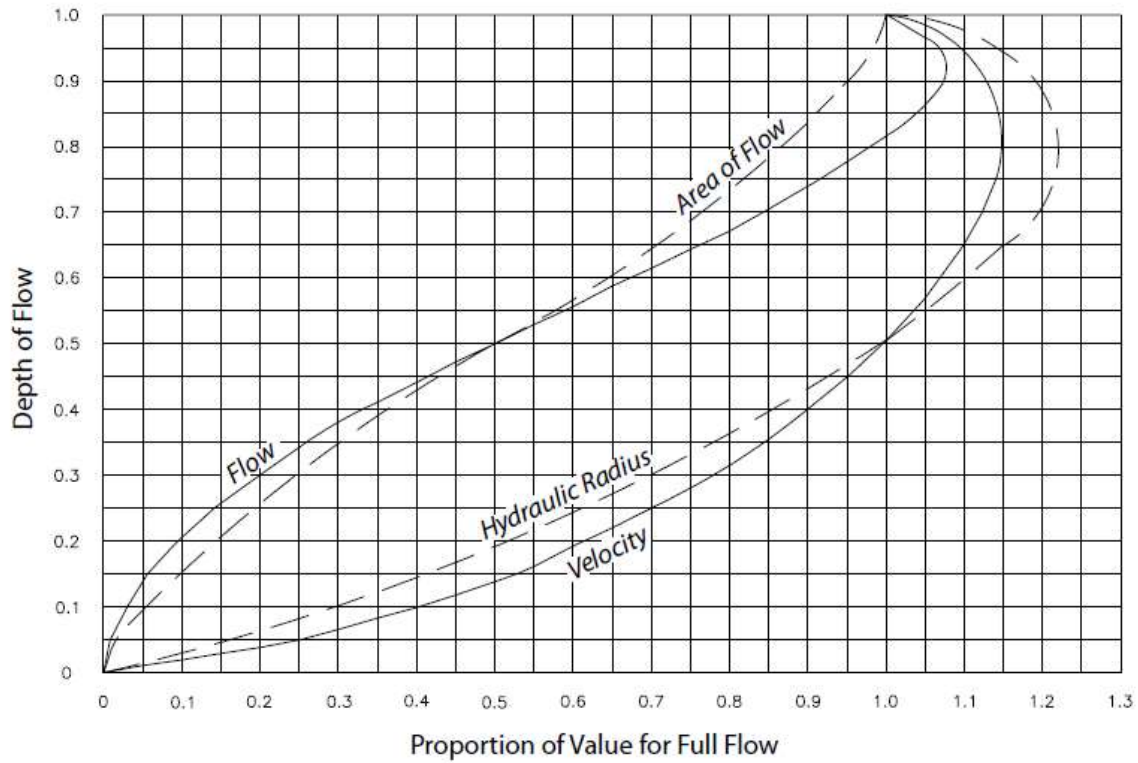


Figure 802

## Hydraulic Properties Horizontal Elliptical Pipe

Reference: Concrete Pipe Design Manual ACPA, 1970

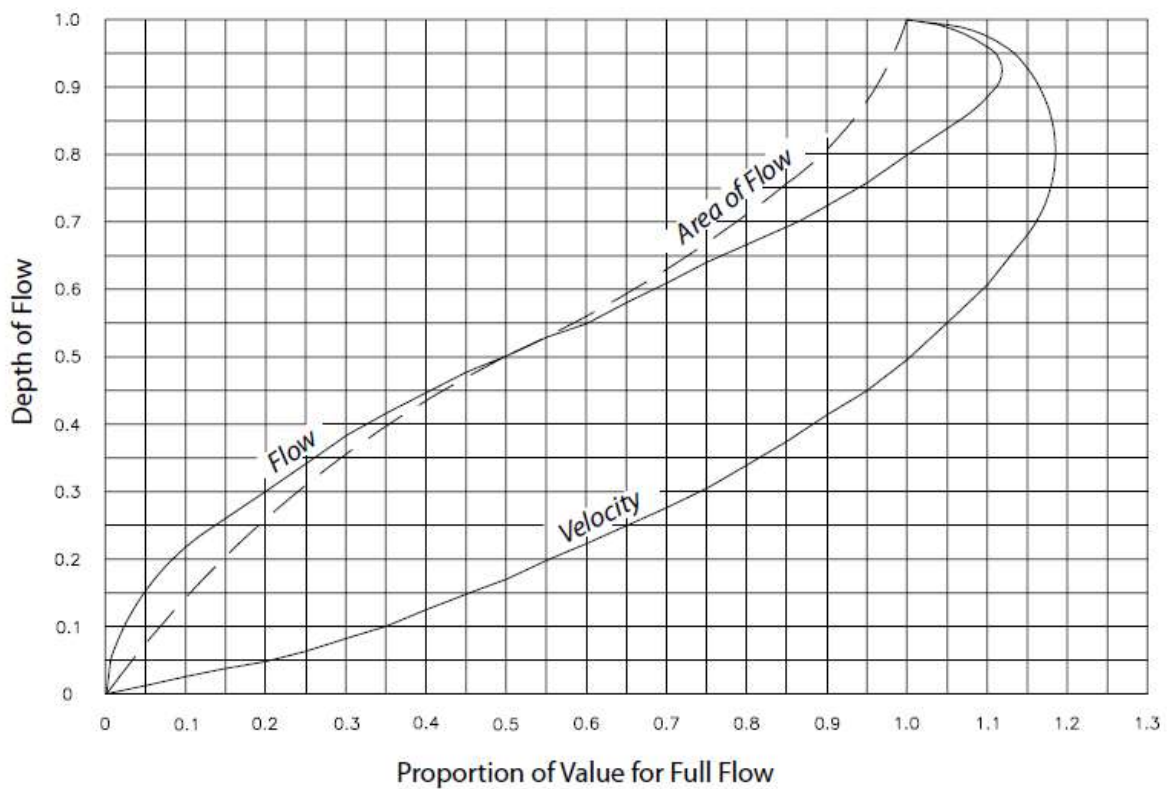


Figure 803

Reference: Concrete Pipe Design Manual ACPA, 1970

The graph illustrates the relationship between the proportion of a value for full flow and the depth of flow. The x-axis represents the 'Proportion of Value for Full Flow' (ranging from 0 to 1.3), and the y-axis represents the 'Depth of Flow' (ranging from 0 to 1.0). Three curves are plotted: 'Flow' (dashed line), 'Velocity' (solid line), and 'Area of Flow' (solid line). The 'Flow' curve is the steepest, followed by 'Area of Flow', and then 'Velocity'.

Proportion of Value for Full Flow	Flow (Dashed)	Area of Flow (Solid)	Velocity (Solid)
0.0	0.00	0.00	0.00
0.1	0.18	0.12	0.05
0.2	0.32	0.22	0.10
0.3	0.42	0.30	0.15
0.4	0.48	0.36	0.20
0.5	0.52	0.41	0.25
0.6	0.55	0.45	0.30
0.7	0.57	0.48	0.35
0.8	0.58	0.50	0.40
0.9	0.59	0.51	0.45
1.0	0.60	0.52	0.50

## Water Surface and Energy Grade Line Calculations for a Storm Sewer

Manning's n \_\_\_\_\_

$\mathbb{C} = [2g(n^2)]$   


---

 2.21

$S_f = [\mathbb{C}H_V]$   


---

 R<sup>1.33</sup>



# Chapter 9 - Storm Sewer Inlets

## 9.1

There are four types of inlets: curb opening, grated, combination and slotted inlets. Inlets are further classified as being on a continuous grade or in a sump. The term "continuous grade" refers to an inlet so located that the grade of the street has a continuous slope past the inlet and, therefore, ponding does not occur at the inlet. The sump condition exists whenever water is restricted or ponds because the inlet is located at a low point. A sump condition can occur at a change in grade of the street from positive to negative, or at an intersection due to the crown slope of a cross street.

Presented in this chapter are the criteria and methodology for design and evaluation of storm sewer inlets in the County. Except as modified herein, all storm sewer inlet criteria will be in accordance with the *Manual*. A number of Excel-based workbook tools are offered by UDFCD on their website ([www.UDFCD.org](http://www.UDFCD.org)).

## 9.2 Standard Inlets

The standard inlets permitted for use in the County are:

Table 901

### Standard Inlets

Inlet Type	Standard Detail	Permitted Use
Curb Opening Inlet Type R	Standard M-604-12 SD-1 (In <i>Criteria</i> )	All street types
Grated Inlet Type C	CDOT M-604-10	All streets/roads with a roadside or median ditch
Grated Inlet Type 13	CDOT M-604-13	Private drives, alleys or parking areas
Combination Inlet Type 13	SD-2 (In <i>Criteria</i> )	All street types
Slotted Inlet	Provide Manufacturer's Specifications	Private drives, alleys or parking areas
Median Inlet	SD-3 (In <i>Criteria</i> )	In medians

## 9.3 Inlet Hydraulics

The procedures and basic data used to define the capacities of the standard inlets under various flow conditions were obtained from the *Manual*, "Streets/Inlets/Storm Sewers". The procedure consists of defining the amount and depth of flow in the gutter, selecting the appropriate inlet type and determining the theoretical flow interception by the inlet. To account for effects which decrease the capacity of the various types of inlets, such as debris plugging, pavement overlaying and variations in design assumptions, the theoretical capacity calculated for the inlets is reduced to the allowed capacity by applying a clogging factor.

## 9.4 Inlet Spacing

The optimum spacing of storm inlets is dependent upon several factors including traffic requirements, contributing land use, street slope and distance to the nearest outfall system. The suggested sizing and spacing of the inlets is based upon the interception rate of 70% to 80%. This spacing has been found to be more efficient than a spacing using 100% interception rate. Using the suggested spacing only, the most downstream inlet in a development would be designed to intercept 100% of the flow. Also, considerable improvements in overall inlet system efficiency can be achieved if the inlets are located in the sumps created by street intersections.

## 9.5 Inlet Capacity

The hydraulic capacity of an inlet is dependent on the type of inlet and the location (on a continuous grade or in a sump).

For the continuous grade condition, the capacity of the inlet is dependent upon many factors including gutter slope, depth of flow in the gutter, height and length of curb opening, street cross slope and the amount of depression at the inlet. In addition, all of the gutter flow will not be intercepted and some flow will continue past the inlet area (inlet carryover). The amount of carryover must be included in the drainage facility evaluation as well as in the design of the inlet (see Figure 901 for example).

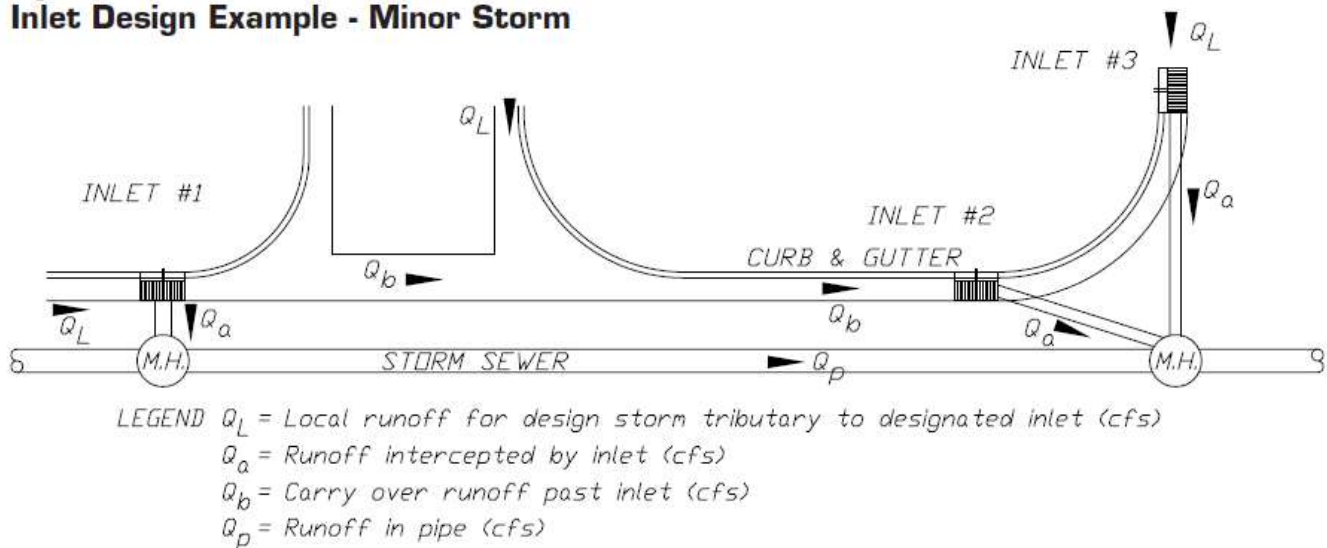
The capacity of the inlet in a sump condition is dependent on the inlet geometry and the depth of ponding above the inlet.

1. Use the Urban Drainage workbook tool (most current versions) to calculate the selected inlet capacity.
2. Calculate design peak flow, including local peak flow and carryover flow, if applicable.
3. Determine street/gutter geometry:
  - (a) Allowable depth to gutter flowline, H



- (b) Gutter width,  $W$
- (c) Gutter depression,  $a$
- (d) Street transverse slope,  $s_x$
- (e) Street longitudinal slope,  $s_o$
- (f) Manning's roughness,  $n$  (0.016)
- (g) Maximum water spread,  $T$
- 4. Determine inlet geometry:
  - (a) Inlet type
  - (b) Length of a single unit,  $L_o$  (5.00' for Type R, 3.27' for Type 13, 3.27' for combination)
  - (c) Width of a grate,  $W_o$  (n/a for Type R, 1.88' for Type 13, 1.88' for combination)
  - (d) Height of curb opening,  $H$  (6" for Type R, n/a for Type 13, 6" for combination)
  - (e) Local depression,  $a_{local}$  (3" for Type R, 0" Type 13, 2" for combination)
  - (f) Angle of throat,  $\theta$  ( $63.4^\circ$  for Type R, n/a for Type 13,  $90^\circ$  for combination)
  - (g) Side width for depression pan,  $W_p$  (3.00' for Type R, n/a for Type 13, 2.00' for combination)
  - (h) Number of units,  $N_o$
- 5. Determine inlet design coefficients, as applicable
  - (a) Clogging factor for a grate,  $C_{o-G}$  (0.5)
  - (b) Clogging factor for a curb opening,  $C_{o-C}$  (0.1)
  - (c) Clogging factor for a slotted inlet,  $C_o$  (0.5)
  - (d) Area opening ratio for a grate,  $A$  (0.6)
  - (e) Grate orifice coefficient,  $C_{d-G}$  (0.67)
  - (f) Grate weir coefficient,  $C_{w-G}$  (3.00)
  - (g) Curb opening orifice coefficient,  $C_{d-C}$  (0.67)
  - (h) Curb opening weir coefficient,  $C_{w-C}$  (2.30)
  - (i) Slotted inlet orifice coefficient,  $C_{d-S}$  (0.80)
  - (j) Slotted inlet weir coefficient,  $C_{w-S}$  (2.48)

**Figure 901**  
**Inlet Design Example - Minor Storm**



# Chapter 10 – Streets/Roads

## 10.1 Introduction

The criteria presented in this chapter will be used in the evaluation of the allowable drainage encroachment within streets/roads. The review of all submittals will be based on the criteria herein and the Manual, "Street, Inlets and Storm Drain" chapter. A number of Excel-based workbook tools are offered by UDFCD on their website ([www.UDFCD.org](http://www.UDFCD.org)).

## 10.2 Function of Streets/Roads in the Drainage System

Streets and roads, specifically the curb and gutter or the street/roadside ditches, are part of the Minor Drainage System. When the drainage in the street/road exceeds allowable limits, a storm sewer system (Chapter 9) or an open channel (Chapter 7) is required to convey the excess flows. The streets/roads are also part of the Major Drainage System when they carry floods in excess of the minor storm also subject to certain limitations. However, the primary function of streets/roads is for traffic movement and, therefore, the drainage function is subservient and must not interfere with the traffic function of the street/road.

Design criteria for the collection and moving of runoff water on streets/roads is based on a reasonable frequency and magnitude of traffic interference. That is, depending on the character of the street/road, certain traffic lanes can be fully inundated once during the minor design storm return period. However, during lesser intense storms, runoff will also inundate traffic lanes but to a lesser degree. The primary function of the streets/roads for the Minor Drainage System is therefore to convey the nuisance flows quickly and efficiently to the storm sewer or open channel drainage without interference with traffic movement. For the Major Drainage System, the function of the streets/roads is to provide an emergency passageway for the flood flows with minimal damage.

## 10.3 The Allowable Use of Streets/Roads as a Drainage System

The streets in the County are classified as arterial/parkway, collector and local, according to the average daily traffic (ADT) for which the street is designed. The larger the ADT, the more restrictive the allowable drainage encroachment into the driving lanes. The limits of storm runoff encroachment for each classification is shown in the following tables:

Table 1001

### Allowable Use of Streets/Roads for Minor Storm Runoff

Street/Road Classification	Maximum Allowable Street/Road Encroachment
Major Collector/Arterial/Parkway	No curb overtopping. Flow spread must leave at least two 10-foot lanes free of water, 10 feet each side of the street/road crown/median.
Collector	No curb overtopping. Flow spread must leave at least one 10-foot lane free of water, 5 feet either side of the street/road crown.
Local	No curb overtopping for 6-inch vertical curb. Flow may spread to the back of sidewalk for a combination curb, gutter and sidewalk.

Table 1002

### Allowable Use of Streets/Roads for Major Storm Runoff

Street/Road Classification	Maximum Allowable Street/Road Encroachment
Major Collector/Arterial/Parkway	Flow may spread to the back of sidewalk or to the top of curb if there is no sidewalk. To allow for emergency vehicles, the depth of water will not exceed 6 inches at the street crown or 12 inches at the gutter flowline whichever is more restrictive.
Local/Collector	Flow may spread to the back of sidewalk or to the top of curb if there is no sidewalk. The depth of water at the gutter flowline will not exceed maximum allowable depth or 12 inches.

Table 1003

### Allowable Flow Depths for Standard Street Templates

The allowable flow depths presented in this table are based on the maximum allowable encroachment in Tables 1001 and 1002 and the standard templates. Allowable flow depths must be calculated for any modifications to the standard templates.

Street Classification	Allowable Minor Storm Flow Depth	Allowable Major Storm Flow Depth
Principal Arterial or Parkway (94' Flowline to Flowline with raised median)	6"	9.4"
Principal Arterial or Parkway (94' Flowline to Flowline without raised median)	6"	9.4"
Minor Arterial (70' Flowline to Flowline with raised median)	5.4"	9.4"
Minor Arterial (70' Flowline to Flowline without raised median)	6"	9.4"

Major Collector (49 feet flowline to flowline with raised median)	6"	9.4"
Major Collector (49' feet flowline to flowline without raised median)	6"	9.4"
Collector (with detached sidewalk)	4.7"	8.4"
Collector (with attached sidewalk)	4.7"	7.1"
Local (34' Flowline to Flowline, 6" vertical curb and detached sidewalk)	6"	8.4"
Local (34' Flowline to Flowline, combination curb, gutter, sidewalk)	5"	5"
Local (28' Flowline to Flowline, vertical curb and detached sidewalk)	6"	8.4"
Local (28' Flowline to Flowline, combination curb, gutter, sidewalk)	5"	5"

Table 1004

#### Allowable Cross Street Flow

Street/Road Classification	Minor Drainage System Maximum Depth	Major Drainage System Maximum Depth
Major Collector/Arterial/Parkway	None	None
Collector	None	12" depth at gutter flowline or edge of pavement if no gutter
Local	6" depth in *cross pan or gutter flowline	12" depth at gutter flowline or edge of pavement if no gutter

*\*Cross-pans are prohibited on arterial streets/roads. Cross-pans are allowed on collector and local streets/roads only at locations where traffic stops are intended at intersections and no storm sewer is present.*

Table 1005

#### Allowable Culvert Overtopping

Street/Road Classification	Minor Drainage System Maximum Depth	Major Drainage System Maximum Depth*
Major Collector/Arterial/Parkway	None	None. Minimum clearance between the low chord or culvert crown and the energy grade line is 6 inches for basins less than 2 square miles, 1 foot for basins up to 10 square miles and 2 feet for basins greater than 10 square miles.
Collector/Local/Driveway	None	12" depth at gutter flowline or edge of pavement if no gutter. The maximum headwater depth is 1.5 times the culvert height.
Local Mountains/ Driveway Mountains	None	Overtopping depth for the 100-year storm event is 12" unless approved by Planning and Zoning

*\*The regulations set forth in the ZR, also apply for culvert crossings that are within the Floodplain Overlay District.*

## 10.4 Hydraulic Evaluation

### 10.4.1. Allowable Gutter Capacity

The allowable gutter capacity is calculated using the modified Manning's formula. This equation is the basis of the UD-Inlet spreadsheet.

$$Q = R(0.56)(Z/n)S^{1/2} d^{8/3}$$

Where

Q = discharge in cfs

Z = 1/S<sub>x</sub>, where S<sub>x</sub> is the street transverse slope(ft/ft)

d = depth of water at face of curb (feet)

S<sub>o</sub> = street longitudinal slope(ft/ft)

n = Manning's roughness coefficient

R = reduction factor (*Manual*, Figure ST-2)

A Manning's n-value of 0.016 will be used for the calculations at all street slopes. The allowable gutter capacity is computed by multiplying the theoretical street capacity by the appropriate reduction factor. The purpose of the reduction factor is for public safety.

The allowable gutter capacity will need to be reduced for non-symmetrical street sections. Street capacity calculations will be submitted to the County at critical locations of the non-symmetrical streets.

#### 10.4.2 Street/Road with Roadside Ditches

Some streets/roads are characterized by street/roadside ditches rather than curbs and gutters. The capacity is limited by the depth in the ditch and the maximum flow velocity. Refer to Section 7.6 for the design and capacity of street/roadside ditches.

# Chapter 11 – Culverts

## 11.1 Introduction

A culvert is defined as a conduit for the passage of surface water under a, street/road, driveway, railroad, canal or other embankment (except detention outlets). Culvert design involves both hydraulic and structural design considerations. This chapter sets forth only the hydraulic aspects of culvert design.

Culverts may be constructed with many shapes and materials. The most commonly used shape is circular. Other shapes include elliptical, arch and box. The most common culvert materials are concrete and steel. The material selected for a culvert is dependent upon factors such as durability, strength, roughness, bedding, water-tightness and abrasion and corrosion resistance.

## 11.2 Culvert Hydraulics

The procedures and basic data to be used for the hydraulic evaluation of culverts in the County will be in accordance with the *Manual*, "Culverts," except as modified herein. The reader is also referred to the many texts covering the subject for additional information.

## 11.3 Culvert Design Standards

### 11.3.1 Construction Material and Pipe Size

Within the County ROW, culverts will be constructed from corrugated steel or concrete. Other materials for construction outside of County ROW will be subject to approval by Planning and Zoning.

The minimum pipe size for culverts within a public ROW will be 18 inches diameter round culvert or will have a minimum cross-sectional area of 1.6 ft<sup>2</sup> for arch shapes. Driveway culverts will be sized to pass the minor storm ditch flow capacity without overtopping the driveway. The minimum size culvert will be an 18" x 11" CSPA (15" equivalent round pipe) with flared end sections. Larger sizes may be required by Planning and Zoning as determined by the required culvert capacity calculations. Culverts crossing a drainageway will be sized to pass a 10-year storm without street overtopping. Using future developed conditions for the 100-year runoff, the allowable street overtopping will be determined based on Table 1005.

### 11.3.2 Inlet and Outlet Configuration

Within the County, all culverts for drainageways are to be designed with headwalls or with flared-end sections at the inlet. Flared-end sections are only allowed on corrugated steel pipes with diameters of 42-inches (or equivalent) or less. No multiple barrel installations will be allowed unless warranted by special conditions as approved by Planning and Zoning.

Headwalls, wingwalls and flared-end sections should be designed and constructed to use the existing landforms of the site and blend with the natural landscape.

Additional protection in the form of riprap will also be required at the outlet due to the potential scouring velocities. Refer to Section 12.2.

### 11.3.3 Hydraulic Data

When evaluating the capacity of a culvert, the following data will be used:

- a. Roughness Coefficient - Table 1101.
- b. Entrance Loss Coefficients - Table 1101.
- c. Capacity Curves - There are many charts, tables and curves in the literature for the computation of culvert hydraulic capacity. To assist in the review of the culvert design computations and to obtain uniformity of analysis, one of the following design aids will be used:

*Urban Storm Drainage Criteria Manual*, Denver, Colorado, latest revision

*HY8 Culvert Analysis Version 6.1*, U.S. Federal Highway Administration, Washington, D.C.

- d. Design Forms - Standard Form SF-3 is to be used for determining culvert capacities. A sample computation is discussed in Section 11.4 and shown on Table 1102.

#### 11.3.4 Velocity Considerations

In design of culverts, both the minimum and maximum velocities must be considered. A minimum velocity of flow is required to assure a self-cleansing condition of the culvert. A minimum velocity in the culvert of 3-fps at the outlet is recommended.

The maximum velocity is dictated by the channel conditions at the outlet. If the outlet velocities are less than 7-fps for grassed channels, then the minimum amount of protection is required due to the eddy currents generated by the flow transition. Higher outlet velocities will require substantially more protection. A maximum outlet velocity of 12-fps is recommended with erosion protection. If the culvert outlet velocity is greater than 12-fps, an energy dissipator will be required. Refer to Sections-12.2 for protection requirements at culvert outlet.

#### 11.3.6 Cross Culvert Location

The surface drainage in a street/roadside ditch will not be carried in excess of 500 feet before being discharged into a natural drainageway. Grade changes of greater than 2% will require a cross culvert. The final location of culverts will be determined by existing field conditions encountered during installation. Culverts will be installed at the slope of the natural terrain.

#### 11.3.7 Structural Design

As a minimum, all culverts will be designed to withstand an HS-25 loading (unless otherwise approved by Planning & Zoning) in accordance with the design procedures of AASHTO, "Standard Specifications for Highway Bridges," and with the pipe manufacturer's recommendation.

#### 11.3.8 Trashracks

Trashracks may be required at the entrance of culverts for some installations as loading (unless otherwise approved by Planning & Zoning), such as areas with potential for significant debris, or in areas where public access is likely. Installation of trashracks prevents debris from entering culverts.

The following criteria will be used for design of trashracks for storm drainage applications:

##### 1. Materials

All trashracks will be constructed with smooth steel pipe with a minimum 1.25 inches outside diameter. The trashrack ends and bracing should be constructed with steel angle sections. All trashrack components will have a corrosion protective finish.

##### 2. Trashrack Design

The trashracks will be constructed without cross-braces (if possible) in order to minimize debris clogging. The trashrack will be designed to withstand the full hydraulic load of a completely plugged trashrack based on the highest anticipated depth of ponding at the trashrack. The trashrack will also be hinged and removable for maintenance purposes. The clear opening at the bottom should be 9 to 12 inches to permit debris at low flow to go through.

##### 3. Bar Spacing

The steel pipe bars will be spaced with a clear opening of 4 ½ to 5 inches. In addition, the entire rack will have a minimum clear opening area (normal to the rack) at the design flow depth of four times the culvert opening area.

##### 4. Trashrack Slope

The trashrack will have a longitudinal slope of no steeper than 3 horizontal to 1 vertical for maintenance purposes.

##### 5. Hydraulics

Hydraulic losses through trashracks will be computed using the following equation:

---

$$H_T = 0.11 (TV/D)^2 (\sin A)$$

where:

$H_T$  = Head Loss through Trashrack (feet)

$T$  = Thickness of Trashrack Bar (inches)

$V$  = Velocity Normal to Trashrack (fps)

$D$  = Center-to-Center Spacing of Bars (inches)

$A$  = Angle of Inclination of Rack with Horizontal

---

This equation will apply to all racks constructed normal to the approach flow direction. The velocity normal to the trashrack will be computed considering the rack to be 50 percent plugged.

This equation is a modification of the equation presented in *Design Standards No. 3 - Canals and Related Structures*, U.S. Department of the Interior, Bureau of Reclamation, Denver, Colorado. The modification consists of changing the computed head loss from inches to feet and eliminating the factor which accounts for approach flow directions other than normal to the trashrack.

Safety Grates will be required when it is not possible to “see daylight” from one end of the culvert to the other, the culvert is less than 42 inches in diameter, or conditions within the culvert (bends, obstructions, vertical drops) or at the outlet are likely to trap or injure a person.

#### 11.4 Design Example

The procedure recommended to evaluate existing and proposed culverts is based on the procedures presented in HEC-5, *Hydraulic Charts for the Selection of Highway Culverts* HEC No. 5, USDOT, FHWA. The methodology consists of evaluating the culvert headwater requirements, assuming both inlet control and outlet control. The rating which results in the larger headwater requirements is the governing flow condition.

A sample calculation for rating an existing culvert is presented in Table 1102. The required data are as follows:

---

Culvert size, length and type (48" CMP,  $L = 150'$ ,  $n = .024$ ).

Inlet, outlet elevation and slope (5540.0, 5535.5,  $so = 0.030$ ).

Inlet treatment (flared end-section).

Low point elevation of embankment ( $EL = 5551.9$ ).

Tailwater rating curve (see Table 1102, Column 5).

---

From the above data, the entrance loss coefficient,  $K_2$ , and the  $n$ -value are determined. The full flow  $Q$  and the velocity are calculated for comparison. The rating then proceeds in the following sequence:

Step 1: Headwater values are selected and entered in column 3. The headwater to pipe diameter ratio ( $H_w/D$ ) is calculated and entered in column 2. If the culvert is other than circular, the height of the culvert is used.

Step 2: For the  $H_w/D$  ratios, the culvert capacity is read from the rating curves (Section-11.3.3) and entered into column 1. This completes the inlet condition rating.

Step 3: For outlet condition, the  $Q$  values in column 1 are used to determine the head values ( $H$ ) in column 4 from the appropriate outlet rating curves (Section-11.3.3).

Step 4: The tailwater depths ( $T_w$ ) are entered into column 5 for the corresponding  $Q$  values in column 1 according to the tailwater rating curve (i.e., downstream channel rating computations). If the tailwater depth ( $T_w$ ) is less than the diameter of the culvert ( $D$ ), column 6 and 7 are to be calculated (go to Step 5). If  $T_w$  is more than  $D$ , the tailwater values in column 5 are entered into column 8 for the  $h_o$  values

and proceed to Step 6.

Step 5: The critical depth ( $dc$ ) for the corresponding  $Q$  values in column 1 are entered into column 6. The average of the critical depth and the culvert diameter is calculated and entered into column 7 as the  $h_o$  values.

Step 6: The headwater values ( $H_w$ ) are calculated according to the equation:

---

$$H_w = H + h_o - LS_o$$

---

where  $H$  is from column 4, and  $h_o$  is from column 8 (for  $T_w > D$ ) or the larger value between column 5 and column 7 (for  $T_w < D$ ). The values are entered into column 9.

Step 7: The final step is to compare the headwater requirements (columns 9 and 3) and to record the higher of the two values in column 10. The type of control is recorded in column 11, depending upon which case gives the higher headwater requirements. The headwater elevation is calculated by adding the controlling  $H_w$  (column 10) to the upstream invert elevation. A culvert rating curve can then be plotted from the values in columns 12 and 1.

To size a culvert crossing, the same form can be used with some variations in the basic procedures. First, a design capacity is selected and the maximum allowable headwater is determined. An inlet type (i.e., headwall) is selected, and the invert elevations and culvert slope are estimated based upon site constraints. A culvert type is then selected and first rated for inlet control and then for outlet control. If the controlling headwater exceeds the maximum allowable headwater, a different culvert configuration is selected and the procedure repeated until the desired results are achieved.

## 11.5 Culvert Sizing Criteria

### 11.5.1 Culverts within Drainageways

The sizing of a culvert is dependent upon two factors, the street classification and the allowable street overtopping. The allowable street overtopping for the various street classifications is set forth in Section 10.3. In addition to this policy, a criteria requiring that no street overtopping occur for a 10-year frequency storm has been established. Therefore, as a minimum design standard for street crossings, the following procedure will be used:

1. Using the future developed conditions 100-year runoff, the allowable street overtopping will be determined from overflow rating curves developed from the street profile crossing the waterway.
2. The culvert is then sized for the difference between the 100-year runoff and the allowable overtopping.
3. If the resulting culvert is smaller than that required to pass the 10-year flood peak without overtopping, the culvert will be increased in size to pass the 10-year flow.

The CRITERIA is considered a minimum design standard and must be modified where other factors are considered more important. For instance, if the procedure still results in certain structures remaining in the 100-year floodplain, the design frequency may be increased to lower the floodplain elevation. Also, if only a small increase in culvert size is required to prevent overtopping, then the larger culvert is recommended.

### 11.5.2. Cross Culverts and Driveway Culverts within Street/Roadside Ditches

Minimum sizing of culverts is delineated in Section 11.6 of these CRITERIA. As a minimum, cross culverts and driveway culverts shall be designed to accommodate the ditch capacity.

## 11.6 Checklist

To aid the designer and reviewer, the following checklist has been prepared:

1. Minimum culvert size within the public ROW, such as cross tubes, is 18-inch diameter round or equivalent for other shapes.



2. Minimum culvert size for street/roadside ditches at driveways is 15-inch diameter round or equivalent for other shapes.
3. Headwalls, wingwalls or flared end sections required for all culverts in accordance with these CRITERIA.
4. Check outlet velocity and provide adequate protection.
5. Check structural requirements.

Table 1101

### Hydraulic Data for Culverts

#### Pipe Roughness Coefficients

Manning's n-value	
Sewer Type	Capacity Calculation
RCP	0.015
CSP	0.026
HDPE/HP	0.012

#### (D) Culvert Entrance Losses

	Type of Entrance	Entrance Coefficient, Ke
<b>Pipe</b>		
	Headwall	
	Grooved edge	0.20
	Rounded Edge (0.15D radius)	0.15
	Rounded edge (0.25D radius)	0.10
	Square edge (cut concrete and CMP)	0.40
	Headwall & 45° Wingwall	
	Grooved edge	0.20
	Square edge	0.35
	Headwall with Parallel Wingwalls Spaced 1.25D apart	
	Grooved edge	0.30
	Square edge	0.40
	Projecting entrance	
	Grooved edge RCP	0.25
	Square edge RCP	0.50
	Sharp edge, thin wall CMP	0.90
	Flared-end Section	0.50
<b>Box, Reinforced Concrete</b>		
	Headwall Parallel to Embankment (no wingwalls)	
	Square edge of 3 edges	0.50
	Rounded on 3 edges to radius of 1/12 barrel dimension	0.20
	Wingwalls at 30° to 75° to barrel	
	Square edged at crown	0.40
	Crown edge rounded to radius of 1/12 barrel dimension	0.20
	Wingwalls at 10° to 30° to barrel	
	Square edged at crown	0.50
	Wingwalls parallel (extension of sides)	
	Square edged at crown	0.70

*Note: The entrance loss coefficients are used to evaluate the culvert or sewer capacity operating under outlet control.*

*Reference: Handbook of Steel Drainage and Highway Construction Products, AISI 1991*

### Standard Form SF-3 Culvert Rating

Station: 2+00

# Chapter 12 - Hydraulic Structures

## 12.1 Introduction

Hydraulic structures are used in storm drainage work to control the flow of the runoff. The energy associated with flowing water has the potential to create damage to the drainage works, especially in the form of erosion. Hydraulic structures, which include Conduit Outlet Structures, energy dissipators, check structures, bridges and irrigation ditch crossings, all control the energy and minimize the damage potential of storm runoff.

The criteria to be used in the design of hydraulic structures will be in accordance with the *Manual*. The specific criteria to be used with the modifications for the County are presented herein.

## 12.2 Conduit Outlet Structures

Outlet protection designed for the 100 year storm event is required for all storm-sewer and culvert locations. The design of Conduit Outlet Structures will be in accordance with the *Manual*.

## 12.3 Channel Grade Control Structures (Check and Drop Structures)

As discussed in chapter, "Open Channels," there is a maximum permissible velocity for major design storm runoff in grass lined channels. One of the more common methods of controlling the flow velocity is to reduce the channel invert slope, which requires a check drop to make up for the elevation difference occurring when the channel slope is reduced.

The design criteria for the check and drop structures will be in accordance with the *Manual*.

## 12.4 Bridges

The design of bridges within the County will be in accordance with the *Manual*. The design capacity of the bridge will be determined by the method presented in Section 11.5 of these *CRITERIA*.

## 12.5 Irrigation Ditch Crossings

Any proposed development in the vicinity of the ditches or canals that crosses or utilizes the canal for surface drainage or proposes to make any modifications to the existing topography which alters and/or affects water quality and drainage patterns to the ditch will have the plans approved by the ditch company prior to approval by the County.

# Chapter 13 - Stormwater Quality Management

## 13.1 Introduction

The intent of this Chapter is to present minimum criteria for the implementation and use of BMPs in order to achieve the goal of mitigated stormwater quality during construction and after construction. Compliance with these *CRITERIA* does not require water quality monitoring by the individual developer, or quantitative descriptions of pollutant load removal. Instead, a performance-based approach is required for erosion, sediment and pollutant transport control. Individual methods must be selected and implemented to best fit the conditions and requirements of each site.

The quality of stormwater runoff from developed lands and urbanized areas can be impacted by some or all of the sources and pollutants shown in Table 1301. Stormwater quality control methods and techniques have been developed for two distinct phases of urbanization: the initial construction period of land disturbing activities and the ongoing response of the urban system to rainfall and runoff events. Site planning and engineering for developing lands must provide controls for both phases of urbanization. The general objectives for each of these two phases of urbanization are discussed in this chapter.

Table 1301

### Possible Sources of Pollutants in Stormwater

Source	Contaminant
Vehicles, Machinery and Industrial Activities	Metals, Lubricants, Solvents, Paints
Lawn Care, Gardening	Pesticides, Herbicides, Fertilizers, Sediments
Household Chemicals	Paints, Solvents, Detergents, Disinfectants, Cleaners, Chlorine
General Population	Litter, Trash, Debris
Pets and Animals	Fecal Matter, Organic Wastes
Parking Lots	Oil, Grease, Automotive Fluids, Sediments
Construction	Soil and Sediment Particles

## 13.2 Temporary Erosion Control for Construction Activities

Construction activities that disturb the natural soil and vegetation have the potential to increase soil erosion and sediment movement. The disturbed, loose soil is easily eroded by the forces of rainfall, concentrated runoff and wind.

Erosion and sediment control practices are required, to the maximum extent practicable, on all developing sites. These practices are required to prevent disturbed soils from leaving the site and to maintain stormwater quality at a level comparable to the historic runoff conditions that existed prior to the construction activities.

Site planning and design must meet all of the objectives for stormwater quality control. Design and performance information for a variety of erosion and sediment control measures that are currently in practice or recommended for use in the region is presented in detail in the *Manual*.

The Land Disturbance Section of the ZR describes the submittal requirements and specifications for grading and erosion control plans and the minimum performance standards for site grading and erosion and sediment control.

## 13.3 Permanent Controls for Stormwater Quality Management

### 13.3.1 Objectives for Permanent Stormwater Quality Control

Jefferson County requires that land undergoing development activities incorporate BMPs to achieve the objectives of permanent stormwater quality control. The following principles and objectives of stormwater quality BMPs will be used by the County to determine if adequate controls have been proposed during the site design and development process:

Minimize, to the maximum extent practicable, impacts of stormwater on receiving waters. An effective level of urban pollutant removal should be accomplished by the selected BMPs.

The site's physical constraints need to be considered. Select and design BMPs to work within the conditions on the site.

Economic impacts of the selected BMPs must be considered. Controls must be evaluated for installation (construction) costs and for future operation and/or maintenance costs.

Multi-use benefits should be incorporated within stormwater quality features whenever possible. Land intensive BMPs, such as detention/retention ponds and vegetative strips should be designed to incorporate recreational and aesthetic features such as open space and landscape values whenever possible.

Opportunities for participation in master-planned regional facilities have been considered. The County will be contacted to determine if regional facilities for stormwater quality control may be available to the planned site.

### 13.3.2 BMPs for Permanent Control

The Four-Step Process described in the *Manual*, is required for selecting structural BMPs in developing areas. Selection of a BMP must include consideration of long-term function and maintenance design expectations, an estimate of annual maintenance costs and maintenance schedule, the source of funding and anticipated life of the structural BMP.

#### Step 1. Employ Runoff Reduction Practices

To reduce runoff peaks and volumes from urbanizing areas, employ a practice generally termed “minimizing directly connected impervious areas” (MDCIA). The principal behind MDCIA is twofold – to reduce impervious areas and to route runoff from impervious surfaces over grassy areas to slow down runoff and promote infiltration. The benefits are less runoff, less stormwater pollution and less cost for drainage infrastructure.

##### a. Reduce “Actual” Impervious Area

- Replace regular pavement with permeable interlocking concrete pavement (PICP) and reinforced grass pavement.
- Replace storm sewer or hard surface swales with grass swales

##### b. Reduce “Effective” Impervious Area

- Direct runoff from impervious surfaces to grass buffers or grass swales
- Replace curb and gutter with grass swales
- Direct stormwater from parking lot(s) into an infiltration and/or water quality BMP prior to conveyance to the stormwater detention and water quality pond

#### Step 2. Provide Water Quality Capture Volume (WQCV)

A fundamental requirement for any site addressing stormwater quality is to provide WQCV. One or more of the many types of water quality basins, each draining slowly to provide for long-term settling of sediment particles, may be selected (*Manual*, Chapter 4, Treatment BMP's).

- Permeable Pavement Systems
- Bioretention (Rain Garden or Porous Landscape Detention)
- Extended Detention Basin
- Sand Filter Basin
- Constructed Wetland Basin
- Underground Practices
- Retention Pond

#### Step 3. Stabilize Drainageways

Drainageway erosion, natural and manmade, can be a major source of sediment and associated constituents, such as phosphorus. Natural drainageways are often subject to bed and bank erosion when urbanizing areas increase the frequency, rate and volume of runoff. It is important that drainageways adjacent to or traversing development sites be stabilized. One of three basic methods of stabilization

may be selected.

- Constructed Grass or Riprap
- Stabilized Natural Channel
- Constructed Wetland Channel

#### Step 4. Implement Industrial and Commercial BMPs

If the development includes industrial or commercial uses, the need for specialized BMPs must be considered.

- Covering Storage and Handling Areas
- Spill Containment and Control

#### Other BMPs

Manufactured devices such as water quality vaults and inlets, infiltration trenches and oil/grease separators, may be considered when stormwater quality is not required in accordance with Section 3.3.7 and site constraints do not allow for full implementation of Step 1 and Step 2 BMPs.

#### 13.3.3 Minimum Design Criteria

It is expected that the BMPs designed for each site will vary depending on land use, extent of development, redevelopment constraints and the physical characteristics of the site (soils, slope and runoff).

The County will evaluate the adequacy and appropriateness of the proposed BMPs based on their fulfillment of the previously stated objectives, as well as the satisfaction of the following minimum design criteria:

1. A site specific Stormwater Quality Control Plan and associated hydraulic calculations will be incorporated in the Phase III Drainage Report and plan describing: the type of BMPs selected and associated hydraulic calculations, a construction and implementation schedule and a description of long term maintenance requirements and responsibilities.
2. The design of sites will incorporate one or more BMPs from Step 1 and Step 2 designed to capture and treat the calculated EURV as defined in the *Manual*.

When incorporating Excess Urban Runoff Volume (EURV) into a stormwater quantity detention basin, the capacity will be based on the following:

Onstream WQCV and EURV facilities are not recommended unless they are designed as regional facilities. If a non-regional WQCV and EURV facility is placed onstream, it must be designed to serve the upstream watershed based on current development conditions.

3. The design of sites will incorporate one or more BMPs from Steps 3 and 4 depending on the planned use of the site and the proximity to drainageways.
4. Design criteria for manufactured devices are dependent on the specific device. The appropriateness of a device will be considered on a case-by-case basis.
5. Non-residential projects which include more than the required number of parking spaces will be required to employ one or more Step 1 BMPs to limit the effective impervious area which would result from the minimum required number of parking spaces as determined by the ZR.
6. Permanent erosion protection and stabilization measures will be provided for all disturbed areas.

#### 13.3.4 Control Measure Requirements

The control measures for applicable development sites shall meet one of the following base design standards listed below:

(A) WQCV Standard: The control measure(s) is designed to provide treatment and/or infiltration of the WQCV and:

- 1) 100% of the applicable development site is captured, except Jefferson County staff may exclude up to 20%, not to exceed 1 acre, of the applicable development site area when Jefferson County staff has determined that it is not practicable to capture runoff from portions of the site that will not drain towards control measures. In addition, the applicant must provide documentation that the implementation of a separate control measure for that portion of the site is not practicable (e.g., driveway access that drains directly to street).
- 2) Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the control measure implemented. Consideration of drain time shall include maintaining vegetation necessary for operation of the control measure (e.g., wetland vegetation).

(B) Pollutant Removal Standard: The control measure(s) is designed to treat at a minimum the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30 mg/L or less.

- 1) 100% of the applicable development site is captured, except Jefferson County staff may exclude up to 20% not to exceed 1 acre of the applicable development site area if Jefferson County staff has determined that it is not practicable to capture runoff from portions of the site that will not drain towards control measures. In addition, Jefferson County staff must also determine that the implementation of a separate control measure for that portion of the site is not practicable (e.g., driveway access that drains directly to street).

(C) Runoff Reduction Standard: The control measure(s) is designed to infiltrate into the ground where site geology permits, evaporate, or evapotranspire a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area for the applicable development site discharged without infiltration. This base design standard can be met through practices such as green infrastructure. "Green infrastructure" generally refers to control measures that use vegetation, soils, and natural processes or mimic natural processes to manage stormwater. Green infrastructure can be used in place of or in addition to low impact development principles.

(D) Applicable Development Site Draining to a Regional WQCV Control Measure: The regional WQCV control measure must be designed to accept the drainage from the applicable development site. Stormwater from the site must not discharge to a water of the state before being discharged to the regional WQCV control measure. The regional WQCV control measure must meet the requirements of the MS4 Permit.

(E) Applicable Development Site Draining to a Regional WQCV Facility: The regional WQCV facility is designed to accept drainage from the applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the applicable development site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. The control measure must be designed in accordance with a design manual identified by the permittee. In addition, the stream channel between the discharge point of the applicable development site and the regional WQCV facility must be stabilized.

The regional WQCV facility must meet the following requirements:

- 1) The regional WQCV facility must be implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.
- 2) The regional WQCV facility must be designed and maintained for 100% WQCV for its entire drainage area.
- 3) The regional WQCV facility must have capacity to accommodate the drainage from the applicable development site.
- 4) The regional WQCV facility be designed and built to comply with all assumptions for the development activities planned within its drainage area, including the imperviousness of its drainage area and the applicable development site.
- 5) Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the facility. Consideration of drain time shall include maintaining vegetation necessary for operation of the facility (e.g., wetland vegetation).

6) The regional WQCV facility shall meet the requirements in the MS4 Permit for the regional WQCV facility consistent with requirements and actions for control measures.

7) The regional WQCV facility must be subject to Jefferson County's authority consistent with requirements and actions for a Control Measure in accordance with the MS4 Permit.

8) Regional Facilities must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered Regional Facilities. Water bodies listed by name in surface water quality classifications and standards regulations (5 CCR 1002-32 through 5 CCR 1002-38) may not be considered regional facilities.

(F) Constrained Redevelopment Sites Standard:

1) Applicability: The constrained redevelopment sites standard applies to redevelopment sites meeting the following criteria:

(a) The applicable redevelopment site is for a site that has greater than 75% impervious area, and

(b) Jefferson County staff has determined that it is not practicable to meet any of the design standards in the MS4 Permit, or

(c) Jefferson County staff determination shall include an evaluation of the applicable redevelopment sites ability to install a control measure without reducing surface area covered with the structures.

2) Constrained Redevelopment Sites Design Standard: The control measure(s) is designed to meet **one** of the following:

(a) Provide treatment of the WQCV for the area captured. The captured area shall be 50% or more of the impervious area of the applicable redevelopment site. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the control measure implemented,

(b) The control measure(s) is designed to provide for treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30 mg/L or less. A minimum of 50% of the applicable development area including 50% or more of the impervious area of the applicable development area shall drain to the control measure(s). This standard does not require that 100% of the applicable redevelopment site area be directed to control measure(s) as long as the overall removal goal is met or exceeded (e.g., providing increased removal for a smaller area), or

(c) Infiltrate, evaporate, or evapotranspire, through practices such as green infrastructure, a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area for the applicable redevelopment site discharged without infiltration.

13.3.5 Site Plan Requirements

(A) Site Plan Requirements: Site plans that include control measures for the applicable development sites must include the following:

1) Design details for all structural control measures implemented to meet the requirements of the MS4 Permit.

2) A narrative reference for all non-structural control measures for the site, if applicable. "Non-structural control measures" are control measures that are not structural control measures, including control measures that prevent or reduce pollutants being introduced to water or that prevent or reduce the generation of runoff or illicit discharges.

3) Documentation of operation and maintenance procedures to ensure the long term observation, maintenance, and operation of the control measures. The documentation shall include frequencies for routine inspections and maintenance activities.

4) Documentation regarding easements or other legal means for access of the control measure sites for operation, maintenance, and inspection of control measures.



(B) Site Plan Review: The site plan review shall include the following minimum requirements designed to prevent inadequate control measures from being implemented or modified:

- 1) Jefferson County approval of the control measures shall include confirmation that control measures meet the requirements of the MS4 Permit.
- 2) Jefferson County approval of the that site plans meet the requirements of the MS4 Permit

# Chapter 14 – Detention

## 14.1 Introduction

The criteria presented in this chapter will be used in the design and evaluation of all facilities. The review of all planning submittals (refer to Chapter 2) will be based on the criteria presented in this section.

The main purpose of a detention facility is to store the excess storm runoff associated with an increased basin imperviousness and discharge this excess at a rate similar to the rate experienced from the basin without development. Any special design condition which cannot be defined by these *CRITERIA* will be reviewed by Planning and Zoning before proceeding with design.

Dams and water diversion/detention areas should be designed and constructed to appear as natural features, creating site amenities. Techniques to achieve this include creation of topographic changes that mimic natural conditions (including a variety of slope changes), using natural materials such as stone, blending with the textures and patterns of the surrounding landscape and using materials that match the local environment. When possible, preserve existing drainage patterns.

## 14.2 Detention Methods

The various detention methods are defined on the basis of where the facility is constructed, such as open space detention, parking lot or underground. Full spectrum detention is required for all new storm drainage facilities. Full spectrum detention is required for all modified facilities if additional pond volume is necessary due to an increase in the proposed development area and/or increased designed impervious area. Full Spectrum Detention will be designed as outlined in Chapter 13 and the *Manual*.

## 14.3 Design Criteria

### 14.3.1 Volume and Release Rates

The maximum release rates, volumes and drain times are determined from 90% of pre-developed flow conditions *or the latest update from the Manual and design spreadsheets*.

When designing water quality and detention facilities reference the latest version of Urban Drainage UD-Detention software.

Drain times must be in conformance with CRS 37-92-602 (8).

### 14.3.2 Design Frequency

All detention facilities are to be designed for the 100-year recurrence interval flood.

### 14.3.3 Hydraulic Design

Hydraulic design data for sizing of detention facilities outlet works is as follows:

#### 1. Weir flow

The general form of the equation for horizontal crested weirs is:

---

$$Q = CLH^{3/2}$$

Where Q = discharge (cfs)

C = weir coefficient

(Table 1401)

L = horizontal length (feet)

H = total energy head (feet)

---

Another common weir is the v-notch; the equation is as follows:

---

$$Q = 2.5 \tan (\theta/2) H^{5/2}$$

Where  $\theta$  = angle of the notch at the apex (degrees)

---

When designing or evaluating weir flow, the effects of submergence must be considered. A single check on submergence can be made by comparing the tailwater to the headwater depth. The example calculation for a weir design on Figure 1403 illustrates the submergence check.

## 2. Orifice Flow

The equation governing the orifice opening and plate is the orifice flow equation:

---

$$Q = C_d A (2gh)^{1/2}$$

Where  $Q$  = Flow (cfs)

$C_d$  = Orifice coefficient

$A$  = Area (ft<sup>2</sup>)

$g$  = Gravitational constant = 32.2 ft/sec<sup>2</sup>

$h$  = Head on orifice measured from centerline of orifice (ft)

An orifice coefficient ( $C_d$ ) value of 0.65 will be used for sizing of square edged orifice openings and plates.

---

## 14.4 Design Standards for Open Space Detention

### 14.4.1 State Engineer's Office

Any dam constructed for the purpose of storing water, with a surface area, volume or dam height as specified in CRS 37-87-105 as amended, will require the approval of the plans by the State Engineer's Office. All detention storage areas will be designed and constructed in accordance with these *CRITERIA*. Those facilities subject to the state statutes will be designed and constructed in accordance with the criteria of the state.

### 14.4.2 Grading Requirements

Slopes on riprapped earthen embankments will not be steeper than 3 (horizontal) to 1 (vertical). For grassed detention facilities, the minimum bottom slope will be 2.0 percent measured perpendicular to the trickle channel. Slopes for detention ponds that are eligible for Urban Drainage maintenance assistance will not be steeper than 4 (horizontal) to 1 (vertical).

### 14.4.3 Retaining Walls

Retaining walls are permitted in detention ponds below the 100-year water surface elevation as long as all of the following requirements are met.

- The retaining wall must be made of large blocks (one-ton weight per block or heavier) or monolithic pour concrete.

- The retaining wall must not exceed 50% of the detention pond perimeter for residential or institutional use.
- Safety improvements are provided as required by Planning and Zoning. Examples include but are not limited to fencing and guardrails.

#### 14.4.4 Freeboard Requirements

The minimum required freeboard for open space detention facilities is 1.0 foot above the computed 100-year water surface elevation.

#### 14.4.5 Trickle Flow Control

All grassed bottom detention ponds, except porous landscape detention, will include a concrete lined trickle channel or equivalent performing materials and design. Trickle flow criteria is presented in Section 7.4.2.6(a).

#### 14.4.6 Outlet Configuration

See the *Manual's* Outlet Structure Fact Sheet in Chapter 4 of Volume 3 for details. Minimum pipe outlet size is 15 inches. Trash racks are required for all water quality and EURV openings and will be designed in accordance with the *Manual*.

The outlet will be designed to minimize unauthorized modifications, which affect proper function. A sign with a minimum area of 0.75 square feet will be attached to the outlet or posted nearby with the following message:

---

#### WARNING

Unauthorized modification of this outlet is a knowing violation of Section 309 of the Clean Water Act.  
Punishment: Fine and/or Imprisonment: 3-6 years

---

The 100-year discharge must pass over the weir and therefore the weir must be of adequate length. The effective weir length (L) occurs for three sides of the box. To ensure the 100-year control occurs at the throat of the outlet pipe, a 50 percent increase in the required weir length is required. In addition, the outlet pipe must have an adequate slope to ensure throat control in the pipe.

#### 14.4.7 Embankment Protection

Whenever a detention pond uses an embankment to contain water, the embankment will be protected from catastrophic failure due to overtopping. Overtopping can occur when the pond outlets become obstructed or when a larger than 100-year storm occurs. Failure protection for the embankment will be provided by a separate emergency spillway having a minimum capacity of twice the maximum release rate for the 100-year storm, or in the form of a buried heavy riprap layer on the entire downstream face of the embankment. Emergency spillways will be directed toward an open channel, natural drainageway, street/roadside ditch or a street (see Figure 1407). Structures will not be permitted in the path of the emergency spillway or overflow. The invert of the emergency spillway should be set equal to or above the 100-year water surface elevation.

#### 14.4.8 Vegetation Requirements

All open space detention ponds under 7000 feet in elevation will be revegetated by either irrigated sod or natural dry-land grasses in accordance with the *Manual*. Detention ponds above 7000 feet in elevation will be revegetated according to the recommendations of the JCD and/or the *Jefferson County Small Site Erosion Control Manual*.

### 14.5 Design Standards for MPLD

MPLD may be used only for single family residential developments within the mountains. See Figure 1408 for the design requirements for MPLD.

All non-lot specific designs of MPLD is required at the time of development process. Lot specific design of the MPLD may be delayed until the time of building permit at the discretion of the Planning and Zoning subject to the following requirements.

- The Phase III Drainage Report includes the MPLD volume calculations and soil type/classification and percolation test if in soil type C and/or D

- The Phase III Drainage Report discusses the general location of the MPLD's and the proposed septic system, if any
- The Phase III Drainage Report includes a typical design of an MPLD
- Drainage easements and performance guarantees for MPLD's are provided

#### **14.6 Design Standards for Parking Lot Detention**

The requirements for parking lot detention is as follows:

##### **14.6.1 Depth Limitation**

The maximum allowable design depth of the ponding for the 100-year flood is 12 inches.

##### **14.6.2 Freeboard Requirements**

The minimum required freeboard for parking lot detention facilities is .25 feet above the computed 100-year water surface elevation. There may need to be more than .25 feet of freeboard depending on overflow weir capacity calculations.

##### **14.6.3 Overflow Requirements**

All parking lot detention ponds will have a safe overflow that at a minimum has capacity for the 100-year allowable release rate.

##### **14.6.4 Outlet Configuration**

The minimum pipe size for the outlet is 15" diameter where a drop inlet is used to discharge to a storm sewer or drainageway. Where a weir and a small diameter outlet through a curb are used, the size and shape are dependent on the discharge/storage requirements. A minimum pipe size of 3" diameter is recommended.

##### **14.6.5 Performance**

To assure that the detention facility performs as designed, maintenance access will be provided in accordance with Section 3.3.9. The outlet will be designed to minimize unauthorized modifications which affect function. Any repaving of the parking lot will be evaluated for impact on volume and release rates and is subject to approval by Planning and Zoning

##### **14.6.6 Flood Hazard Warning**

All parking lot detention areas will have a minimum of two signs posted identifying the detention pond area. The signs will have a minimum area of 1.5 square feet and contain the following message:

---

#### **WARNING**

This area is a detention basin and is subject to periodic flooding to a depth of (provide design depth).

---

Any suitable materials and geometry of the sign are permissible, subject to approval by Planning and Zoning.

##### **14.6.7 EURV**

EURV in a parking lot must meet the standards for permeable interlocking concrete pavement (PICP) and reinforced grass pavement outlined in the *Manual*.

#### **14.7 Design Standards for Underground Detention**

The requirements for underground detention are as follows:

##### **14.7.1 Materials**

Underground detention will be constructed using ASP, HP, HDPE or RCP. The pipe thickness cover, bedding and backfill will be designed to withstand HS-20 loading or as required by Planning and Zoning.

#### 14.7.2 Configuration

Pipe segments will be sufficient in number, diameter and length to provide the required minimum storage volume for the 100-year design. As an option, the design can be stored in the pipe segments and the difference for the 100-year stored above the pipe in an open space detention (Section 14.4) or in a parking lot detention (Section 14.5). The minimum diameter of the pipe segments will be 36 inches.

The pipe segments will be placed side by side and connected at both ends by elbow tee fittings and across the fitting at the outlet (see Figure 1405). The pipe segments will be continuously sloped at a minimum of 0.25% to the outlet. Manholes for maintenance access (see Section 14.6.5) will be placed in the tee fittings and in the straight segments of the pipe, when required.

Permanent buildings or structures will not be placed directly above the underground detention.

#### 14.7.3 Overflow Requirements

All underground detention will have a safe overflow that at a minimum has capacity for the 100-year allowable release rate.

#### 14.7.4 Inlet and Outlet Design

The outlet from the detention will consist of a short (maximum 25 ft.) length(s) of CSP, HP or RCP with a 15" minimum diameter. A two-pipe outlet may be required to control both design frequencies. The invert of the lowest outlet pipe will be set at the lowest point in the detention pipes. The outlet pipe(s) will discharge into a standard manhole (see CDOT M-604-20) or into a drainageway with erosion protection provided per Sections 11.3.2, 12.2 and 12.3. If an orifice plate is required to control the release rates, the plate(s) will be hinged to open into the detention pipes to facilitate back flushing of the outlet pipe(s).

Inlet to the detention pipes can be by way of surface inlets and/or by a local private storm sewer system.

#### 14.7.5 EURV

EURV facilities must be designed in accordance with the *Manual* design criteria, unless it is demonstrated that the proposed method is as effective as the *Manual* design criteria.

#### 14.7.6 Maintenance Access

Access easements to the detention site will be provided in accordance with Section 3.3.10. To facilitate cleaning of the pipe segments, 3-foot diameter maintenance access ports will be placed according to the following schedule:

##### Maintenance Access Requirements

Detention Pipe Size	Maximum Spacing	Minimum Frequency
36" to 54"	150'	Every pipe segment
60" to 66"	200'	Every other pipe segment
>66"	200'	One at each end of the battery of pipes

The manholes will be constructed in accordance with the detail on Figure 1405.

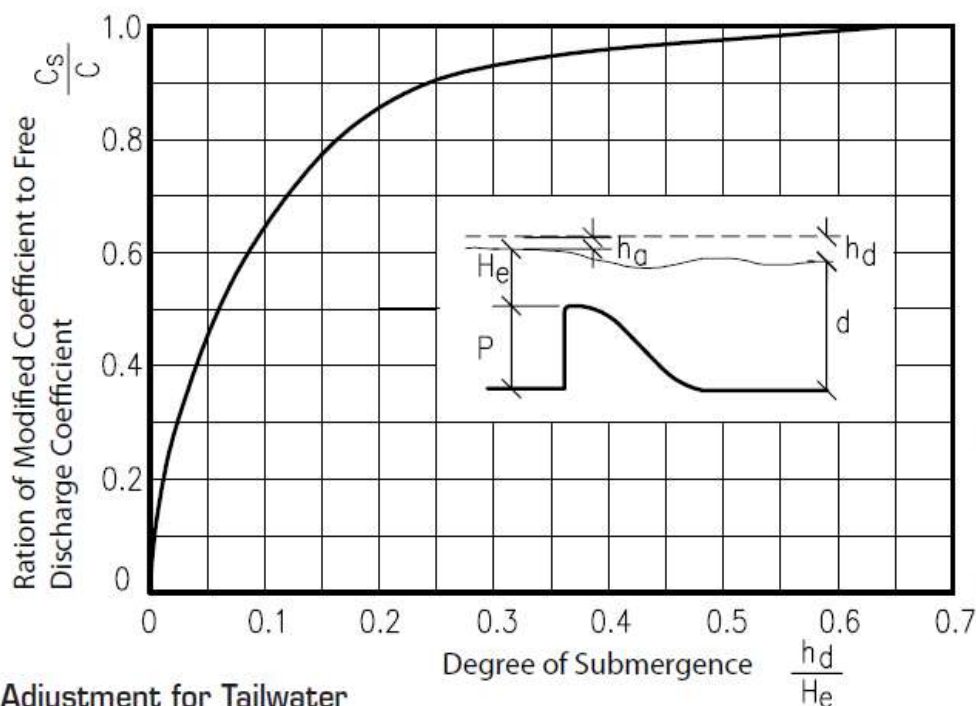
### 14.8 Design Standards for Combined Detention Ponds

Combined detention ponds, such as open space/parking lot detention, must meet the relevant set of design standards for design of each portion of the detention pond.

Table 1401

**Weir Flow Coefficients**

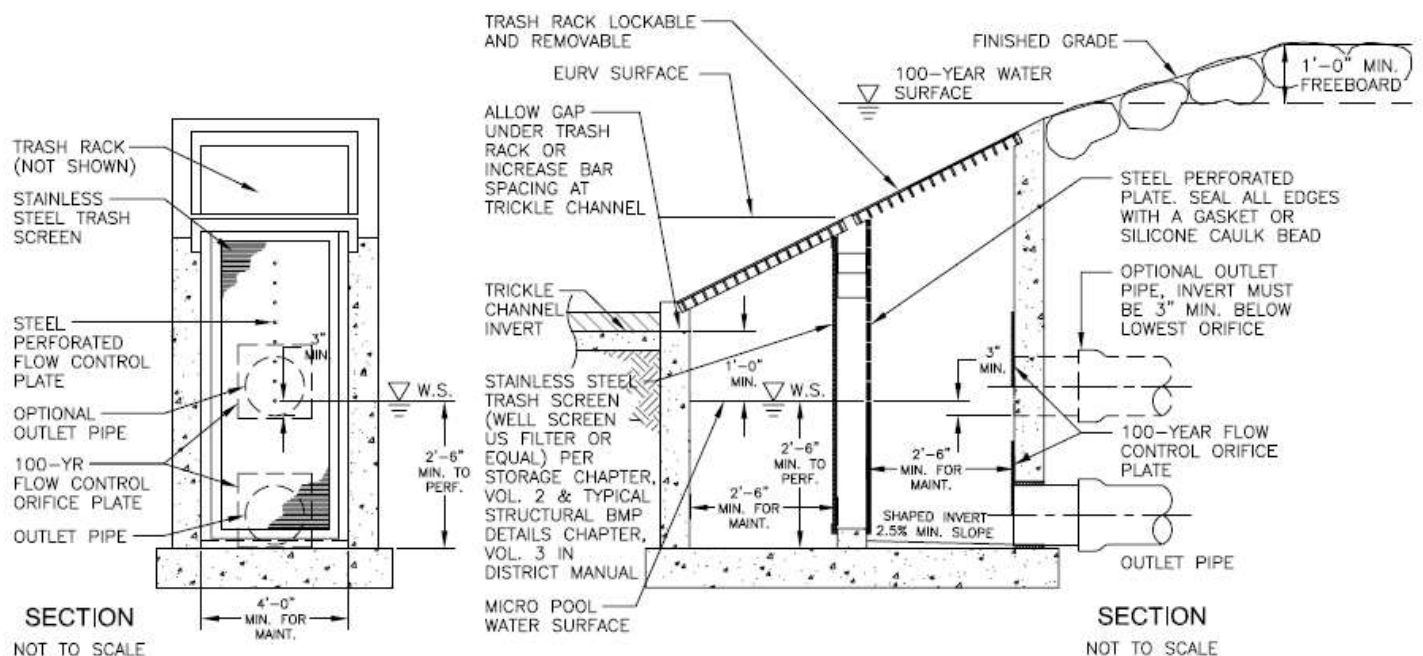
Shape	Coefficient	Comments	Schematic
<b>Sharp Crested</b>	- (H in feet)		
Projection Ratio (H/P = 0.4)	3.4	H < 1.0	
Projection Ratio (H/P = 2.0)	4.0	H > 1.0	
<b>Broad Crested</b>			
W/Sharp U/S Corner	2.6	Minimum Value	
W/Rounded U/S Corner	3.1	Critical Depth	
<b>Triangular Section</b>			
<b>A) Vertical U/S Slope</b>			
1:1 D/S Slope	3.8	H > 0.7	
4:1 D/S Slope	3.2	H > 0.7	
10:1 D/S Slope	2.9	H > 0.7	
<b>B) 1:1 U/S Slope</b>			
1:1 D/S Slope	3.8	H > 0.5	
3:1 D/S Slope	3.5	H > 0.5	
<b>Trapezoidal Section</b>			
1:1 U/S Slope, 2:1 D/S Slope	3.4	H > 1.0	
2:1 U/S Slope, 2:1 D/S Slope	3.4	H > 1.0	
<b>Road Crossings</b>			
Gravel	3.0	H > 1.0	
Paved	3.1	H > 1.0	



Reference: King & Brater,  
Handbook of Hydraulics,  
McGraw Hill Book Company,  
1963 – Design of Small Dams,  
Bureau of Reclamation, 1977

**Adjustment for Tailwater**

**Figure 1401**  
**Detention Pond Outlet Configurations**  
 For small sites <5 acres



Adopted from the City and County of Denver Storm Drainage Criteria

**Figure 1402**  
**Detention Pond Details**

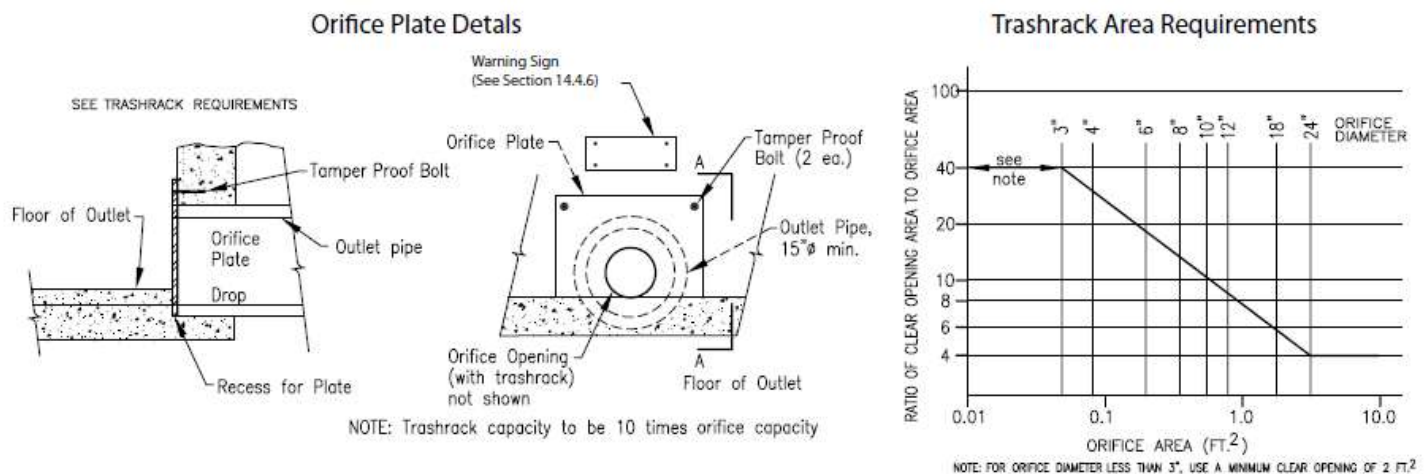
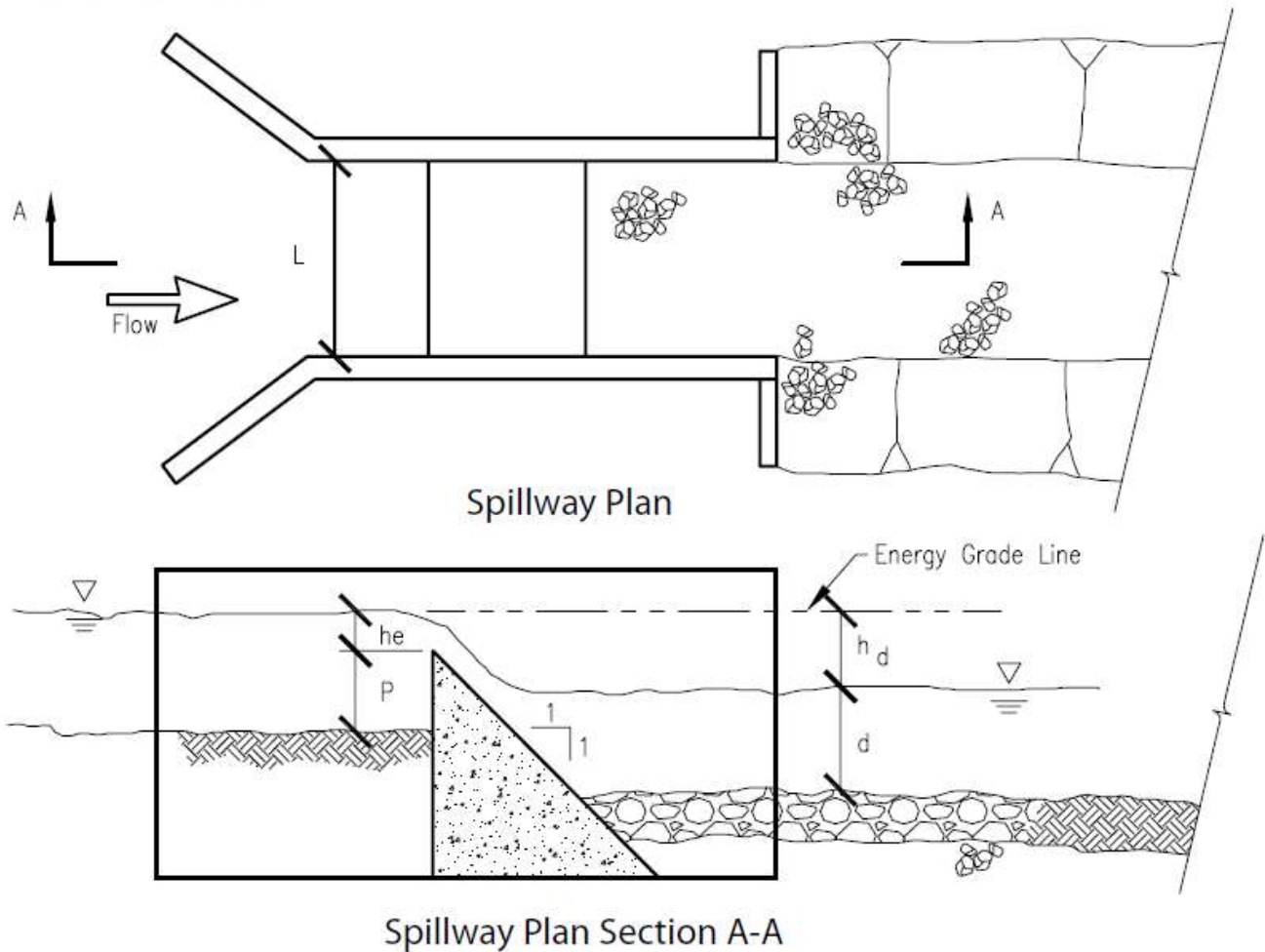




Figure 1403  
**Weir Design Example**



GIVEN:  $Q = 100$  CFS, Triangular weir with vertical face, and 1:1 downstream slope,  $p = 2'$ ,  $h_e = 2'$ , tailwater depth = 4.5',  $h_d = 1.5$

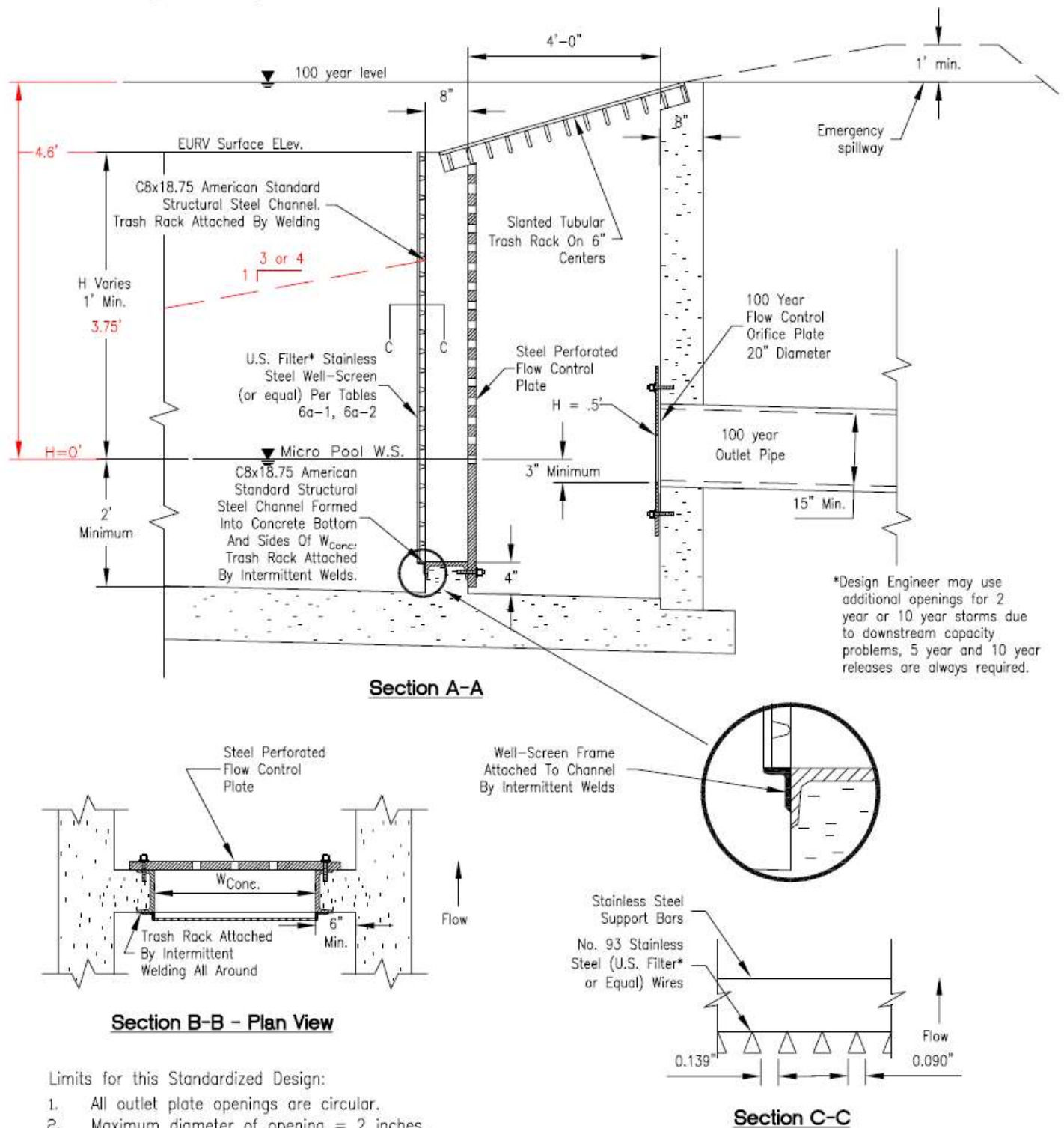
FIND:  $L$ , and check submergence

Solution:  $L_w = Q/CH^{3/2} = (100)/(3.8)/(2)^{3/2} = 9.3$  FT.

Submergence check

$$\frac{h_d}{h_e} = \frac{1.5}{2.0} = 0.75, \text{ then from Table 1401, } C_s/C = 1.0, \text{ therefore no submergence adjustment is required.}$$

Figure 1404  
Outlet Design Example



\*Design Engineer may use additional openings for 2 year or 10 year storms due to downstream capacity problems, 5 year and 10 year releases are always required.

Limits for this Standardized Design:

1. All outlet plate openings are circular.
2. Maximum diameter of opening = 2 inches.

\*U.S. Filter, St. Paul, Minnesota, USA

\* Recommended only for Ponds with a large tributary area

Red indicates design example

$$R \text{ Value} = (\text{net open area}) / (\text{gross rack area}) = 0.60$$

Reference: Urban Drainage and Flood Control District Drainage Criteria

Figure 1405  
**Underground Detention**

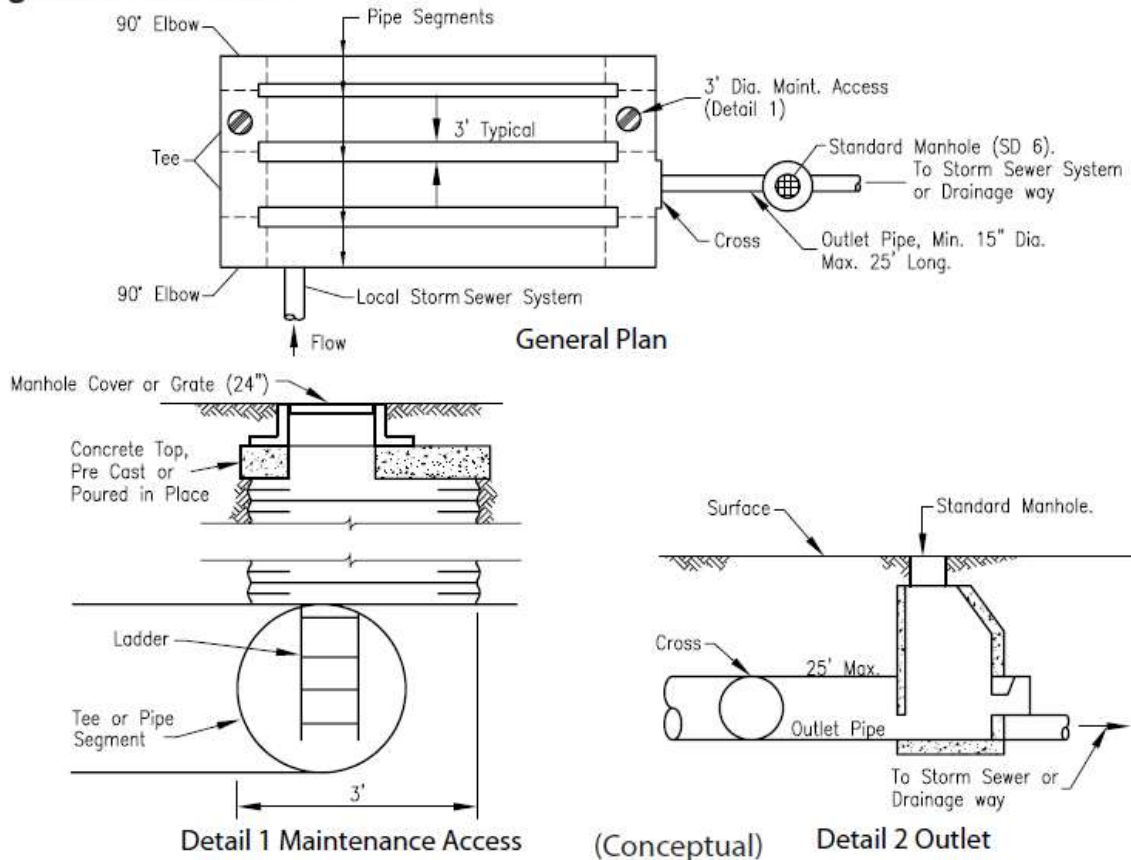
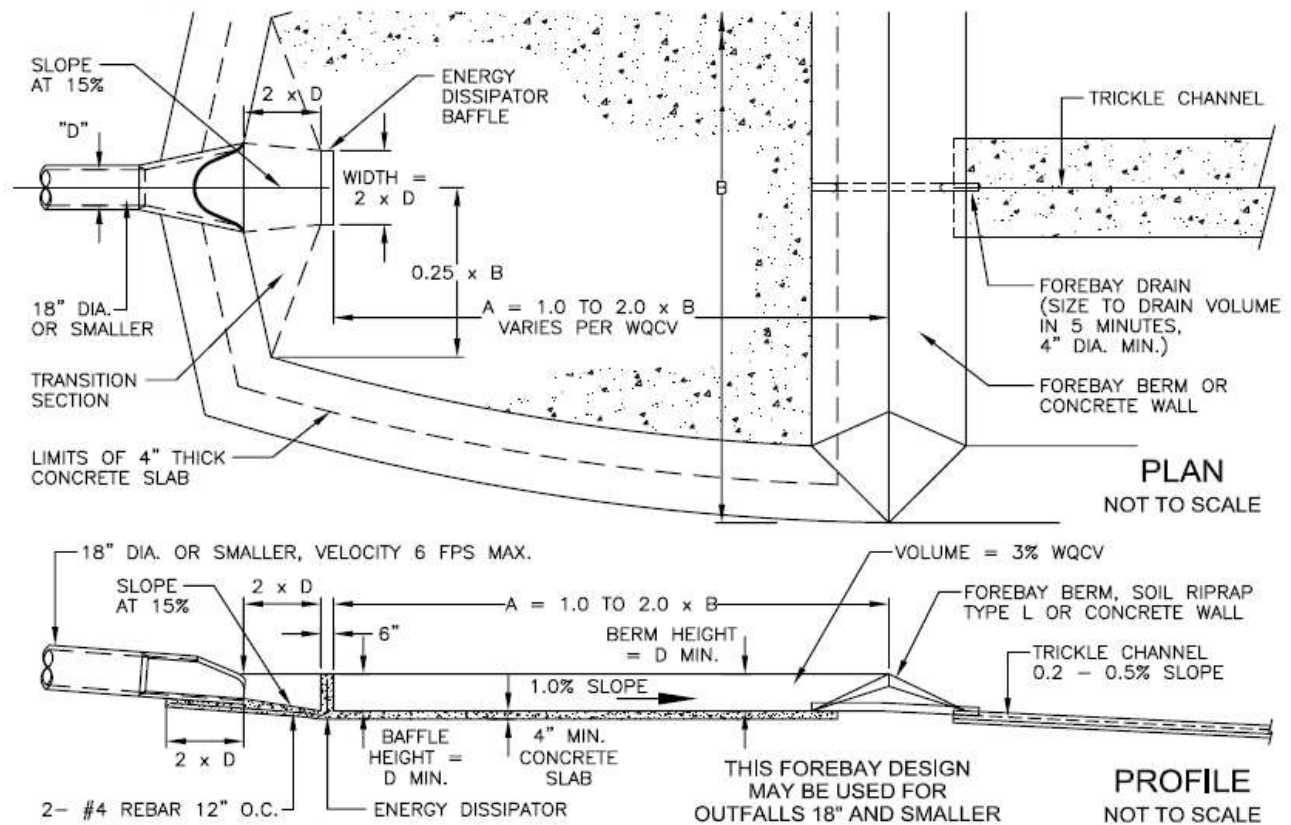


Figure 1406  
**Pond Forebay With Dissipator**

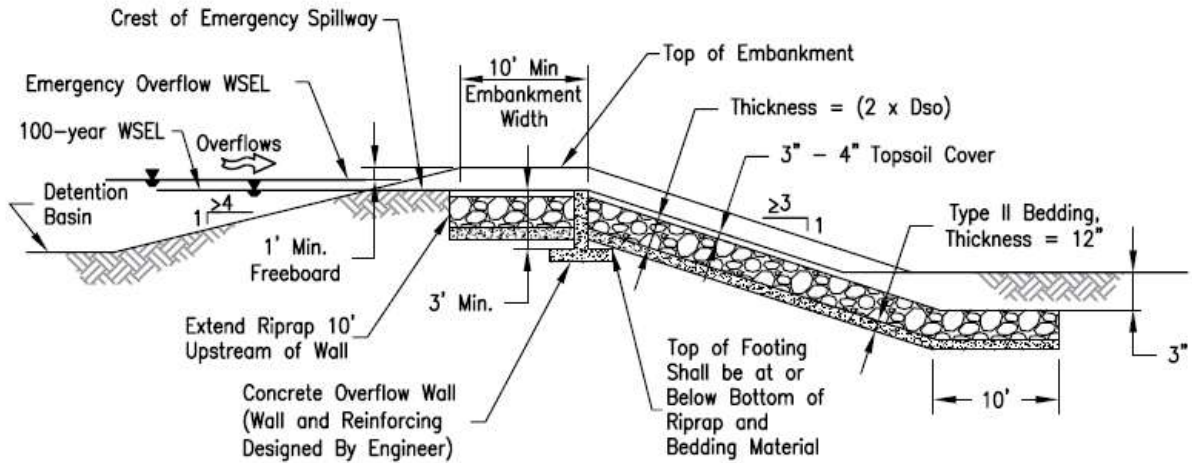


Adopted from the City and County of Denver Storm Drainage Criteria

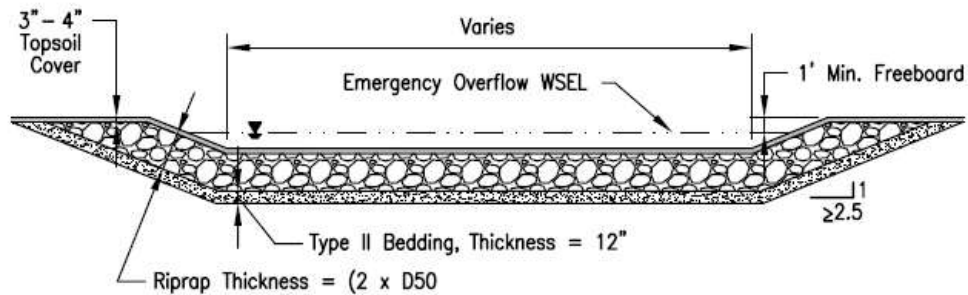


Figure 1407

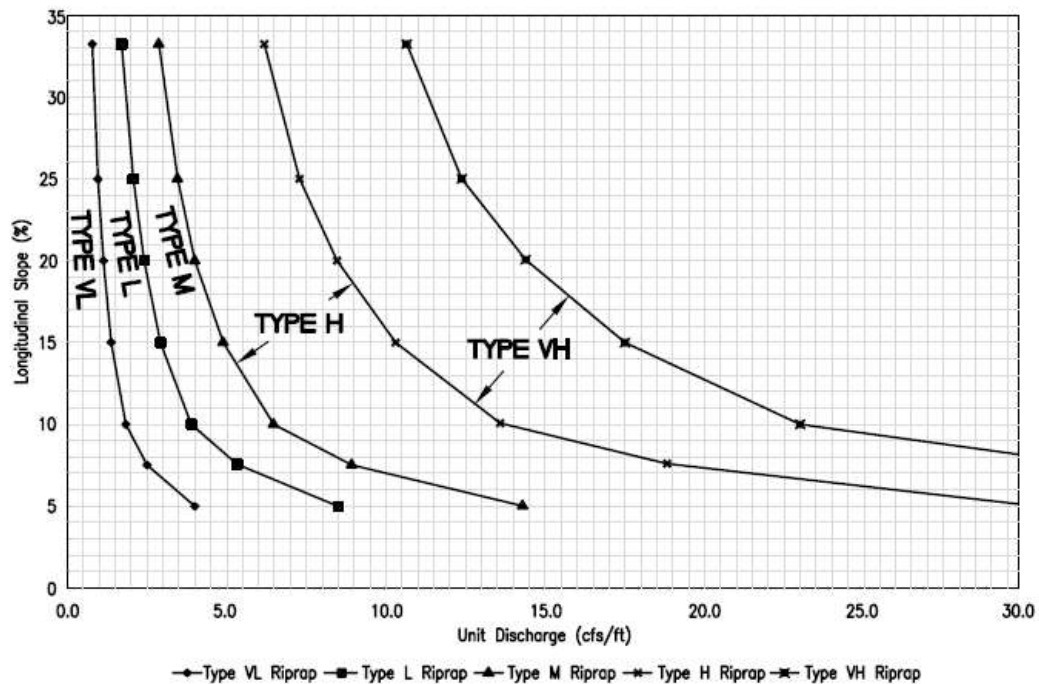
## Embankment Protection Details And Rock Sizing Chart



### Emergency Spillway Profile



### Spillway Channel at Crest and Downstream Side of Embankment

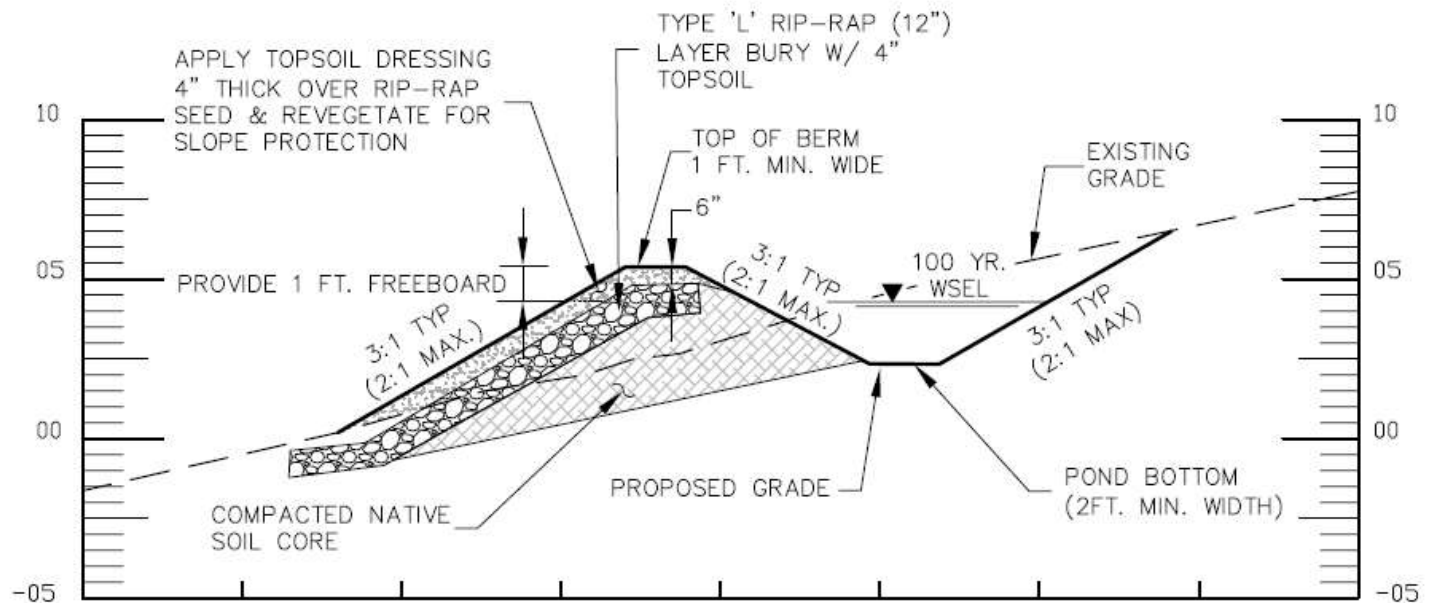


Reference: Douglas County Drainage Criteria

## Figure 1408 Mountain Porous Landscape Design

### NOTES:

1. Volume of Mountain Porous Landscape Design pond (MPLD): 100 year plus full water quality volume.
2. NRCS Hydrologic Soil Group:
  - a.) Type A and B - No percolation test required.
  - b.) Type C and D - Provide percolation test data for each proposed MPLD. Perform percolation test at bottom elevation of proposed MPLD. Provide soil classification analysis.
3. Provide verification that there are at least 4-feet of suitable material below the bottom of the proposed MPLD to allow for sufficient infiltration. Maximum drain time is 72 hours.
4. Maximum depth of MPLD: 5-feet including 1-foot of freeboard.
5. Maximum internal and external slopes: 2: 1 (H: V). Provide up-slope in-flow erosion control measures. Rolled erosion control products are required for slopes exceeding 3: 1.
6. Minimum pond bottom width: 2-feet.
7. Minimum top of berm width: 1-foot.
8. Elevation of top of berm shall be within 0.10 of a foot.
9. Overflow slope rip-rap: Type L minimum 12-inch minus. Verify with rip-rap calculations.
10. If the existing slope exceeds 30%, provide detail for key-in into native material. Based on site conditions, a slope stability analysis may be required.
11. The design engineer shall perform an open-hole inspection at time of excavation to verify soil conditions. The design engineer shall certify the volume of the MPLD with as-built drawings.
12. The MPLD shall be maintained by the property owner.



# Appendix

## Detention Facility Construction Drawing Checklist

### General

- ☐ Overall plan view of Detention Basin
- ☐ Pond profile(s)
- ☐ Enlarged plan view of forebay(s) and construction details
- ☐ Enlarged plan view of micropool(s) and construction details
- ☐ Outlet structure construction details
- ☐ Construction details of other features and components

### Overall Detention Plan View Details

- ☐ Prepare at a maximum scale of 1" =50'
- ☐ Proposed contours with contour labels and slope labels
- ☐ Existing contours with contour labels
- ☐ Show location and label forebay(s)
- ☐ Show location and label micropool
- ☐ Show location and label outlet structure
- ☐ Show location and label emergency overflow spillway
- ☐ Show location and label inflow pipe(s)
- ☐ Show location of stormwater management facility sign(s)
- ☐ Show location and label concrete trickle/low flow channel(s)
- ☐ Show location of riprap outlet protection
- ☐ Show location and label access/maintenance road(s) or ramps
- ☐ Show EURV water surface limits
- ☐ Show 100-year water surface elevation
- ☐ Existing and proposed utilities within or adjacent to Detention Basin
- ☐ Property/Tract boundaries
- ☐ Existing and proposed easements
- ☐ Label all proposed walls and provide spot elevations at top and bottom of wall

### Detention Basin Profile(s)

- ☐ Low flow/trickle channel profile from inlet(s) to outlet structure

- ☐ Invert elevations, longitudinal grades along flow path
- ☐ Profile through outlet structure and outlet pipe (provide pipe sizes, length, slope and hydraulic grade line)
- ☐ Invert elevations and longitudinal slopes of outlet structure features
- ☐ Invert elevations and longitudinal slopes of outfall pipe
- ☐ EURV water surface elevation
- ☐ 100-year water surface elevation
- ☐ Micropool depths and elevations
- ☐ Emergency overflow spillway elevation (with top of bank elevations)
- ☐ Energy dissipation/rip rap protection at pond outlet
- ☐ Energy dissipation/rip rap protection at emergency overflow spillway

Enlarged plan view of forebay(s) and construction details (See Figure 1406)

- ☐ Prepare at a maximum scale of 1" = 20'
- ☐ Enlarged plan view with dimensions and spot elevations, slope of bottom
- ☐ Cross section of concrete lined forebay with concrete slopes or 6" curb sides
- ☐ Structural/reinforcing details
- ☐ Energy dissipation structure details
- ☐ Drain pipe or weir detail
- ☐ Overflow protection, rip rap size, depth, dimension and location
- ☐ Maintenance access to forebay

Enlarged plan view of micropool and construction details

- ☐ Prepare at a maximum scale of 1" = 20'
- ☐ Enlarged plan view with dimensions, depths and spot elevations
- ☐ Cross section of concrete lined or grouted boulder micropool
- ☐ Permanent pool water surface elevation
- ☐ Floor elevation
- ☐ Details of low flow/trickle channel connection to micropool
- ☐ Details of connection to or interface with outlet structure
- ☐ Details for safety ramp/improvements

Outlet structure construction details

- ☐ Enlarged view with dimensions, depths and spot elevations

- ☐ Enlarged plan view to show proposed detailed grading/spot elevations around structure
- ☐ Cross sections, as required, to show depths, concrete thicknesses, EURV, 100-year and other appropriate water surface elevations, etc.
- ☐ Water quality outlet plate details and material specifications (plate dimensions, perforation size, number of row and a number of columns)
- ☐ Water quality outlet plate anchoring detail
- ☐ Overflow grate dimensions, material, type, opening size, anchoring detail
- ☐ Well screen/trash rack dimensions, material, type, opening size, anchoring detail
- ☐ Wingwall layout and structural reinforcing details

#### Construction details of other features and components

- ☐ Cross section of access/maintenance road(s) or ramps with all-weather surface treatment (specify material type, thickness, slope and width)
- ☐ Emergency overflow spillway profile and cross section (weir elevation, weir length, riprap size, depth, dimensions, bedding material)
- ☐ Construction details for stormwater management facility signs
- ☐ Low flow/trickle channel construction details (cross section, material specification, slope)



# **PROPOSED REGULATIONS – REDMARKED COPIES**

**TRANSPORTATION  
DESIGN AND  
CONSTRUCTION  
MANUAL –  
REDMARKED COPY**

# Jefferson County

# Transportation Design & Construction

# Manual

JEFFERSON COUNTY, COLORADO PLANNING AND ZONING DIVISION

## *Revision Dates*

*The Transportation Design & Construction Manual, formerly known as Roadway Design & Construction Manual, adopted by the Board of County Commissioners of Jefferson County, Colorado on March 21, 1995, has since been amended on the following dates:*

*December 5, 1995*

*May 12, 1998*

*March 23, 1999*

*October 1, 2002*

*July 1, 2003*

*November 25, 2003*

*December 5, 2006*

*May 20, 2008*

*October 13, 2009*

*November 24, 2015*

*July 17, 2018*

*December 17, 2019*

[XX-XX-XX](#)

Jefferson County Planning and Zoning Division

100 Jefferson County Parkway, Suite 3550, Golden, Colorado 80419

303-271-8700 • <http://planning.jeffco.us>

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*Resolution*

*Chapter I*

## General Provisions

### 1.1. Short Title

These regulations together with all future amendments shall be known as the “Jefferson County Transportation Design and Construction Manual” (hereafter called MANUAL) as referenced in the Jefferson County Land Development Regulation (hereafter called LDR) and the Jefferson County Zoning Resolution (hereafter called ZR).

### 1.2. Jurisdiction

The requirements of this MANUAL shall apply to all subdividers, developers or other landowners, their employees, agents or contractors designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations. The foregoing design and construction of transportation systems are subject to review and approval by the County pursuant to any County regulation or requirement.

### 1.3. Purpose and Effect

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads. All land development or any other proposed construction submitted for approval under the provisions of the LDR and/or ZR as applicable, shall include adequate transportation system analysis and appropriate transportation system design. Such analysis and design shall conform to the criteria set forth herein. Technical criteria not specifically addressed in this MANUAL shall follow the provisions of the American Association of State Highway and Transportation Officials (AASHTO) “A Policy of Geometric Design of Highways and Streets”, as amended; the Colorado Department of Transportation (CDOT) Design Standards, as amended; and the Manual on Uniform Traffic Control Devices (MUTCD), as amended.

### 1.4. Enactment Authority

The LDR has been adopted pursuant to the authority conferred within: Article 28 of Title 30 (County Planning); Article 2 of Title 43 (State, County, and City Highway Systems); Article 20 of Title 29 (Land Use Control and Conservation); and other applicable sections of the Colorado Revised Statutes, as amended.

This MANUAL is adopted by resolution of the Board of County Commissioners, as the authority provided by which the County promulgates the LDR.

Transportation Design and Construction Manual – Amended ~~12-17-19~~[XX-XX-XX](#)

### **1.5. Amendment and Revisions**

These criteria may be amended as new technology is developed and/or if experience gained in the use of this MANUAL indicates a need for revision. Amendments and revisions will be made by resolution of the Board of County Commissioners.

### **1.6. Enforcement Responsibility**

It shall be the obligation of the Board of County Commissioners acting through the Department of Development and Transportation to enforce the provisions of this MANUAL.

### **1.7. Review and Approval**

The County will review all submittals for compliance with this MANUAL. An approval by the County does not relieve the owner, engineer, or designer from responsibility of ensuring that the calculations, plans, specifications and construction are in compliance with the MANUAL and accepted engineering practices.

### **1.8. Interpretation**

In interpretation and application of the provisions of the MANUAL, the following shall govern:

1.8.1. The provisions shall be regarded as the minimum requirements for the protection of public health, safety, comfort, convenience, prosperity, and welfare of the residents of the County.

1.8.2. Whenever a provision of this MANUAL and any other provision of the LDR or any provision in any law, ordinance, resolution, rule, or regulation of any kind, contains any restriction covering any of the same subject matter, whichever restrictions are more restrictive or impose higher standards of requirements shall govern.

1.8.3. This Jefferson County Transportation Design and Construction Manual was adopted by the Board of County Commissioners on March 21, 1995. Any amendments to this MANUAL shall be immediately effective upon its adoption by the Board of County Commissioners. All applications shall be subject to the provisions of this MANUAL that are in effect at the time of the formal application submittal, unless otherwise specified by the Board of County Commissioners resolution.

### **1.9. Relationship to Other Standards**

If the State or Federal Government imposes stricter criteria, standards, or requirements, these shall be incorporated into the County's requirement after due process and public hearings needed to modify the County's regulations and standards.

## ***Chapter 2***

# **Construction Drawing Requirements**

### **2.1. General Requirements**

Construction drawings must be submitted in Portable Document Format (PDF) unless otherwise approved for hard copy submittal, to scale, shall be a complete package, which includes all details and documentation necessary for the construction of the proposed improvements. The plans shall be prepared by, or under the direction of a professional engineer, registered in the State of Colorado, and qualified in the field of civil engineering.

The final set of plans (hard copy) for each drawing shall be 24" x 36", unless otherwise approved by the County, and shall contain a title block, sheet number, scale, north arrow, and date.

The developer's engineer shall comply with Colorado Revised Statute 9-1.5-101 through 9-1.5-108 "Excavation Requirements" when the nature of work proposed (1) will involve a contract with Jefferson County (this shall include, but not be limited to binding agreements such as permits and Subdivision Improvement Agreements); (2) will involve primarily Horizontal Construction and not the construction of buildings; (3) will involve excavation that exceeds two (2) feet in depth and that is a contiguous 1,000 square feet, or involve Utility

Boring; and (4) requires the design services of a licensed professional engineer. Existing and Proposed Subsurface Utilities shall be identified on the design plans in accordance with ASCE 38 Standards. For more information please reference the Colorado Revised Statutes and Federal Highway Administration websites.

## 2.2. Cover Sheet

A cover sheet ~~should~~ shall be provided with each submittal which contains the following:

1. A vicinity map at a minimum scale of 1" - 2000' which shows the location and name of all arterial streets/roads within one mile of the proposed development and all streets/roads within the proposed development.
2. A legend, scale, and north arrow.
3. General notes.
4. Index of sheets.
5. Seal, signature, and date of the professional engineer responsible for plan preparation.
6. A permanent benchmark description and location based on USGS datum. At least one permanent benchmark must be established within each subdivision or filing thereof, located on public property.

If a cover sheet is not provided, the above information shall be included on the first sheet of the submittal.

## 2.3. Plan

The plan view shall include but not be limited to, the following:

1. The scale shall be a minimum of one (1) inch to fifty (50) feet and shown on the plan.
2. Locations and dimensions of existing and proposed improvements, property lines, easements, and Right-of-Way. Plan view limits shall extend 100 linear feet before the Point of Beginning, and 100 linear feet after the Construction End. Each Point of Beginning and Construction End shall be clearly labeled and identified with stationing.
3. Names of streets/roads.
4. Survey line ties to section or quarter corners.
5. Survey lines and centerline stationing. Stationing shall be equated to flowline stationing at horizontal radius curves, cul-de-sacs, and other departures from normal roadway cross sections.
6. Centerline stations for all intersecting roadways and commercial driveways.
7. Existing and proposed street/road improvements (sidewalk, curb, gutter, pavement limits, bridges, culverts, inlets, manholes, asphalt core sample locations, guardrails, curb ramps, etc.). Existing improvements shall be clearly depicted by a dashed line; proposed improvements shall be depicted by a solid line and or greyscale or hatching. Plans shall include existing and proposed limits for asphalt pavement, including areas of milling and overlaying, as well as new asphalt placement. All items shall have a corresponding legend.
8. Curve layout including radius, degree of curve, deflection angle, length of curve, point of curvature, and point of tangency.
9. Elevations and station shall be noted for all curb returns, points of curvature, points of tangency, and high or low points of all vertical curves. The existing and proposed percent cross slope shall be repeated on the plan sheets at select points. Include elevations and cross slopes, existing and proposed, for all lanes of intersection improvements, regardless if construction is planned for opposing streets.
10. Rate of super elevation.
11. Typical template(s) for streets/roads.

12. Match lines and consecutive sheet numbers.
13. Key map.
14. A minimum of one (1) permanent bench mark, based on United States Geological Survey's datum, fully described, within each subdivision or filing thereof.
15. Existing and proposed utilities and structures, including but not limited to: water, fire hydrants, sanitary sewer, storm sewer, telephone, gas, electric, cable television, fiber optic. Existing utility pothole information shall be organized on a separate plan sheet to identify location, depth, utility type, pipe size and material, conflicts with proposed improvements, and other information obtained during subsurface investigation. Subsurface investigation shall include new laterals or service connections to existing main lines and be clearly shown on separate plan sheets. \*
16. Stations and critical elevations of all utility and drainage appurtenances. \*
17. Construction phasing. \*
18. Major Collector and/or Arterial intersection design at a scale of one (1) inch to twenty (20) feet. \*
19. Traffic signal design at a scale of one (1) inch to twenty (20) feet. \*
20. Signing and Striping Plan.
20. Noise attenuation measures/details. \*
21. Trails. \*
22. Sediment and erosion control measures/details. \*
23. Landscaping. \*

\*May be included on separate plan sheets.

## 2.4. Profile

The profile shall include, but not be limited to the following:

1. The scale shall be a minimum of one (1) inch to five (5) feet for street profiles and a minimum of one (1) inch to ten (10) feet for road profiles, and be shown on the plan.
2. Existing (dashed line) and proposed (solid line) grades.
3. Continuous centerline stationing for the entire portion of the existing and proposed roadway shown in the plan. Clearly label centerline stationing for all intersecting roadways and commercial driveways.
4. All design elevations shall be centerline, flowline, back of curb, or lip of gutter.
5. Vertical curve data including length of curve, P.V.C., P.V.T., P.V.I., beginning and end grades. All vertical curves shall be symmetrical.
6. Curb return profiles at a horizontal scale of 1" = 10' and vertical scale of 1" = 1'.
7. All existing curbs, gutters, sidewalks, culverts or storm sewers, ditches and irrigation structures and asphalt adjacent to the proposed design, as well as the same such features that are 100 linear feet before the Point of Beginning and continue for 100 linear feet beyond the Construction End. Basis for existing grades shall be as-built elevations at intervals not to exceed fifty (50) feet. All existing grades, locations and alignments shall be field surveyed by a licensed Professional Land Surveyor for design of the proposed improvements. Previously approved designs are not an acceptable means of establishing existing grades.
8. Separate flowline or top of curb profiles shall be provided for all proposed curb and gutter, including for design of cul-de-sacs and any other departure from a 2% street/road cross slope. In addition, cross-sections at intervals not to exceed 50 feet are required if a departure from a normal cross-slope is proposed.
9. Existing and proposed utilities. \*



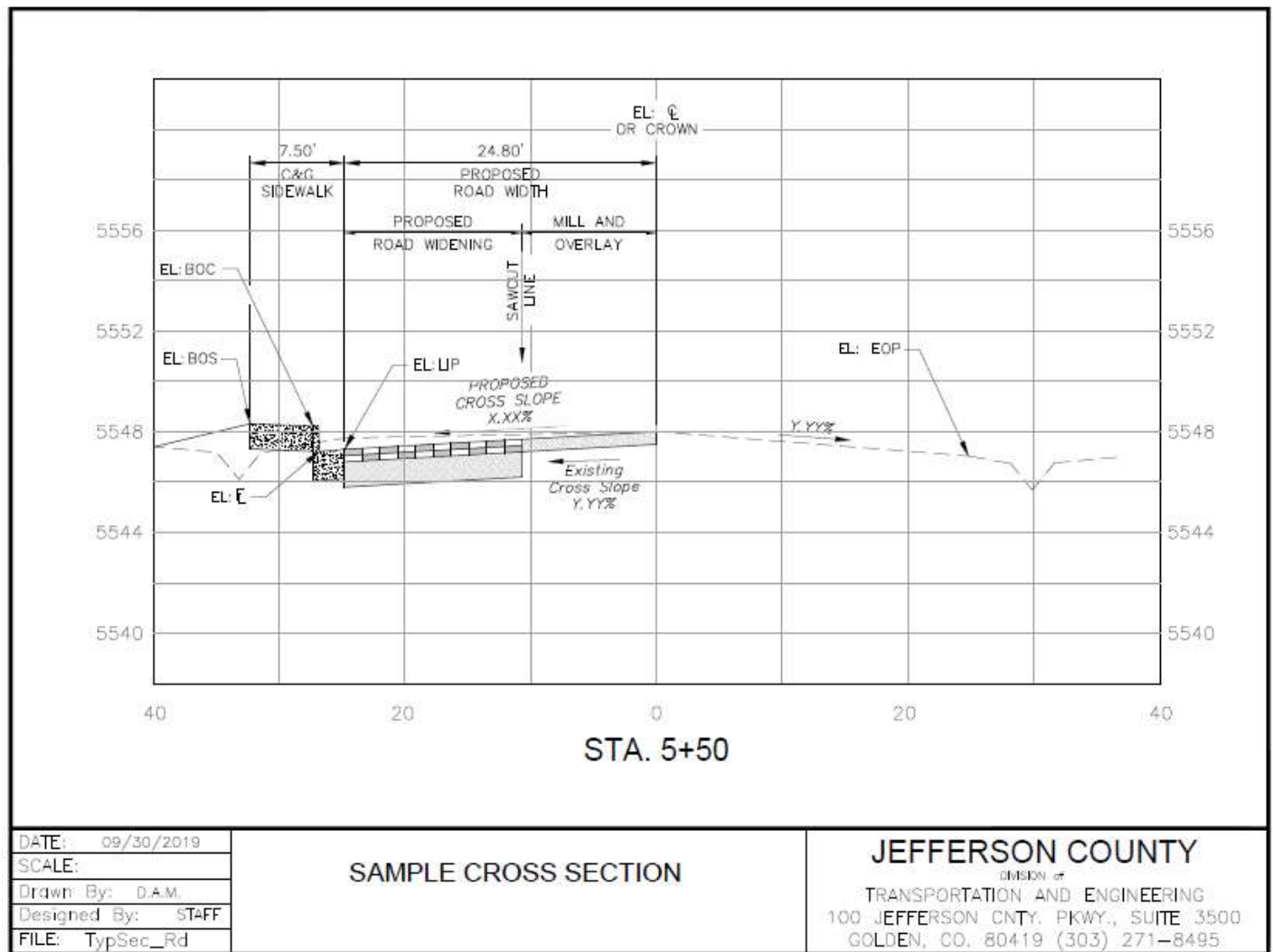
\*May be included on separate plan sheets.

## 2.5. Cross Sections

1. On widening or matching projects, or as required by the Jefferson County Planning & Zoning, cross sections of the proposed new construction and existing improvements within the Right-of-Way shall be provided at survey stationing at a maximum of fifty foot intervals and at locations of cross culverts. The scale shall correspond to that used on the plan and profile.
2. Cross sections shall identify both the existing or matching percent cross slope of the roadway, as well as percent proposed cross slope.
3. Cross sections shall identify the elevation at the point of match for widening projects for each station interval.
4. Cross sections shall identify the proposed new road segment in gray scale or other hatching.
5. Cross sections shall identify the proposed pavement treatment or alterations, such as mill and overlay of the match point; as well as the proposed new pavement section and respective lifts asphalt.
6. Core samples shall be collected from the existing roadway prior to construction to determine the existing asphalt depth and condition. Such cores shall not exceed 4-inches in diameter and shall be collected at the centerline of the existing road, as well as edge of existing asphalt. The existing depth of asphalt shall be represented on the cross sections.
7. Proposed widening shall avoid cross sections with gross inverts or peaks at the match point. Normal roadway cross sections shall follow AASHTO design criteria that limit the minimum cross slope to 1.5% and maximum cross slope to 3.0%. Cross slope grade change shall not exceed +/- 0.5% as measured every 50 linear feet along the station intervals. There shall be no change in existing cross slope greater than +/- 1.0% from the match point to the proposed edge of asphalt, or the flow line or the lip of the gutter pan.

Refer to Figure 2-1 "Sample Cross Section" below:

Figure 2-1 - Sample Cross Section



## 2.6. Details

Jefferson County or CDOT standard details ~~may~~shall be referenced as applicable. Where these standards cannot be used, a separate detail sheet shall be provided with an explanation detailing why these standard details are not being used.

## 2.7. Standard Notes

The following general notes shall appear on the cover sheet or the first sheet of the plans for all street/road construction plan packages.

1. A Construction Permit from Transportation and Engineering is required prior to commencing work within County Right-of-Way.
2. Any work within State Right-of-Way will require a State Construction Permit.
3. The contractor shall notify Transportation and Engineering at least 24 hours prior to starting construction within the Right-of-Way.
4. The contractor shall provide all signs, barricades, ~~flagmen~~flaggers, lights, or other devices necessary for safe construction traffic control in accordance with the current edition of the MUTCD and as modified by the Colorado Supplement to the MUTCD. A construction traffic control plan shall be submitted to and approved by Transportation and Engineering prior to the issuance of any construction

permit for work within County Right-of-Way.

5. The contractor shall contact the Utility Notification Center of Colorado at least 48 hours prior to construction.
6. Construction specification: Current edition of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, special provisions and revisions thereto, and as amended by Chapter 5 of this MANUAL.
7. The subgrade material shall be scarified or removed to a depth required by Jefferson County per information obtained from laboratory tests and/or as required in the Pavement Design Report. Additives or approved material may be required if the native material is unsatisfactory. The subgrade shall be compacted to a minimum density and moisture content range of 2 percent below optimum to 2 percent above as determined in accordance with AASHTO designation T180 or T99 and in accordance with the Standard Specifications Section 203.07.
8. Class 6 aggregate base course for shoulders shall be placed and compacted 95 percent modified Proctor Test (AASHTO T180) after placement of asphalt.
9. Existing asphalt pavement shall be straight sawcut or blade-cut when adjoining with new asphalt pavement. SS-1 tack coat shall be applied to all surfaces.
10. Structural section, including subbase and asphalt, shall be constructed according to the Final Pavement design that has been prepared by the developer's engineer, and approved by Transportation and Engineering according to Chapter 4 of this MANUAL. Existing structural section at the match point shall comply with the minimum Full Depth Asphalt thickness identified in Table 4.3 "Minimum Pavement Sections" of this MANUAL for the respective road classification, regardless of the original thickness of asphalt and / or sub-base.

The following notes shall appear in addition to the above for all street construction, as applicable:

1. Concrete may be placed by machine methods if all finish lines are within 1/8" + tolerance of the lines shown on the plans. The flowline must be free draining and comply with this MANUAL.
2. One half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.
3. The contractor is advised to first obtain inspection of forms by Transportation and Engineering before placing concrete curb, gutter, sidewalk, inlets, and/or other concrete drainage structures.

### *Chapter 3*

## **Design and Technical Criteria**

### **3.1. General**

This section sets forth the minimum design and technical criteria to be used in the preparation of all [public and private](#) street/road construction plans. All street/road design shall be in accordance with the current edition of AASHTO Geometric Design of Highways and Streets, unless modified herein.

For this regulation, streets shall be used in the Plains and roads shall be used in the Mountains, except as indicated below:

- 3.1.1 Roads may be allowed in the Plains in locations with slopes greater than 15%, subject to approval by Planning and Zoning.
- 3.1.2 Streets may be required in the following Mountains locations as directed by Planning and Zoning: 1) Areas where urban development is projected based on Community Plans designations, 2) Areas where curb and gutter would be needed to mitigate drainage impacts.

## 3.2. Street/Road Types

3.2.1 Public Streets/Roads: Streets or roads that are owned and maintained by the City, County or State for public use.

3.2.2 Private Streets/Roads: Streets or roads that are owned, maintained, or restricted for the use by a person, group of people, or non-governmental entity.

3.2.3 Non-Maintained Streets/Roads in County ROW: Streets or roads that are owned by the County for public use, but are not constructed to a County public standard and are not County maintained.

## 3.3. Functional Classification

Jefferson County has adopted a Major Thoroughfare Plan based on traffic volumes, existing and/or zoned land use, and anticipated growth. The Major Thoroughfare Plan designates streets/roads as freeway, parkway, principal arterial, minor arterial, major collector, or collector.

3.3.1. Freeway: A freeway serves major regional traffic movements and carries the highest traffic volume of all classifications. A freeway is planned to have four to six through lanes and may have frontage roads. The movement of traffic takes precedence over access. Access is fully controlled and is allowed only to other freeways or to arterials by grade separated interchanges. Opposing movements on a freeway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes. A freeway may be developed as a parkway with at-grade intersections as a first phase. Freeways are typically in State jurisdiction.

Design Speed: Special Design Required

3.3.2. Parkway: A parkway serves major regional traffic movements and carries high traffic volumes. A parkway is planned to have four to six through lanes. The movement of traffic takes precedence over access. Access is fully controlled and allowed only to major collector classifications or higher. Grade separation at major intersections is preferred over traffic signals. Opposing movements on a parkway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 40 - 50 MPH

3.3.3. Arterial.

3.3.3.1. Principal Arterial: A principal arterial serves major regional traffic movements and carries high traffic volumes. A principal arterial is planned to have four to six through lanes in the Plains and four through lanes in the Mountains. The movement of traffic takes precedence over access. Access is controlled and allowed to collectors and higher class facilities is preferred, but some restricted access to major developments may be allowed. Opposing movements are usually separated by a raised, depressed, or painted median. Pedestrians and bicycle traffic may be carried on detached walks and trails unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 35 - 45 MPH

3.3.3.2. Minor Arterial: A minor arterial serves intracommunity traffic and carries moderate traffic volumes. Minor arterials are planned to have four lanes in the Plains. In the Mountains, minor arterials are planned to have two lanes, plus turn lanes and passing or climbing lanes where warranted. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally separated by a raised, depressed, or painted median in the Plains. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40 MPH

3.3.4. Major Collector: A major collector serves intracommunity traffic and carries moderate traffic volumes. Major collectors are planned to have two lanes, plus turn lanes where warranted, in the Plains and the Mountains. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally

separated by a median/turn lane. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40MPH

3.3.5. Collector: A collector serves neighborhood traffic movements over short distances, generally accessing arterials and major collectors. A collector has two lanes, plus turn lanes where warranted, in the Plains and two lanes in the Mountains. Access takes precedence over the movement of traffic. Reasonable access [for streets](#) is allowed except for private residential driveways. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 25 - 30 MPH

3.3.5. Local: A local street or road serves neighborhood traffic over very short distances to higher class roadways. A local street or road has two travel lanes. It is always paved in the Plains and usually paved in the Mountains. Access to adjacent land is its primary purpose. All types of access are allowed. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 15 - 25 MPH

### 3.4. Standard Templates

The following templates reflect the minimum section for each street/road classification and for cul-de-sacs. Any additional requirements including, but not limited to, acceleration/deceleration lanes and left turn lanes are not shown.

Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
1	Principal Arterial Street	Greater than 25,000	130'
2	Minor Arterial Street	15,000 to 25,000	100'
3	Major Collector Street	8,000 to 15,000	<del>78'</del> 84'
4	Collector Street (36' FL to FL) with Attached Sidewalks	1,000 to 8,000	50'
5	Collector Street (36' FL to FL) with Detached Sidewalks	1,000 to 8,000	37' + 20' <a href="#">minimum</a> easement for sidewalks, maintenance and traffic signs
6	Local Street (34' FL to FL) with Attached Sidewalks	Less than 1,000	50'
7	Local Street (34' FL to FL) with Detached Sidewalks	Less than 1,000	35' + 20' <a href="#">minimum</a> easement for sidewalks, maintenance and traffic signs
8	Local Street (28' FL to FL) with Attached Sidewalks	Less than 350	45'
9	Local Street (28' FL to FL) with Detached Sidewalks	Less than 350	30' + 18' <a href="#">minimum</a> easement for sidewalks, maintenance and traffic signs

Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
10	Minor Arterial Road	Greater than 8,000	70'
11	Major Collector Road	2,000 to 8,000	50' <del>55'</del> 60' for turn lanes
12	Collector Road	1,000 to 2,000	50'
13	Local Road	Less than 1,000	50'
14	Street Cul-de-sac – Option 1 Street Cul-de-sac – Option 2 Street Cul-de-sac – Option 3	See LDR, Section 15	90' 100' 112'
15	Partial Cul-de-sac for Local Streets	See LDR, Section 15	45' <del>R</del>
16	Offset Cul-de-sac for Local Streets – <a href="#">Option 1</a> <a href="#">Offset Cul-de-sac for Local Streets – Option 2</a> <a href="#">Offset Cul-de-sac for Local Streets – Option 3</a>	See LDR, Section 15	90' <a href="#">100'</a> <a href="#">112'</a>
17	Cul-de-sac for Local Roads	See LDR, Section 15	90'
<a href="#">Driveway, p</a> Private street/road templates and Non-maintained streets/roads in County ROW templates ( <a href="#">see section 3.7.8</a> ) *			
<del>18</del>	<del>Driveway/Private Street/Road &amp; Non-maintained Street/Road in County ROW (No Parking)</del>	See LDR, Section 15	20' minimum
<a href="#">18a</a>	<a href="#">Driveway</a>		<a href="#">14'- 16'</a>
<a href="#">18b</a>	<a href="#">Private Road</a>		<a href="#">14'-24'</a>
<a href="#">18c</a>	<a href="#">Private Street with Curb and Gutter</a>		<a href="#">14'-24'</a>
<a href="#">18d</a>	<a href="#">Private Street with Streetside Ditch</a>		<a href="#">14'-24'</a>
19	Pull Out for Private Road	N/A	n/a
20	Hammerhead Turnaround for Driveway/Private Road	See LDR, Section 15	varies
21	Hammerhead Turnaround for Private Street	See LDR, Section 15	varies

\*The "non-maintained streets/roads in County ROW" templates can only be used if the following provisions apply:

1. The County is not holding a guarantee [for](#) a previous development process that would require the construction of a County public standard street/road in the ROW.
2. The County does not wish to have the street/road constructed to a County public standard.
3. The street/road is not identified on the Jefferson County Major Thoroughfare Plan.

### 3.5. Horizontal Alignment

3.5.1. Horizontal Curves: [The design of roadway curves should be based on an appropriate relationship between design speed and curvature and on their joint relationships with superelevation \(roadway banking\) and side friction. Although these relationships stem from the laws of mechanics, the actual values for use in design depend on practical limits and factors determined more or less empirically, and the most recent edition of AASHTO Policy on Geometric Design of Highway & Streets \(the Green Book\) Chapter 3 should be referenced for designing appropriate horizontal curves.](#) ~~Minimum curve radii for a normal crown section based on design speed are summarized in the table below.~~

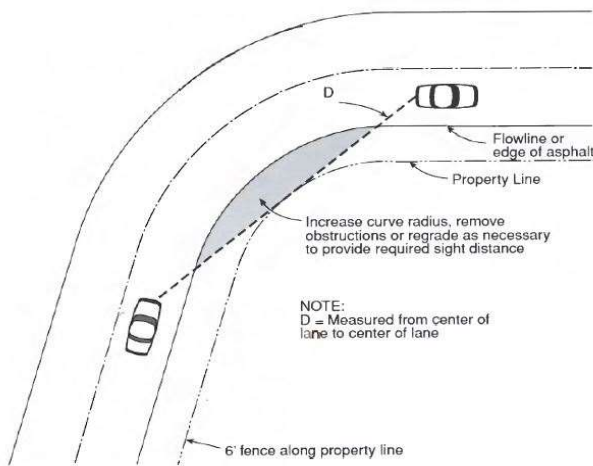
Design Speed (mph)	<del>Minimum Curve Radius (feet)</del> <a href="#">Paved</a>	<a href="#">Recycled Asphalt</a>	<a href="#">Gravel</a>
15	50	<a href="#">60</a>	<a href="#">75</a>
20	<del>107</del> <a href="#">90</a>	<a href="#">110</a>	<a href="#">135</a>
25	<del>198</del> <a href="#">140</a>	<a href="#">170</a>	<a href="#">210</a>
30	<del>333</del> <a href="#">200</a>	<a href="#">240</a>	<a href="#">NA</a>
35	<del>510</del> <a href="#">275</a>	<a href="#">NA</a>	<a href="#">NA</a>
40	<del>762</del> <a href="#">Special Design</a>	<a href="#">NA</a>	<a href="#">NA</a>
45	<del>1039</del> <a href="#">Special Design</a>	<a href="#">NA</a>	<a href="#">NA</a>
50	Special Design	<a href="#">NA</a>	<a href="#">NA</a>

~~3.5.1.1. For collector roads, the centerline line radius may be reduced to a minimum of one hundred (100) feet, provided, however, that on a curve with a centerline radius less than four hundred (400) feet, the maximum grade shall be reduced by one (1) percent for each one hundred (100) feet or fraction thereof the radius is reduced.~~

3.5.2. Super Elevation: Super elevation is required for curves on all principal and minor arterial streets/roads and selected collector streets/roads. Minimum horizontal curve radius, rate of super elevation, and lengths of tangent runout and super elevation runoff shall be in accordance with the recommendations of the current edition of AASHTO [Policy on](#) Geometric Design of Highways and Streets.

Super elevation shall not be used on local streets, but may be used on local roads.

3.5.3. Sight Distance: Horizontal alignment must provide at least the minimum stopping sight distance for the design speed at all points. This includes visibility at intersections, as well as around curves and roadside encroachments. Where an object off the traveled surface restricts sight distance, the minimum radius of curvature is determined by the stopping sight distance. A likely obstruction may be a bridge abutment, retaining wall, cut slope, landscaping, or side or corner of a building. In considering sight distance, it shall be assumed a 6'-0" fence (as measured from finished grade) exists along all property lines except in the sight distance triangles required at all intersections. Minimum stopping sight distance (measured from the centerline of the inside lane) shall [follow AASHTO Policy on Geometric Design of Highways & Streets \(The Green Book\) Chapter 3.](#) ~~be as follows for centerline grades equal or less than 3%:-~~



Design Speed (mph)	Stopping Sight Distance (d) (feet)
15	80
20	115
25	150 <del>5</del>
30	200
35	250
40	30 <del>2</del> 5
45	<del>400</del> 360
50	42 <del>7</del> 5

~~For grades greater than 3%, stopping distance shall be in accordance with the recommendations of the current edition of AASHTO Geometric Design of Highways and Streets.~~

### 3.6. Vertical Alignment

3.6.1. Grades: The minimum grade for all new streets and roads is 2%, except within a sag. A minimum flowline grade of 1.5% shall be maintained around all full and partial cul-de-sac bulbs, except within a sag. Planning and Zoning may approve grades as low as 1% if existing conditions make it infeasible to construct a minimum of 1.5%. The maximum grade for all public streets is 6.0% and for public roads is 8.0%. The maximum grade for public roads may be increased to 10% where the dip of the natural terrain bears between South 60° East and South 45° West.

3.6.2. Intersection Grades: The maximum grade at intersections shall be in accordance with the following figure and table. Grades and lengths apply to the street/road controlled by a stop sign. At signalized and uncontrolled intersections, grades and lengths apply to all legs of the intersection.

	Through Street / Road		
Intersection Street/Road	Local	Collector	Major Collector/Arterial
Local	50' @ 4%	100' @ 4%	100' @ 4%
Collector	-	100' @ 3%	200' @ 2%
Major Collector/Arterial	-	-	200' @ 2%

3.6.3. Changing Grades. Continuous grade changes shall not be permitted. The use of grade breaks in lieu of vertical curves is discouraged; however, if a grade break is necessary and the algebraic difference in grade (A) does not exceed four-tenths (0.40) of a percent along the street/road, the grade break will be permitted.

The maximum grade break allowed at the point of tangency at a curb return for local and collector streets shall be two (2) percent and a maximum of one (1) percent for arterial streets.

3.6.4. Vertical Curves. All vertical curves shall be symmetrical. A vertical curve shall be used when the algebraic difference in grade (A)



equals or is greater than four-tenths (0.40) of a percent. The minimum grade within a sag (sump) vertical curve is five-tenths (0.50) of a percent. All vertical curves shall be labeled, in the profile with curve length (L) and K value ( $= L/A$ ). [Vertical Curve requirements shall apply to all public and private streets, roads and driveways.](#) The minimum K values for crest and sag vertical curves shall be in accordance with ~~the following table~~ [the current edition of AASHTO Policy on Geometric Design of Highways & Streets \(The Green Book\) Chapter 3.](#)

Design Speed (mph)	Minimum K Value	
	Crest	Sag
30	<del>30</del> <a href="#">19</a>	<del>40</del> <a href="#">37</a>
35	<del>50</del> <a href="#">29</a>	<del>50</del> <a href="#">49</a>
40	<del>80</del> <a href="#">44</a>	<del>70</del> <a href="#">64</a>
45	<del>120</del> <a href="#">61</a>	<del>90</del> <a href="#">79</a>
50	<del>160</del> <a href="#">84</a>	<del>110</del> <a href="#">96</a>

### 3.6.5. Connection with Existing Streets/Roads

3.6.5.1. Connection with existing roadways shall be smooth transitions conforming to normal vertical curve criteria (see Section 3.6.4. of these standards) if the algebraic difference in grade (A) between the existing and proposed grade exceeds four-tenths (0.40) of a percent. When a vertical curve is used to make this transition, it shall be fully accomplished prior to the connection with the existing improvement, and comply with the grade requirements at intersection approaches.

3.6.5.2. Existing grade shall be shown for at least three hundred (300) feet with field verified as-builts showing stations and elevations at twenty-five (25) foot intervals. In the case of connection with an existing intersection, these as-builts are to be shown within a three hundred (300) foot radius of the intersection. This information will be included in the plan and profile that show the proposed roadway.

3.6.5.3. Previously approved designs for the existing improvement are not an acceptable means of establishing existing grades; however, they are to be referenced on the construction plan where they occur.

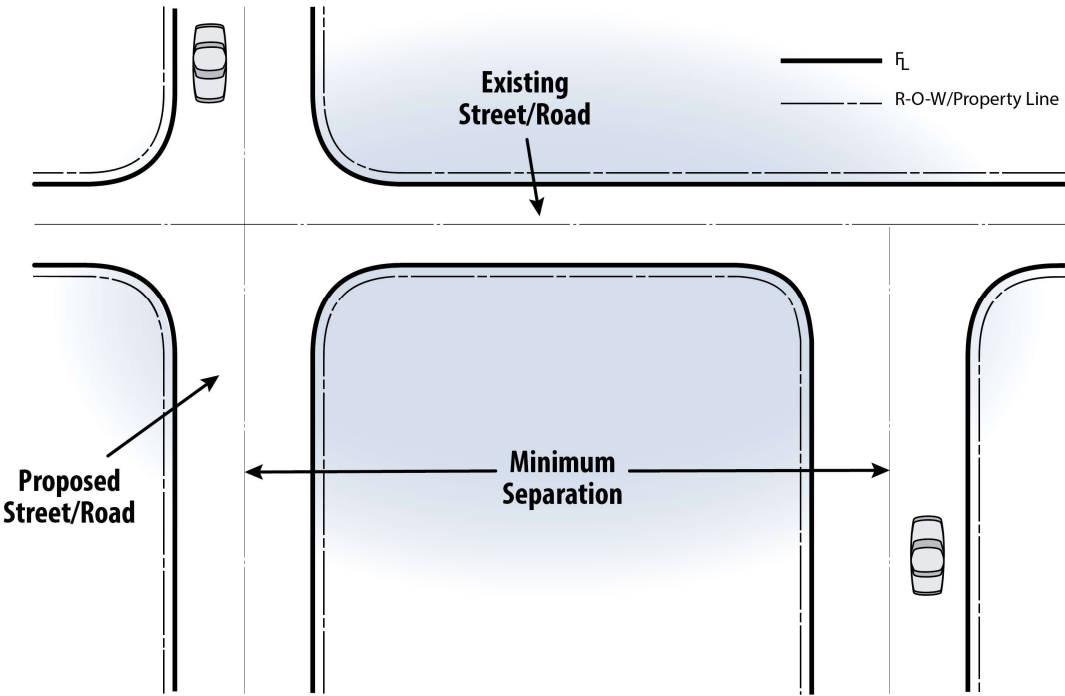
3.6.5.4. The basis of the as-built elevations shall be the same as the design elevations (both flowline or top of curb, etc.) unless otherwise approved by Planning and Zoning.

## 3.7. Intersection Spacing, Vision Clearance Triangle and Sight Distance [for Streets, Roads and Driveways](#)

3.7.1. Intersection Spacing: Spacing of intersections (measured centerline to centerline) shall be in accordance with the following table [and the graphic below](#):

Proposed Street/Road: Existing Street/Road	Minimum Separation (feet)
Local: Local or Collector	175
Local: Arterial or Major Collector	500
Collector: Collector	230
Collector: Major Collector <del>or higher</del>	<del>1000</del> <a href="#">660</a>
<a href="#">Collector: Arterial or higher</a>	<a href="#">1000</a>
Major Collector: Major Collector	<del>660</del> <a href="#">1000</a>

Major Collector: Arterial or higher	1320
Arterial: Arterial or higher	5,280'

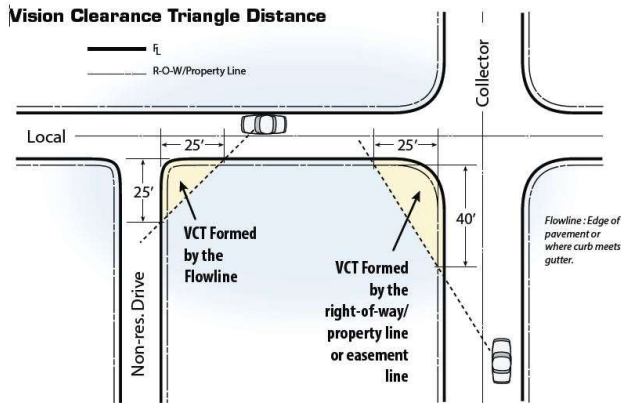


3.7.2. Vision Clearance Triangle: The table below shows where a vision clearance triangle must be provided.

Required	Not Required
Street/Road Intersections	Intersection of internal drive isles in non-residential*
Intersections of non-residential driveways with streets/roads	Multi-family and townhome developments*
Intersections of multifamily and/or townhome residential drive isles with streets/roads	
Intersections of street/roads and railroad Right-of-Way	

*\*Layout of these types of developments should not impede a driver's ability to see on-coming vehicles and pedestrians at intersections*

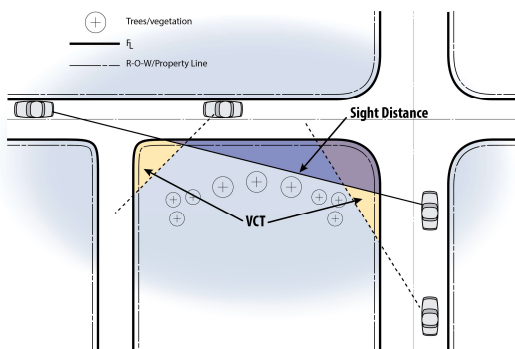
As illustrated below, the vision clearance triangle must provide an unobstructed view across the triangle formed by the Right-of-Way/property line or easement line adjacent to a street or road as illustrated. The vision clearance triangle may also be formed by the flowline adjacent to a street or road as illustrated below subject to approval by Planning and Zoning. The approval of the vision clearance triangle formed by a flowline is predicated on a fully built-out street or road and existing Right-of-Way that exceeds the Right-of-Way requirements in the Land Development Regulation. Within the area of the triangle, there shall be no fence, wall, landscaping, structure or other obstruction to view more than forty-two (42) inches in height, ~~or trees with foliage or signs lower than eight (8) feet in height~~ (measured from the flowline or edge of pavement on the street/road surface). The allowable height of forty-two (42) inches is determined by measuring from the flowline or edge of pavement, as applicable. For example, the grade on a lot within the triangle is 12” higher than the flow line of a gutter, the allowable height of landscaping would be 30” on the property.

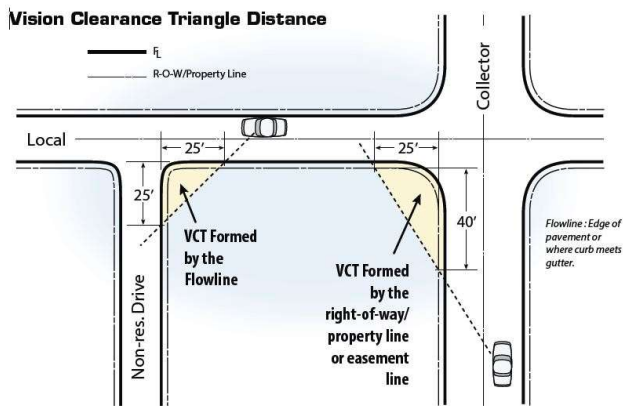


Street/Road Classification	Required Distance from Intersection
<a href="#">Non-residential drive</a>	<a href="#">25'</a>
<a href="#">Local</a>	<a href="#">25'</a>
<a href="#">Collector</a>	<a href="#">40'</a>
<a href="#">Major Collector/Arterial/Parkway</a>	<a href="#">55'</a>
<a href="#">Railroad Right-of-Way</a>	<a href="#">55'</a>

Note that if there is any conflict between this provision (3.7.2) and the Sight Distance provision (3.7.2.1) of this MANUAL, the Sight Distance provision shall take precedence. Note that if a physical median exists or is proposed at an access point restricting or eliminating a conflict point, the Vision Clearance Triangle requirements will not apply where no conflict points exist. [See graphic below for a comparison between Sight Distance and the Vision Clearance Triangle.](#)

#### [Comparison between Sight Distance and the Vision Clearance Triangle](#)





Street/Road Classification	Required Distance from Intersection
Non-residential drive	25'
Local	25'
Collector	40'
Major Collector/Arterial/Parkway	55'
Railroad Right-of-Way	55'

3.7.2.1. Sight Distance: At any street/road intersections or multifamily residential, commercial and industrial site driveways, an unobstructed view as defined above must be provided across the area formed by the flowline or edge of pavement on one street/road and the flowline or edge of pavement of the intersecting street/road (or edge of driveway) and lines (labeled d1 or d2 on the Sight Distance figure) connecting them at ten (10) feet from their point of intersection. This area will be used to ensure that drivers of vehicles exiting from the stopped approach have the minimum required sight distance available. ~~The minimum required sight distance shall be in accordance with the Minimum Sight Distance Requirements table for two-lane streets/roads.~~ [Minimum Sight Distance requirements for all intersection types must follow the provisions covered in the current edition of AASHTO Policy on Geometric Design of Highways & Streets \(The Green Book\) Chapter 9.](#)

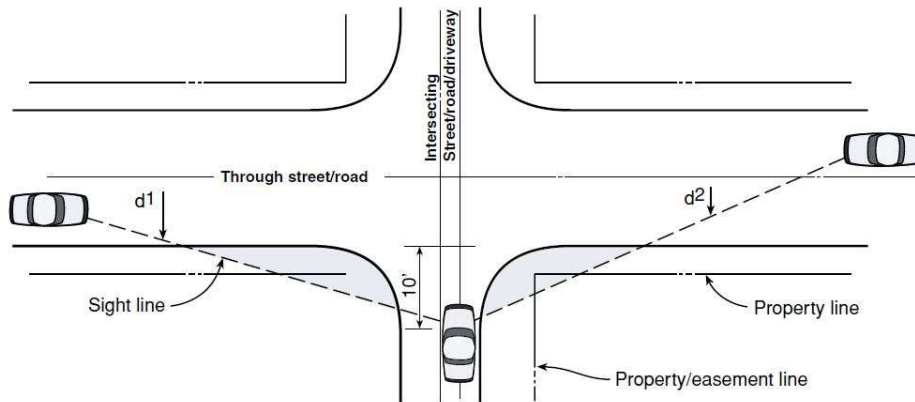
#### Minimum Sight Distance Requirements

~~(in feet) for vehicles entering onto two-lane streets/roads:~~

Operating Speed (mph)	Left Sight Distance d1 *	Right Sight Distance d2 **
20	220	130
25	260	170
30	350	260
35	430	350
40	530	440
45	610	570
50	740	700

~~\*d1 Left sight distance~~ ~~M~~measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the outside lane.

~~\*\*d2 Right sight distance~~ ~~m~~Measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the median lane.



1. Requirements assume that the vehicle is stopped on the proposed public or private street/road or driveway.
2. Requirements are based on a 3.5-foot driver eye height in the stopped vehicle and a 4.25-foot height of the approaching vehicle.
3. The operating speed of the approaching vehicle is assumed to be the posted speed limit.

~~4. Sight distance requirements as shown in the Minimum Sight Distance Requirements table are designed to enable vehicles entering the street/road to accelerate to the operating speed of approaching vehicles without causing the approaching vehicles to reduce speed by more than 10 mph.~~

~~54. Truck traffic (WB30 or larger) entering onto streets/roads requires longer sight distances and the current edition of AASHTO Policy on Geometric Design of Highway & Streets Chapter 9 shall be referenced for the appropriate adjustment. than shown in Table. Any proposed public or private street/road or driveway regularly used by truck traffic may require an individual will require this~~ -analysis.

~~65. When the criteria for sight distances cannot be met, the County may deny the access, prohibit left turns by vehicles entering the street/road or require speed change lanes.~~

### 3.7.3. Right Turn Lanes

3.7.3.1. Right Turn Acceleration Lanes: Right turn acceleration lanes may be required based on an approved transportation study. Right turn acceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning.

3.7.3.2. Right Turn Deceleration Lanes: Right turn deceleration lanes are required at arterial and major collector street/road intersections and at driveways on arterial streets/ roads as needed based on required transportation study/analysis. Transportation study/analysis shall address storage, as applicable. Right turn deceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning.

3.7.3.3. If the proposed street/road intersection or driveway is within two different speed zones, the criteria for the higher speed zone apply.

3.7.3.4. Where there are three or more through lanes in the direction of travel, right turn acceleration and deceleration lanes will be required only when determined necessary by Planning and Zoning due to high traffic volume or other site specific safety considerations.

3.7.3.5. Taper and lane lengths shall be in accordance with the following criteria [after an engineering analysis shows conditions without any extenuating factors or alternative needs. All taper length and lane length alterations must be accordance with the provisions set forward by the latest editions of the current edition of AASHTO Policy on Geometric Design of Highways & Streets and the Manual on Uniform Traffic Control Devices.](#)

### Deceleration Right Turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length* (Taper Length + Lane Length)
25	80'	120'	200'
30	100'	150'	250'
35	120'	190'	310'
40	140'	230'	370'
45	160'	280'	440'
50	180'	320'	500'

*\*At signalized intersections, where storage is needed for right-turning vehicles, additional length shall be provided to accommodate the average number of vehicles anticipated.*

### Acceleration Right turn Lanes

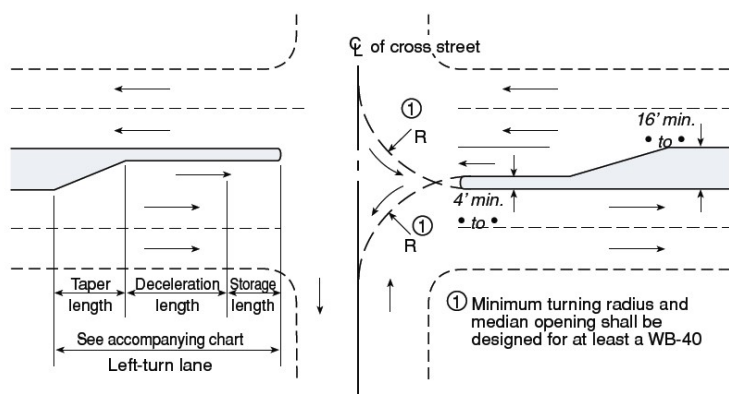
Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length (Taper Length + Lane Length)
30	120'	190'	310'
35	120'	270'	390'
40	180'	380'	560'
45	180'	550'	730'
50	240'	760'	1000'

3.7.3.6. A continuous accel/decel lane may be required if the acceleration lane for one access and the deceleration lane for another access overlap or are in close proximity to each other.

3.7.3.7. The minimum pavement width for acceleration and deceleration lanes shall be eleven (11) feet, excluding gutter pan or shoulder.

3.7.3.8. Grade correction factors are required where street/road grades are steeper than three (3) percent.

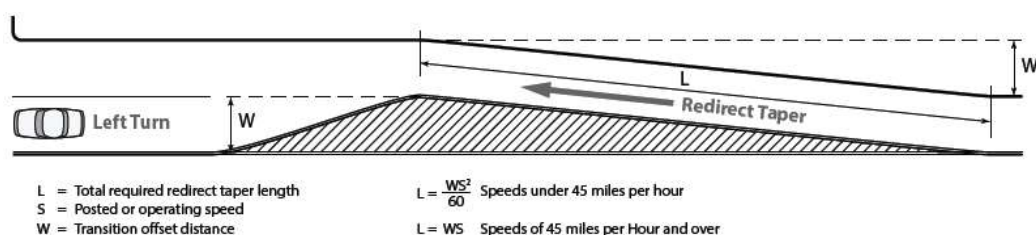
3.7.4. Left-Turn Lanes: Left-turn lanes are required at all arterial and major collector street/road intersections and at driveways on major collector/arterial streets/roads. Design of left-turn lanes shall be in accordance with the following criteria.



### Left-Turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Decel Length	Total Length
30	100'	150'	*250'
40	140'	230'	*370'
45	160'	280'	*440'
50	180'	320'	*500'

\*Plus storage length



3.7.4.1. Storage Lengths: Storage lengths for signalized and unsignalized intersections shall be determined by an approved transportation analysis or transportation study, as applicable.

3.7.4.2. Median Design: Other left-turn median designs such as reverse curve taper, offset approach nose and double left-turn lanes must be approved by Planning and Zoning and shall conform to AASHTO standards.

### 3.7.5. Curb Returns

3.7.5.1. The table below provides the minimum street/road intersection radii measured to flowline or edge of pavement where no curb and gutter is required.

#### Curb Return Radii (R) To Flowline

Intersecting Street	Principal Arterial	Minor Arterial	Major Collector	Collector	Local
Principal Arterial	Special Design*	Special Design*	40'	40'	30'
Minor Arterial	Special Design*	Special Design*	30'	30'	25'
Major Collector	40'	30'	30'	30'	25'
Collector	40'	30'	30'	25'	20'
Local	30'	25'	25'	20'	20'/15'

\*Special Design should provide consideration for right turn channelization.

3.7.5.1.1. At driveway locations where curb returns are used, the minimum radii allowed on arterials and major collectors shall be twenty-five (25) feet.

3.7.5.1.2. At driveway or private access locations where there is no curb and gutter, the minimum radii (measured to edge of pavement) allowed on arterials and major collectors shall be twenty-five (25).

3.7.5.2. The minimum elevation difference (fall) around curb returns (PCR to PCR) for flow along the curb line shall be as follows:

Radius	Minimum Fall
15'	0.3'
20'	0.4'
25'	0.5'
All Others	1.27% of length from PCR to PCR

3.7.5.3. The maximum fall around curb returns shall be equal to the steepest grade coming into or out of the return multiplied by the return length, + 0.2 feet.

3.7.5.4. Curb Return Profiles: Curb return profiles are required for radii equal to or greater than thirty (30) feet within the public Right-of-Way. A midpoint elevation along the arc length of the curb return shall be shown in plan view for radii equal to or greater than twenty-five (25) feet. Curb return design shall be set in accordance with the following design procedure. General standards for flowline control and profiles within the curb returns shall be as follows:

3.7.5.4.1. The point of tangency at each curb return shall be determined by the projected tangent grade beginning at the point of intersection (P.I.) of the flowlines.

3.7.5.4.2. The arc length and external distance of the curb return shall be computed and indicated on the drawing.

3.7.5.4.3. Show the corresponding flowline (or top of curb) grade for each roadway beyond the P.C.R.

3.7.5.4.4. Design of the curb return flowline shall be such that the maximum cross slope between the midpoint of the curve and the PICR (external distance) does not exceed +5 percent. Grade breaks at the PCR's will not exceed two (2) percent for local and collector streets and one (1) percent for arterials. The flowline design of the curb return will be accomplished within the return without affecting street grades beyond the PCR. Maximum vertical curves will equal the arc length of the curb return. The elevation and location of the high or low point within the return, if applicable, is to be called out in the profile.

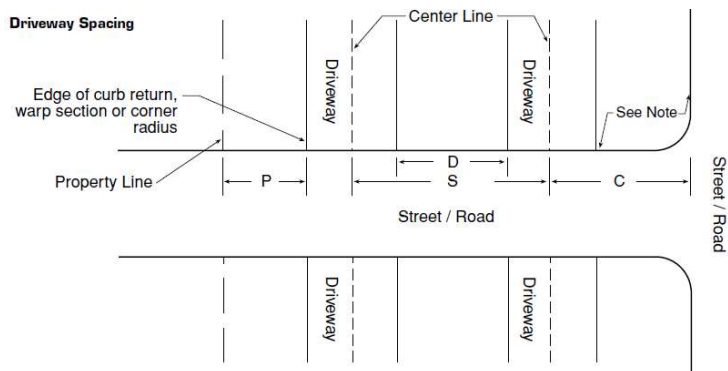
3.7.5.4.5. Scale for the curb return profile is 1" = 10' horizontally and 1" = 1' vertically. See Section 2.4.6.

#### 3.7.6. Driveway Spacing

Opposing and adjacent driveway locations shall be in accordance with the following figure and table. The minimum spacing shall be increased as necessary to accommodate left turn storage bays. Offset of opposing driveway locations is not required if driveways are physically constrained to right-in, right-out.

~~NOTE: Flowline of curb/gutter or edge of asphalt if curb/gutter does not exist or edge of shoulder if asphalt does not exist.~~





NOTE: Flowline of curb/gutter or edge of asphalt if curb/gutter does not exist or edge of shoulder if asphalt does not exist.

	Figure Reference	Distance
<b>Residential Driveways</b>		
From property lines	P	0'
From streets/roads	C	30'
Between driveways		
<del>N/A</del> 0'		
On local streets/roads	D	10'
On collector streets/roads	S	80'***
On major collector/arterial streets/roads	S	325'
<b>Non-Residential Driveways on Locals/Collectors</b>		
From property lines	P	0'
From major collectors/arterial streets/roads	C	300' *
From collector streets/roads	C	200' *
From local streets/roads	C	125'
Between driveways		
30 MPH design speed	S	180'
35 MPH design speed	S	200'
<b>Non-Residential Driveways on Major Collectors/Arterials/Parkways</b>		
From property lines	P	0'

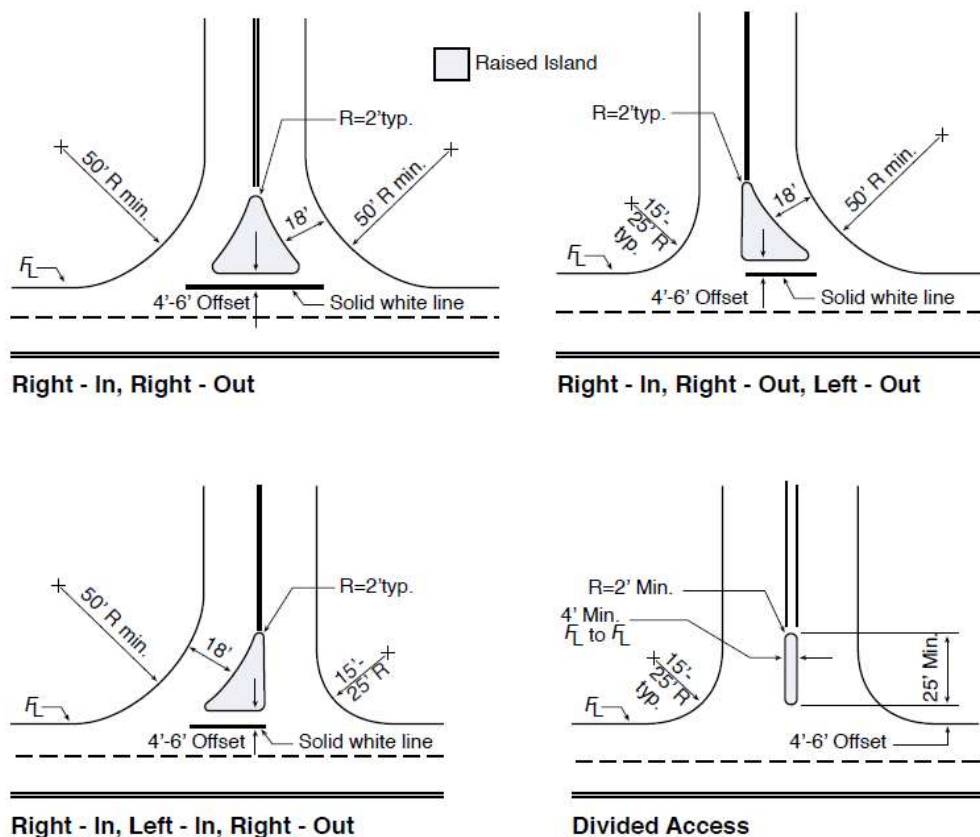
From streets/roads	C	500' **
Between driveways		
40 MPH design speed	S	275'
45 MPH design speed	S	325'

\* The C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. The minimum distance shall be no less than 150 feet.

\*\* If the proposed driveway is restricted to right turn movements or if it is not aligned with an existing or planned left turn lane, the C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. If signalization is proposed, the minimum C distance shall be increased to 660 feet.

\*\*\* May be reduced for circular driveways or driveways with a standard hammerhead turnaround If approved by Planning and Zoning.

3.7.7. Channelizing Islands The following figures illustrate the minimum design for channelizing islands for site accesses with various turn movement restrictions.



3.7.7.1. Non-rigid post mounted delineators are required on raised islands.

3.7.7.2. Curb ramps four (4) feet wide, with a maximum slope of 12:1, are required and shall be shown on the plans.

3.7.8. [Non-Maintained Roads in County Right-of-Way](#), Driveways, and Private [Street/Roads](#), and [Non-Maintained Roads in County Right-of-Way](#) Standards.

3.7.8.1. Driveways serving one dwelling unit shall meet the following standards ([Template 18a](#)):

[Exception: If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.4. do not apply.](#)

3.7.8.1.1. [Curve Radius](#): Minimum horizontal curve radius of 30 feet at centerline [or as required by the applicable fire protection district.](#)

3.7.8.1.2. Width: A total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side in accordance with Template 18a.

~~or if the length of the driveway in the Mountains exceeds 150-500 feet in length, and is a total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side, then pullouts shall be required at 200-foot intervals in accordance with Template 19. Due to site constraints, this 200-foot interval could be modified by 50 feet in either direction. Alternatively, if pullouts are not desired, a total width of 16 ft, including a 12-foot all-weather travel surface and two-foot shoulders on either side is required in accordance with Template 18 required.~~

3.7.8.1.3. Grade: Maximum grade of ten (10) percent on straight sections ~~and 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West.~~ Maximum grade of eight (8) percent for curves with radius of less than or equal to 50 feet at centerline.

Exceptions: In the Mountains, a maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100) feet is allowed provided the appropriate fire sprinkler systems are installed per the National Fire Protection Association (NFPA) 13D or International Residential Code (IRC) P2904 - Standards for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes. There may be more than one section up to 15% provided if it is separated they are separated by a distance of 1000 feet. This spacing may be reduced to 300 feet provided a pullout in accordance with this Manual is provided in a break between sections. This pullout is required regardless of the road width.

~~3.7.8.1.4. If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.34. do not apply.~~

3.7.8.1.54. Turnaround: If the length of the driveway exceeds 150 feet, a hammerhead turnaround shall be provided in accordance with Template 20. ~~and the location of the turnarounds shall be approved by the appropriate fire protection district. The centerline of the turnaround shall be located a minimum distance away from the structure. The minimum distance equals 1.5 times the height of the structure. Building height is measured as the distance between the average point between grade and the average point of the roof.~~

**3.7.8.2. Private streets/roads serving more than one dwelling unit and non-maintained streets/roads in county Right of Way shall meet the following standards (Templates 18b, 18c, and 18d):**

3.7.8.2.1. Curve Radius: Minimum horizontal curve radius of 30 feet at centerline or as required by the applicable fire protection district.

3.7.8.2.2. Width (For a street/road serving up to 15 dwelling units): A total width of 20 feet, including a 16-foot all-weather travel surface and two-foot shoulders on either side in accordance with Templates 18b, 18c or 18d ~~for roads serving up to 15 dwelling units.~~ Alternatively, ~~if for a private road~~ a total width of 146 feet, including a 102-foot traveled surface, ~~and two-foot shoulders on either side,~~ is proposed, then ~~and~~ pullouts at 150-200 foot intervals in accordance with Template 19 are required. Due to site constraints, this 200 foot interval could be modified by 50 feet in either direction.

3.7.8.2.13. Width (For a street/road serving 16 or more dwelling units or one or more non-residential units): A total width of 24 feet, including an 18-foot paved surface (plains) or all-weather surface (mountains) and three-foot shoulders on either side is required in accordance with Templates 18b, 18c, or 18d. ~~for roads serving 16 or more dwelling units or one or more non-residential units.~~

3.7.8.2.34. Grade: Maximum grade of ten percent on straight sections; ~~Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West.~~ Maximum grade of eight percent for curves with radius of less than or equal to 50 feet at centerline.

Exceptions: In the Mountains, 3.7.8.2.5mM, for all new dwellings the street/road serves to 500'

**3.7.8.3. Offsite Non-Compliant Driveways/Private Streets/Roads:**

~~—The appropriate fire protection district may approve alternative standards for driveways and private roads. Plans shall be submitted~~

~~that bear the written approval of the appropriate fire protection district. The onsite and off-site driveway or private road shall meet the requirements as described in this section.~~ If the proposed or existing driveway or private street/road cannot meet the requirements of this section, the following shall be submitted to Planning and Zoning through a relief request:

1) A signed and stamped letter/statement by a qualified Colorado-registered professional engineer indicating:

- The existing and/or proposed conditions,
- The conditions that do not meet requirements, and documentation of why the requirements cannot be met,
- Any offsite improvements that can and will be completed,
- That the existing or proposed driveway or private street/road will be able to serve the residence under normal and expected conditions and that the existing and/or proposed design is satisfactory,
- That the material and method of work offered adequately meets the intent of this section and the minimum prescriptive requirements of the applicable International Fire Code (IFC) 104.9, and
- This statement shall include a detailed explanation of how an emergency apparatus within the appropriate fire protection district will be able to serve the residence under normal and expected conditions. This analysis may include auto-turn or turning radius templates. Such statement shall bear the professional engineer's seal, signature and date.

2) Plan and profile showing the existing conditions and proposed design, and

~~and that the proposed design is satisfactory and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, durability and safety and adequately meets the intent of this section and the minimum prescriptive requirements of 2018 International Fire Code (IFC) 104.9. This statement shall include a detailed explanation of how an emergency apparatus within the appropriate Fire Protection District will be able to serve the residence.~~

~~Tanalysis.~~ 3) A written statement from the property owner that a fire sprinkler system will be installed per National Fire Protection Association (NFPA) 13D or International Residential Code (IRC) P2904 at the time of Building Permit.

4) Affidavit, signed by the property owner and recorded with the County stating that the property owner acknowledges that the driveway or street/road as proposed does not meet the requirements of the Transportation Design and Construction Manual and as a result, emergency services may be impacted. This form shall be provided by the County.

These submittal documents will be required to be reviewed and approved by Planning and Zoning prior to issuance of a building permit. Planning and Zoning may consult directly with the appropriate fire protection district when evaluating ~~offsite~~ driveways or private streets/roads which cannot meet the requirements of this section.

Prior to closeout of the land disturbance permit, as-built drawings are required.

Note: This section applies to on or offsite private driveways/streets/roads on private land and within non-maintained County Right-of-Way or platted Right-of-Way. This shall not apply to County maintained Right-of-Way.

3.7.8.4. Driveway approaches and private road intersections with public roads must comply with Standard 8 - Driveway and Private Road Approaches onto Roads.

3.7.8.5. Cattle guards shall conform to the current edition of the CDOT M&S Standard Plans and approved by the appropriate fire protection district.

3.7.8.6. All gates and entry-way structures shall be approved by the appropriate fire protection district.

3.7.8.7. All streets in the Plains are required to be paved.

3.7.8.8. All rules and regulations of the applicable fire protection district shall govern unless less restrictive than the requirements of this Manual.

3.7.8.9 All culverts, bridges and other conveying structures shall meet loading requirements for the heaviest fire apparatus potentially  
Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

[serving the residence\(s\). Maximum capacity of any bridge or culvert with a span larger than 4 feet shall be posted on signs at both approaches for through roads and at the entrance for cul-de-sacs.](#)

### **3.8. Drainage**

All storm drainage systems shall be designed in accordance with Jefferson County Storm Drainage Design and Technical Criteria (JCSDDTC). Safe and efficient conveyance of traffic is the primary function of streets/roads; therefore, design of the storm drainage function shall not exceed the limits (such as gutter capacity and street overtopping) set forth in the JCSDDTC. All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T", in accordance with Jefferson County Land Development Regulation Section 33.

3.8.1. Crosspans: Crosspans are not permitted across collector or arterial streets, nor are they allowed on streets with existing storm sewer systems. Crosspans may be used parallel to collector or arterial streets to convey storm runoff across local streets.

3.8.2. Inlets: Inlets shall be located to intercept gutter flow at the point gutter capacity is exceeded by the storm runoff (see Chapter 9 of the JCSDDTC for gutter capacity). Inlets shall also be installed to intercept cross-pavement flows at points of transition in superelevation. Due to the presence of curb ramps at intersections, inlets are not allowed within the curb return, but shall be located at the tangent points of the curb return.

3.8.3. Cross Slope: Except at intersections, or where superelevation is required, streets/roads shall be level from top of curb to top of curb (or flowline to flowline) and shall have a two (2) percent crown. At or within 150' of an intersection, the maximum elevation difference between flowlines is that dictated by the intersection grade (Section 3.5.2.) and the actual distance between flowlines.

3.8.3.1. Parabolic or curved crowns are not allowed. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street.

3.8.3.2. Carrying the crown at a side street into the through street is permitted only when drainage considerations warrant such a design.

3.8.3.3. The rate of change in pavement cross slope, when warping side streets at intersections, shall not exceed one (1) percent every twenty-five (25) feet horizontally on local streets/roads, one (1) percent every thirty-seven and one-half (37.5) feet horizontally on collector streets/roads, or one (1) percent every fifty-six and one-half (56.5) feet horizontally on arterial streets/roads.

3.8.4. Temporary Erosion Control: Temporary erosion control is required along and at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc., in accordance with the Jefferson County Zoning Resolution, Section 15.

3.8.5. Cross Culverts: Cross culverts shall be installed at locations where roads cross natural drainageways and/or where changes in road grade are greater than two (2) percent. The culvert slope shall match as nearly as possible that of the existing topography, but shall in no case be less than one (1.0) percent. Cross culverts for roads shall be spaced a maximum of five hundred (500) feet apart.

### **3.9. Traffic Control**

3.9.1. Construction Traffic Control: Traffic safety in construction zones should be an integral element of every project from planning through design and construction. Pedestrian, as well as vehicular traffic, should be considered in the design of a traffic control plan. A traffic control plan shall be submitted to and approved by Transportation and Engineering prior to issuance of a construction permit.

Design of all traffic control plans shall be in accordance with Part VI of the Manual on Uniform Traffic Control Devices, Standards for Work Zone Traffic Control. All necessary signs, pavement markings, barricades, etc. shall be shown on the plan.

3.9.2. Traffic Signals: Traffic signals shall be installed at street/road intersections or site accesses identified as meeting warrants in the traffic study submitted for a proposed development. If the proposed signal location is within twelve hundred (1,200) feet of any adjacent

signal, a two-way progression analysis shall be included in the traffic study.

Design of all traffic signals shall be in accordance with the Manual on Uniform Traffic Control Devices and the Colorado Department of Transportation Standards and Specifications. Traffic signal plans shall be submitted to and approved by Planning and Zoning.

Traffic signal poles shall not be installed within sidewalks or curb ramps.

3.9.3. Signing and Striping: Plans are required for signing/ striping of new streets/roads and re-signing/stripping of existing streets/roads necessitated by development. All signing/stripping plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and shall be submitted as part of the construction plans.

3.9.3.1. The signing plan shall:

1. Show the general longitudinal location of each existing and proposed sign (by side of street/road and station).
2. Specify the sign legend and sign type (from the MUTCD).
3. Specify the sign size.
4. Include a typical detail of installation dimensions (height, distance from curb or edge of pavement).
5. Include a detail of post and base dimensions and installation plan (showing any wedges or sleeves, depth below surface, any materials used).
6. Specify the blank gauge and material of the sign(s).
7. Note the reflectorization provided.

3.9.3.2. The striping plan shall show:

1. Striping material (paint, thermoplastic, preformed tape, etc.).
2. Color designation and line width.
3. Lane width.
4. Proposed and existing lane striping including skip interval.
5. Typical treatments for accel/decel lanes, turning lanes, bike lanes and crosswalks.

3.9.3.1. Stop signs shall be placed at intersections in accordance with the MUTCD, unless otherwise approved by the Director of Planning and Zoning.

3.9.3.2. All street/road name signs shall be in accordance with the current edition of DRCOG "Guidelines for the Design and Placement of Street Signs in the Denver Region".

### **3.10. Miscellaneous**

3.10.1. Guardrail: In locations where guardrail is required, as determined by Planning and Zoning, design shall be in accordance with the Colorado Department of Transportation Standards and Specifications. Determination of guardrail requirements shall be based on Colorado Department of Transportation Roadway Design [ManualGuide](#), [Section 702Chapter 20](#) and other applicable CDOT criteria. Guardrail locations shall be shown on the construction plans.

3.10.2. Noise Attenuation: In locations where arterial streets/roads are adjacent to existing or planned residential areas, fencing and/or other noise attenuation measures are required. These measures may include, but are not limited to, earth beams, landscaping, walls, or a combination.

3.10.3. Street Lighting: Street lights shall be provided at all parkway/arterial/major collector street/road intersections. In addition, street lights shall be provided at all locations where multifamily residential, commercial or industrial site driveways intersect parkway/arterial/major collector streets/roads. Street lights shall be designed in accordance with the most recent ANTI/ICES Roadway Lighting Standards and installed in accordance with Public Service Company of Colorado standards. Light poles shall not be installed within Transportation Design and Construction Manual – Amended [12-17-19XX-XX-XX](#)

sidewalks or curb ramps.

3.10.4. Roundabouts: Roundabouts may be constructed subject to an approved traffic study. Roundabouts shall be designed in accordance with the current edition of the Federal Highways Administration Publication, Roundabouts: An Informational Guide, and approved by Transportation and Engineering and the appropriate fire protection district. [Roundabouts shall also conform to CDOT Roadway Design Guide Chapter 19.](#)

3.10.5. Bridges: Bridges shall be designed in accordance with CDOT Bridge Manuals, [the CDOT Roadway Design Guide Chapter 15](#) and approved by Transportation and Engineering and the appropriate fire protection district.

3.10.6. Curb Extensions (mid-block and corner) and Pedestrian Refuge Islands: Curb extensions and pedestrian refuge islands shall be designed in accordance with the current version of the Federal Highway Administration Bicycle and Pedestrian Report, [the CDOT Roadway Design Guide Chapters 12 and 14](#) and approved by Transportation and Engineering and the appropriate fire protection district.

## *Chapter 4*

# **Pavement Design and Technical Criteria**

### **4.1. General**

This section sets forth the minimum criteria and design procedures for public ~~and private street~~/roadway pavements. Recommended design methodologies for asphalt are addressed and essentially follow the Colorado Department of Transportation (CDOT) and the Asphalt Institute methodology. Some standardization of criteria has been made in design procedures. Other design methodologies may be presented for comparison to the current County design method. [For private streets and non-maintained streets/roads in County Right-of-Way these same design methodologies are required.](#)

### **4.2. Pavement Design Report Submittal**

4.2.1 Preliminary Pavement Design: A Preliminary Pavement Design shall be used for estimating purposes only to determine the financial security "Exhibit A" associated with development projects. Three standardized Preliminary Pavement Designs corresponding to three zones of unique geotechnical characteristics within Jefferson County are presented in Construction Standards ~~1622-1824~~. Construction Standard ~~19-25~~ shows each of the three zones. Zone 1 corresponds with materials associated with ~~decomposing granite fractured crystalline rock~~ in the higher elevation foothills and mountains. Zone 2 addresses highly expansive clay and claystone material within the Designated Dipping Bedrock Area. [The template for this zone includes edge drains for public and private streets. The inclusion of edge drains should be evaluated as a part of the preliminary and final pavement design and edge drain design and details shall be provided with the Street Construction Plans. Final pavement design modifications presented by the applicant, including changes to or elimination of edge drains, may be allowed as determined appropriate by Transportation and Engineering for public streets and Planning and Zoning for private streets. The evaluation of the edge drains in the pavement design and approval of an alternative standard shall be made based on data provided by the Geotechnical Engineer and evaluation by the County. ~~with edge drains.~~](#) Zone 3 involves non-cohesive soil and weathered bedrock along the Front Range. The Preliminary Pavement Design shall be replaced with the Final Pavement Design, and the associated "Exhibit A" financial security costs recalculated, after County approval of the Final Pavement Design Report.

#### 4.2.2 Final Pavement Design:

The final pavement design shall be completed and submitted after or in conjunction with County approval of the associated construction plans. All soil samples must be taken after overlot grading, or represent the "as-constructed" soil conditions after construction has been completed. Transportation Design and Construction Manual – Amended ~~12-17-19~~[XX-XX-XX](#)



completed. Pavement design approval is required prior to placement of any concrete flatwork and/or paving within County Right-of-Way.

The report shall be prepared by or under the supervision of and signed by a Professional Engineer registered in the State of Colorado and shall include the following information:

- A. Vicinity map to locate the investigated area.
- B. Scaled drawings showing the location of borings, and required information stated in 4.3.2.
- C. Scaled drawings showing the estimated extent of subgrade soil types and Equivalent Daily Load Application (EDLA) for each street.
- D. Pavement design alternatives for each street on a scaled drawing.
- E. Tabular listing of Sample Designation, Sample Depth, Composite Group Number, Liquid Limit, Plasticity Index, Percent Passing the No. 200 sieve, American Association of State Highway and Transportation Officials (AASHTO) Classification, Group Index, Percent Swell from Swell Consolidation tests, and Soil Description.
- F. California Bearing Ratio (CBR) or R-value test results and calculations for each soil type used in the design. Include natural moisture content and natural density.
- G. Pavement design nomographs supplied by Jefferson County properly drawn to show Soil Support, EDLA and Structural Number (SN).
- H. Design calculations for pavement thickness.
- I. Percentage water soluble sulfates, sampled at a minimum of every other boring.
- J. A discussion regarding potential subgrade soil problems including, but not limited to:
  - 1. heave or settlement prone soils
  - 2. frost susceptible soils
  - 3. ground water
  - 4. drainage considerations (surface and subsurface)
  - 5. cold weather construction (if appropriate)
  - 6. other factors or properties which could affect the design or performance of the pavement system
- K. Recommendations to alleviate or mitigate the impact of problems discussed in Item J above.

### **4.3. Subgrade Investigation**

4.3.1 Field Investigation: The field investigation shall consist of boring soils to a depth of at least five feet below the bottom of the proposed asphalt pavement layer elevation for roads classified as Local or Collector. Borings shall extend 10 feet below the bottom of the proposed asphalt pavement layer elevation on Major Collector / Minor Arterial and Major Arterial roadways. In all cases borings shall be spaced no more than 250 feet apart, or a minimum of one boring for each section of street, unless otherwise required by Transportation and Engineering. The borings shall be checked for ground water at the time of drilling, and then 24-hours after the borings are completed. Samples shall be taken after overlot grading is completed and the subgrade is "rough cut" (1 to 2 feet of proposed elevation). Soil classifications shall be verified after installation of utilities.

Geological features within five feet of the existing ground surface, and all new roadways proposed in the Dipping Bedrock Area, require more detailed investigation including drilling and/or trenching. Every third bore hole shall be a minimum of 10 feet deep, regardless of the road classification.

California Drive samples shall be obtained from each boring within 12-18 inches of the final subgrade elevation.

4.3.2. Boring Profiles: Boring logs shall include the following:

- a. Date, Strata Elevations, Depth of Boring.



- b. Natural moisture content, Blow Count and Dry Density of each undisturbed sample.
- c. Water table elevation.

4.3.3. Classification Testing: Each soil sample shall be tested according to AASHTO and/or the American Society for Testing Materials (ASTM) criteria to determine: Liquid Limit, Plastic Limit, Plasticity Index, and Percentage passing the U.S. Standard No. 200 sieve. Samples of sands and gravels shall require gradation analysis for classification determination.

These data shall be determined using the following methods:

- a. Liquid Limit - AASHTO T 89 (ASTM D 4318)
- b. Plastic Limit - AASHTO T 90 (ASTM D 4318)
- c. Passing No. 200 - AASHTO T 11 (ASTM C 117)
- d. Gradation - AASHTO T 27 (ASTM D 422)

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

4.3.4. Soil Grouping: Soil samples collected in the field investigation can be combined to form soil groups. These groups shall be based upon the AASHTO Classification, Group Index and location within the area investigated. Groupings shall not consist of samples with different AASHTO Classifications (Note: There may be more than one group index within a given classification). Composite samples can be manufactured by combining representative, equal portions of each sample contained within the group and mixing to provide a uniform composite sample of the soil group. This shall be limited to group indices within the range of 7. Composite samples shall be subjected to Classification Testing as outlined in Section 4.3.3. Moisture-Density curves must be included for groups used in the design.

4.3.5. Subbase Support Testing: Individual subbase or composite samples shall be tested to determine the support value using either CBR (California Bearing Ratio) or Hveem Stabilometer (R-value) testing. These values shall be used in the design of pavement sections in accordance with the procedures outlined in Section 4.5. Tests shall be conducted in accordance with the following procedures:

4.3.5.1. CBR Tests: California Bearing Ratio tests shall be conducted in accordance with AASHTO T 193 with the following modifications:

- a. Note 4 of AASHTO T 193 shall not apply. A 3- point CBR evaluation is required.
- b. The compaction method used for the CBR test shall be determined by the soil classification.
- c. Surcharge shall be calculated using a unit weight of 140 pcf for bituminous pavement and 135 pcf for untreated aggregate base course.
- d. The design CBR value shall be determined from the CBR - Dry Density Curve and shall be the CBR value at 95 percent compaction.
- e. In addition to the values requested in AASHTO T 193, Stress-Penetration curves for each sample, a CBR - Dry Density curve and Proctor Compaction test results shall be reported.

4.3.5.2. R-Value Tests: Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

- a. Dry density and moisture content for each sample.
- b. Expansion pressure for each sample.
- c. Exudation Pressure - corrected R-value curve showing the 300 psi design R-value.

#### **4.4. Pavement Design Criteria**

This section sets forth the parametric input data to be used for the design of pavements of various roadway classifications. If cohesive soil mitigation is required, the soil treatment shall extend from back of sidewalk to back of sidewalk.

4.4.1. Equivalent (18 Kip) Daily Load Applications (EDLA): The pavement design procedure in this chapter is intended to provide for a 20-year service life of pavement, given that normal maintenance is provided to keep roadway surface in an acceptable condition. EDLA and Design Traffic Number (DTN) are considered equivalent units based on 20-year design criteria and an 18 kip axle loading. All data

and design nomographs in this chapter use EDLA units for pavement loading repetitions. Calculations shall be included, where applicable.

EDLA criteria for each Jefferson County roadway classification are given in Table 4.1.

**Table 4.1 Recommended Equivalent (18 Kip) - Daily Load Applications (EDLA)**

Classification	Class Modifier	EDLA Values
Local	Serving <50 D.U.	8
	Serving >50 D.U.	10
Collector	Residential	30
	Other	100
Major Collector/Minor Arterial	All	200
Principal Arterial	All	200

*NOTE: Alternative EDLA values may be considered with justification provided by the Transportation Study, proposed land uses, and traffic analysis that defines proportion of truck vehicles, including construction truck traffic.*

4.4.2. Design Serviceability: The following criteria shall be used for all Jefferson County roadways to be dedicated for public use [and for all private street/roads and non-maintained streets/roads in County ROW](#):

**Table 4.2 Serviceability Index**

Roadway Classification	SI
Arterials	2.5
Collectors	2.5
Local	2.0

4.4.3. Minimum Pavement Layers: This paragraph provides the minimum acceptable pavement layers for public [and private streets/roads](#) ~~roadways~~ in Jefferson County. These pavement layer thicknesses may be used for preliminary planning purposes. Final pavement designs must be based on actual subbase support test results. Table 4.3 lists these minimum thicknesses for each roadway classification.

**Table 4.3 Minimum Pavement Sections**

Road Classification	EDLA	Composite Section (inches)			Full Depth Asphalt (inches)
		Asphalt	Subbase		
			Base Course	Stabilized	
<50 D.U.	8	4	6	12	5
=>50 D.U.	10	4	6	12	5
Residential	30	4	6	12	5
Other	100	5	6	12	6
Major Collec- tor	200	5	6	12	7
Minor Arterial	200	5	6	12	7

Major Arterial	200	5	6	12	8
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Regardless of the pavement layer design, all soils with an R-value less than 10, or PI greater than 15, shall be stabilized to a minimum of 12 inches below the bottom of the asphalt pavement layer, and shall be included in the depth of treatment.

Cohesive soil subbases shall be overexcavated and replaced with moisture conditioned fill. Minimum requirements for overexcavation are listed below in Table 4.3a.

**Table 4.3a Minimum Overexcavation Requirement for Cohesive Soils**

Plasticity Index	Depth of Overburden/Fill Treatment	
	Locals/Collectors	Major Collectors/Arterials
15-20	1 foot	2 feet
21-30	2 feet	3 feet
31-40	3 feet	4 feet

**NOTES:**

1. Road segments with isolated soil types may be designed separately for that individual segment.
2. Soil with (PI) over 40 shall be removed and wasted to a depth of five feet for any type of street.
3. In the Designated Dipping Bedrock Area, all bedrock shall be overexcavated to a depth of at least five (5) feet below the bottom of the proposed pavement layer. Where the bedrock is claystone, the top of the weathered claystone shall be considered as the top of bedrock. Should soil other than bedrock be found throughout the five (5) foot zone, it shall be overexcavated as shown in Table 4.3a.
4. The overexcavation areas shall be recompact to 95% of maximum Standard Proctor Density (ASTM D-698) at 0 to +4% above optimum moisture content. There shall be a minimum of 12 inches of soil stabilization below the bottom of the asphalt layer that is included in the total depth of overexcavation.
5. Overexcavation of overburden/fill below the stabilization section may be waived by Transportation and Engineering in areas where either previous overexcavation work during overlot grading has been validated or in cases where a thorough geotechnical investigation determines overexcavation is not warranted. Previous overexcavation work must be validated by compaction reports provided by the developer's geotechnical firm and in accordance with the Land Development Regulation (LDR).

4.4.4. Flexible Pavement Strength Coefficients: Table 4.4. contains standard design coefficients for various pavement materials. Non-standard design coefficients may be used only if approved in advance by Transportation and Engineering. In addition, design values must be verified by predesign mix test data and supported by daily construction tests; or, redesign values will be required.

**Table 4.4 Strength Coefficients**

Pavement Structure Component*	Strength Coefficients	(Limiting Test Criteria)
Conventional Materials		
Hot Mix Asphalt	0.40	1800 Lbs. Marshall Or R 90+)
Exist. Asphalt Pavement	0.30	(9-15 Yr)
	0.24	(>15 Yr)
Aggregate Base Course	0.12	(Cbr 80+ Or R 78+)
Exist. Aggregate Base Course	0.10	(Cbr 50+ Or R 69+)
Granular Subbase Course	0.07	(Cbr 15 Or R 50+)
Treated Materials		
Cement Treated Aggregate Base	0.23	(7 day, 650-1000 psi)
Lime Stabilized Subbase	0.14	(PI.<6, net swell <.5%, PH >12.3)

		Compressive Strength >200 psi, per ASTM 5102-04, Procedure B
All Stabilized Subbase	0.14	Compressive Strength >200 psi, per ASTM 5102-04, Procedure B

*\*The combination of one or more of the following courses placed on a subgrade to support the traffic load and distribute it to the roadbed.*

Structural Layers of a conventional flexible pavement design are defined below.

- a) Surface Course: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course.”
- b) Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course. The use of base course is not accepted in areas that base course does not adequately drain from roadway system.
- c) Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course, surface course or both.
- d) Subgrade: Prepared and compacted soil extending to such a depth as to affect the structural design.

## 4.5. Pavement Design Procedure

4.5.1. Flexible Pavements: The following procedure should be used in determining the Structural Number (SN) of the pavement being designed:

4.5.1.1. Using the appropriate roadway classification, determine the corresponding EDLA (Table 4.1).

4.5.1.2. Determine the Serviceability Index (SI) of the roadway classification (Table 4.2).

4.5.1.3. Select the proper nomograph:

Example: Figure 4.1 Flexible Pavements with SI = 2.0

Example: Figure 4.2 Flexible Pavements with SI = 2.5

NOTE: Original nomographs required are available from Transportation and Engineering.

4.5.1.4. Using subgrade CBR or R-Value test results and EDLA, determine the SN from the appropriate design nomograph.

4.5.1.5. Once the Structural Number (SN) has been determined, the design thicknesses of the pavement structure can be determined by the general equation:

$$SN = a_1D_1 + a_2D_2 + a_3D_3 + \dots$$

where

$a_1$  = Hot Mix Asphalt (HMA) strength coefficients

$a_2, a_3, a_n$  = strength coefficients of additional pavement components

$D_1$  = thickness of Hot Mix Asphalt (HMA) (inches)

$D_2, D_3, D_n$  = thickness of additional pavement component sections

The strength coefficients for various components of the pavement structure are given in Table 4.4.

The component thickness selected must meet two conditions:

- a. Total HMA thickness selected cannot be less than the minimum specified in Table 4.3. for the roadway classification.
- b. The base course thickness selected cannot exceed 2.5 times the HMA thickness selected, with a maximum thickness of eight (8) inches.

4.5.1.6. The design must reference any mitigative measures required when the subbase and / or subgrade contains cohesive or expansive soils. Design reports recommending permeable layers such as untreated aggregate base course in the pavement system, must

present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the fine-grained soils. If cohesive or expansive soil mitigation is required, the soil stabilization shall extend from back of sidewalk to back of sidewalk. It is required that soils with R-values less than 10 or Plasticity Index greater than 15 be stabilized. Stabilization is for a minimum of the upper twelve (12) inches below the bottom asphalt pavement layer, and shall be included in the depth of treatment.

4.5.2 Rigid Pavements: This procedure has been deleted.

## **4.6. Material Specifications**

The Specifications presented in this section are performance oriented. The County's objective in setting forth these Specifications is to achieve an acceptable quality of roadway structures. All sources for the mined or manufactured materials must be annually approved by Transportation and Engineering as having met the appropriate materials performance specifications. This approval is a condition of using those material sources for ~~public~~ improvement construction. For the purpose of these Standards, ~~public~~ improvements are all roadway improvements ([both public and private](#)), sidewalks, curbs and gutters, appurtenant drainage basins or structures, storm sewer and their access ways, other public works within Jefferson County Right-of-Way, and required stormwater detention structures built on private property and maintained by the property owner(s).

### **4.6.1. Violations of Approval Conditions**

4.6.1.1. Random Testing. Transportation and Engineering may order random tests of materials used in County public improvements [and for all private street/roads and non-maintained streets/roads in County ROW](#) to verify compliance with material specifications. These tests are in addition to the requirements of the roadway inspection and testing procedures.

4.6.1.2. Any and all material used to construct public improvements that is not from a certified source, or that is from a certified source and fails one or more random material test, may be subject to complete removal as a condition of County acceptance of that public improvement. Additional tests will be required to confirm the existence and extent of the sub-standard material prior to the initiation of remedial action. The extent of the material to be removed will be at the discretion of Transportation and Engineering.

4.6.2. Use of Materials Not Listed in Section 4.6. Materials in this section and provided with a set of specifications are those deemed to be the primary structural materials commonly or typically used in public improvements. Ancillary public improvement materials such as manufactured paints and coatings, bonding agents, sealers, fabrics or gaskets, insulating materials, etc., should be in compliance with CDOT material specifications for the appropriate material employed. Alternative materials for construction may be proposed for use. Decisions on acceptability of alternative materials will be made by Transportation and Engineering.

### **4.6.3. Material Specifications**

4.6.3.1. Hot Mix Asphalt: This shall comply with material specifications for PG Binders and asphalt mixes in accordance with CDOT's most recent edition of Standard Specifications for Road and Bridge Construction, 702 and 703. This is hereby referred to as "CDOT Standard Specifications".

[4.6.3.2. Stone Mastic Asphalt \(SMA\): SMA mix shall comply with CDOT Standard Specifications as referenced in Section 4.6.3.1. SMA shall be placed as a 2-inch top lift on all new arterial and collector roads and streets. Local roads and streets may be constructed with all HMA. New acceleration and deceleration lanes added to existing arterials or collectors shall match the existing asphalt mix, whether HMA or SMA.](#)

4.6.3.2.3. Aggregate Base Course Material. This material shall consist of hard, durable particles or fragments of stone or gravel, crushed to required sizes, containing an appropriate quantity of sand or other finely-divided mineral matter which conforms to the requirements of AASHTO M 147, and to Section 703.03, CDOT Standard Specifications.

Specifications. In addition, the material must have an R-value of 78 or greater, or a CBR of 80+, and must be moisture stabilized. Moisture stability is determined by R-value testing which shows a drop of 12 points or less in R-value between exudation pressures of 300 psi and 100 psi.

Only aggregate from sources approved by the Transportation and Engineering shall be used.

**Table 4.5 Aggregate Base Course Materials**

Sieve Size	Mass Percent Passing Square Mesh Sieves	
	Class 5	Class 6
2"	100	
1"	95 - 100	100
3/4"	—	95
#4	30 - 70	30 - 65**
#8	—	25 - 55
#200*	03 - 15	03 - 12**
Liquid Limit (LL)	30 Max.	30 Max.

\*ASTM (C117)

\*\*For gravel shoulders, No. 200 shall be 9-12 and No. 4 shall be 30-50.

Base course may be used only where the base can daylight in barrow ditches or where the subgrade consists of material classifying as GM, GW, GP, SM, SW, or SP using the Unified Soil Classification System.

4.6.3.3.4. Cement Treated Aggregate Base Course. This material shall consist of a mixture of aggregate materials, Portland cement and water as outlined in Section 304 of the CDOT Standard Specifications. Acceptable aggregates include CDOT Classes 5 and 6. Other aggregates may be used, if previously approved by Transportation and Engineering.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering. As a minimum, the mix design report shall contain a description of material sources, gradations and Atterberg limits of aggregates, cement type, Proctor compaction curves and unconfined compressive strength results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO specifications. Minimum in-place thickness for cement treated aggregate base course shall be twelve (12) inches.

To be approved, the mix shall have a seven-day compressive strength of at least 650 psi and no more than 1,000 psi. The minimum acceptable cement content shall be five percent by weight. Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis, or an annual basis for suppliers, prior to issuing construction permits.

4.6.3.4.5. Lime Treated Subgrade: This Material consists of a mixture of native or imported soils, hydrated or quick lime and water as outlined by ASTM Specification C977, CDOT Standard Specification 307.

The materials to be used in construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five day, 100°F cure unconfined compressive test results for each mix, strength versus lime content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Minimum pH of 12.3 after completion of initial mixing.
2. Plasticity Index less than 6, per ASTM D4318.
3. Minimum hydrated lime of 5.0% dry weight, per ASTM D3.

4. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.

5. Sulfate concentrations not to exceed .5%

Note: Field validation shall be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.56. Lime/Fly-Ash Stabilized: This material consists of a mixture of native or imported soils, hydrated or quick lime, Class “C” Fly-Ash, and water as outlined by ASTM Specification C977, CDOT Section 307.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus lime/fly-ash content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Plasticity Index less than 6, per ASTM D4318.
2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
3. Sulfate concentrations not to exceed .5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.67. Cement Stabilized Subgrade. This material consists of a mixture of native or imported soils, Portland cement and water.

The materials to be used on construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Minimum Portland cement of 3.0% dry weight per ASTM D3.
2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
3. Sulfate concentrations not to exceed 0.5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

## *Chapter 5*

# **Construction Specifications and Standards**

## **5.1 Construction Specifications**

The Permittee agrees to adhere to all construction specifications set forth in the latest edition of the Jefferson County Land Development Regulation, the Jefferson County Transportation Design and Construction Manual and the Colorado Department of Transportation Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX



(CDOT) Standard Specifications for Road and Bridge Construction manuals.

5.1.1. Permits: All work performed within County Rights-of-Way and/or easements shall require the issuance of a street/road construction permit. Permits shall be obtained at the Jefferson County Transportation and Engineering office, located at 100 Jefferson County Parkway, Suite 3500, Golden, Colorado.

5.1.1.1. Any permit issued shall pertain only to construction within the County-owned Right-of-Way and is in no way considered a permit to enter on any private property adjacent to such Right-of-Way nor to alter or disturb any facilities or installations existing within the Right-of-Way which may have been installed, and are owned, by others.

5.1.1.2. Permits, when issued, shall be valid for a period of ninety (90) calendar days, and may be renewed for one (1) additional ninety (90) calendar day period, providing the renewal is obtained (renewal may be obtained by telephone) prior to the permit expiration date. Failure to obtain a renewal as stated herein will require obtaining a new permit and payment of applicable fees.

5.1.1.3. Any permit determined to be without an adequate bond as required in Section 5.1.2. below, shall be subject to immediate revocation by Transportation and Engineering.

5.1.2. Bonds: A non-cancellable permit bond shall be required for Right-of-Way Use and Construction Permits and License Agreements Section of the County Policies and Procedures for Streets and Roads.

5.1.3. General Specifications:

5.1.3.1. Any work done to a street/road or other County property under a permit shall result in the street/road or other property being returned to a condition equal to or better than original, within the limits of careful, diligent workmanship, good planning, and quality materials, with said work being accomplished in the least possible time and with the least disturbance to the normal functioning of the street/road or other property.

5.1.3.2. All backfill material, compaction, and resurfacing of any excavation made in the County property shall be done in accordance with specifications and standards approved by and on file with Transportation and Engineering.

5.1.4. Road Closures: Normally, only one side of a public street/road may be blocked at any given time. Should operating conditions require complete closure, advance approval of the closing of a public street/road must be obtained from Transportation and Engineering or advance approval of the closing of a private road must be obtained from Planning and Zoning. The permittee shall notify the appropriate fire protection district, the Jefferson County Sheriff's Department, and the Colorado State Patrol concerning exact location of barricades and dates traffic will be impeded. Barricades shall be maintained by the responsible contractor.

5.1.5. Utility Installations:

5.1.5.1. Underground: All utility lines, including Cable TV, shall be installed a minimum of two (2) feet below ground surface, or proposed roadway elevation, whichever is lower. This requirement is applicable throughout the Right-of-Way, including ditch lines and/or borrow pits. Exceptions may be granted by Transportation and Engineering where warranted and upon prior written request and approval.

5.1.5.2. Overhead: A minimum ground clearance of 18 feet 0 inches shall be provided where overhead utility lines cross public roads and streets. The clearance shall be measured at the lowest point where the line crosses the traveled portion of the road and/or street.

5.1.6. Base Course: All aggregate base course shall meet CDOT Class 6 Specifications, or an acceptable base course predicated on specific site conditions as approved by Transportation and Engineering. Native material is unacceptable as base course.

5.1.7. All concrete shall be in conformance with the appropriate class as specified in Section 601 of the CDOT Standard Specifications. A combination cure-sealer shall be used for concrete flatwork. Provide adequate texture by means of a moderately heavy broom finish to surfaces prior to applying the cure-sealer. The product shall be Dayton Superior Cure & Seal LV 25% J20 UV or approved equal. Apply two coats per manufacturer's instructions to all exposed surfaces, with the second coat applied at right angles to the first for complete coverage. The temperature range of application is 35 to 90 degrees F. Concrete shall not be left exposed for more than one hour between the time finishing is completed and commencement of curing treatment.



5.1.7.1. Concrete may be placed by machine methods provided that all finish lines are within 1/8" ± tolerance of the lines shown on the plans. The flowline must be free draining.

5.1.7.2. One-half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.

5.1.7.3 Median Cover Material and Median Edging Patterned Concrete: Median cover material and median edging patterned concrete shall be colored concrete that is Davis color #5084 "Harvest Gold" or approved equal. The release agent shall be Concrete Coatings Stamp-TEK™ liquid release or approved equal. The stamp pattern shall be Matcrete "UK Cobblestone" or equivalent. A combination cure-sealer containing silane shall be used for concrete flatwork. The cure-seal product shall be SpecChem Cure Shield EX or approved equal. Control joints are saw cut every 10 feet. Expansion joint material with a zip-strip shall be installed between the patterned concrete and the back of curb. Control joints and expansion joints shall be sealed with Sikaflex-2C or approved equal. Refer to STND-18 and STND-19 for details. Granular pre-emergent herbicide shall be placed in the areas that are to receive median cover.

5.1.7.4. Detectable Warnings on Concrete Curb Ramps: Detectable Warnings on concrete curb ramps shall be truncated domes of the dimensions shown on the plans. Domes shall be BRICK RED in color. Domes shall be prefabricated by the manufacturer as a pattern on embeddable surface plates. Dome plates shall be set into wet concrete and shall not be glue or spray-on varieties. Detectable warning plates shall not be concrete pavers, masonry pavers, or cast-iron plates. Refer to STND-16 for details.

5.1.7.5. Waterproofing Membranes: Waterproofing membrane shall be placed on concrete bridge deck surfaces, and concrete box culverts per the waterproofing membrane detail. Surfaces to receive waterproofing membrane shall be thoroughly cleaned via sand-blasting or high pressure water. The waterproofing membrane shall be a hot pour asphaltic material, with 55 pound (#55) minimum asphaltic based roll material immediately placed on top. Refer to STND-17 for details.

5.1.8.1 Storm Sewer Pipe: Within County Right-of-Way and/or easements, all storm sewer pipe shall be minimum Class II Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76-03, C-506-02 or C-507-02 or HP Storm Pipe. Actual depth of cover, live load, and field conditions may require structurally stronger pipe. CSP and HDPE pipe, in accordance with manufacturer's specifications, are only permitted in privately owned and maintained installations and shall be located within County drainage easements.

5.1.8.2 All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T" in accordance with Jefferson County Land Development Regulation Section 33. Test boxes shall be placed behind curb and gutter if sidewalk is detached, and behind sidewalk if attached. See details for the tracer wire and test box installation 28-1 through 28-3.

5.1.9. Culverts: Within County Right-of-Way and/or easements, all culverts shall conform to the Storm Drainage Design and Technical Criteria.

#### 5.1.10. Traffic Control Devices

All traffic control devices shall conform to the MUTCD and be approved by Transportation and Engineering prior to installation. Conformance to the following minimum materials specifications or approved equal is required. Traffic signals shall conform to CDOT standards.

5.1.10.1. Signs, Sign Posts, and Anchors: Sign faces, posts and bases-anchors shall conform be in conformance with the following materials specifications. All Nonstandard signs faces, posts, and anchors bases must be approved by Transportation and Engineering. Nonstandard signs will not be maintained by the County. Post anchors for sign installation after complete construction require approval by Transportation and Engineering.

5.1.10.1.1. Street Name Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy 0.100 -080-inches thick. Polyethylene plates (Polyplate) is not allowed. (no polyplate allowed). Facing shall be green, electrocut High Hi-Intensity reflective sheeting with white Hi Hi-Intensity Prismatic grade retroreflective sheeting letters and numerals. Refer to STND-12 for details.

5.1.10.1.2. Regulatory and Warning Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy ~~.10~~0.100 inches thick. High-Intensity prismatic grade retroreflective sheeting shall be used for the background color, and letters and numerals for ~~on~~-all regulatory (~~i.e. stop, speed limit~~)-and warning signs. Refer to STND-12 for details.

5.1.10.1.3. Sign Posts: ~~All sign posts shall be two (2) inch by two (2) inch galvanized telespar tube with .120 inch wall thickness, and three eighths (3/8) inch holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length. U posts are not allowed. All sign posts shall be two (2) inch by two (2) inch galvanized TELES PAR® (or equivalent) telespar tube with 12 Gauge (0.105 .120 inch wall thickness), and three eighths (3/8) 7/16 inch pre-punched holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length. U-posts are not allowed.~~

5.1.10.1.4. Sign Post Bases: ~~All sign post bases shall be twist resistant mounting for telespar type post consisting of a steel angle (1/4" x 2 1/2" x 2 1/2" x 24") with a formed and welded steel plate (1/8" x 10" x 15"), used with a compression fit V lock wedge of 1/8 inch galvanized steel. The wedge must have a one half (1/2) inch hole drilled in one side for removal.~~ All sign post anchors shall be anchored securely in the soil or concrete to create a breakaway system. All sign post anchors shall be 2.25 inch x 2.25 inch perforated square tubing, galvanized steel, TELES PAR® (or equivalent), a minimum of 3 feet in length. Each tube section shall be 12 Gauge (0.105 inch wall thickness) with 7/16 inch diameter pre-punched holes on 1-inch centers, all sides over full length. The anchor tubing shall be twist resistant and allow mounting of a one-size smaller TELES PAR® (or equivalent) sign post. The anchor shall be driven into the soil no less than 30 inches. The sign post shall be inserted 8 inches inside the anchor tubing and double bolted in place prior to covering. Each bolt shall be a Hex Head with a Washer and matching Hex Nut. Bolts shall be secured at the exposed top of the anchor base and placed at opposite tube sides, 90 degrees apart. Signs to be placed in concrete medians or islands shall have the anchor driven inside of a 6-inch Schedule 40 PVC sleeve, with the sleeve measuring the thickness of the concrete plus 1-inch, and secured to the post in the same fashion as described in 5.1.10.1.3. The PVC sleeve shall be embedded in the surrounding concrete when the concrete is placed. Sign post anchors driven in soil not within concrete medians or islands shall be anchored in the same fashion without the PVC sleeve. Refer to STND-13 for details.

5.1.10.2. Pavement Marking: Specified ~~P~~pavement marking materials shall be used as specified for the service life, type, and at locations as identified below.

5.1.10.2.1. Temporary Application, Construction, or Detours: Waterborne paint (High Build) shall be used for short duration striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. The same waterborne paint may be used for crosswalks and stop (bar) lines as deemed necessary. Stencil markings, such as symbols or arrows, shall not be placed for temporary use unless approved by the engineer. ~~3M-Stamark-5730 preformed plastic marking material or an approved equivalent shall be used for crosswalks, stop bars, symbols (i.e. turn arrows) and striping for separation of turn and through lanes.~~

5.1.10.2.2. Permanent Application: Epoxy paint shall be used for striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. Preformed Thermoplastic Pavement Markings shall be used for crosswalk and stop (bar) line markings, railroad (RR) crossings, words, symbols, and arrows. The thickness of all Preformed Thermoplastic Pavement Markings shall be 125 mils. Preformed Plastic Marking Tape (Type I), may be used in lieu of Preformed Thermoplastic Pavement Markings, if approved by Transportation and Engineering prior to installation. Preformed Plastic Marking Tape shall be 3M™ Stamark™ 5730 (White), 3M™ Stamark™ A270ES (White), or approved equivalent. ~~Preformed plastic marking material or reflectorized paint shall be used for all other pavement marking. Use of thermoplastic pavement marking is not permitted.~~

5.1.10.3. Curb Ramps: All required curb ramps shall conform to current CDOT M&S Standard Plans and be approved by Transportation and Engineering.

5.1.10.4. Bike Racks: All required bike racks shall conform to Association of Pedestrian and Bicycle Professionals "Essentials of Bike Parking: Selecting and Installing Bike Parking that Works".

## 5.2 Construction Standards

All construction within County Right-of-Way and/or easements shall be in conformance with current CDOT M & S Standards and the following County construction standards.

Standard Number	Description
1	Curb and Gutter
2	Combination Curb, Gutter and Sidewalk
3	6" Vertical Curb, Gutter and Attached Sidewalk
4	6" Vertical Curb, Gutter and Detached Sidewalk
5	Typical Intersection Crosspan
6	Driveway Section for 6" Vertical Curb and Gutter
<del>7-1</del> and <del>7-2</del>	<del>Optional Concrete</del> Driveway Sections for Combination Curb, Gutter and Sidewalk (Type 2 and Type 3)
8	Driveway/ <u>Private Road</u> Approaches <del>for Roads</del>
9	Typical Median Designs
10	Concrete Joint Details
<del>11</del>	<del>Asphalt Street/Road Patchback</del>
<u>11</u>	<u>Raised Crossing Details</u>
<u>12</u>	<u>Speed Hump Installation</u>
<u>13</u>	<u>Asphalt Street/Road Patchback</u>
<u>14</u>	<u>Road and Street Name Signs</u>
<del>12</del>	<del>Road and Street Name Signs</del>
<del>13</del> <u>15</u>	Sign Posts and Bases
<del>14</del> <u>16</u>	Typical Arterial/ <u>Major Collector</u> Street Lighting
<del>15</del> <u>17</u>	Street Name Sign and Bracket on Traffic Signal Pole
<u>18</u>	<u>Waterproofing Membranes for Concrete Box Culvert</u>
<u>19</u>	<u>Waterproofing Membranes for Bridge Deck</u>
<u>20</u>	<u>Median Cover Material Patterned Concrete</u>
<u>21</u>	<u>Median Edging Patterned Concrete</u>
<u>22</u> <del>46</del>	Zone 1 Foothills / Mountain Area Preliminary Pavement Design

<a href="#"><u>23-1 and 23-2</u></a> <del>17</del>	Zone 2 Dipping Bedrock Area Preliminary Pavement Design <a href="#"><u>Attached and Detached Sidewalks in ROW</u></a>
<a href="#"><u>24</u></a> <del>18</del>	Zone 3 Front Range Area Preliminary Pavement Design
<a href="#"><u>25</u></a> <del>19</del>	Design Zone Preliminary Pavement Sections
<a href="#"><u>26-1</u></a>	<a href="#"><u>Signal Poles Design Information</u></a>
<a href="#"><u>26-2</u></a>	<a href="#"><u>Signal Poles General Layout</u></a>
<a href="#"><u>26-3</u></a>	<a href="#"><u>Signal Poles Maximum Loading Information (1)</u></a>
<a href="#"><u>26-4</u></a>	<a href="#"><u>Signal Poles Maximum Loading Information (2)</u></a>
<a href="#"><u>26-5</u></a>	<a href="#"><u>Signal Poles Details (1)</u></a>
<a href="#"><u>26-6</u></a>	<a href="#"><u>Signal Poles Details (2)</u></a>
<a href="#"><u>26-7</u></a>	<a href="#"><u>Signal Poles Caisson Details (1)</u></a>
<a href="#"><u>26-8</u></a>	<a href="#"><u>Signal Poles Caisson Details (2)</u></a>
<a href="#"><u>26-9</u></a>	<a href="#"><u>Signal Poles Caisson Details (3)</u></a>
<a href="#"><u>26-10</u></a>	<a href="#"><u>Signal Pole and Mast Arm Mounting Details (1)</u></a>
<a href="#"><u>26-11</u></a>	<a href="#"><u>Signal Pole and Mast Arm Mounting Details (2)</u></a>
<a href="#"><u>26-12</u></a>	<a href="#"><u>Traffic Signal Pull Box</u></a>
<a href="#"><u>27-1, 27-2 and 27-3</u></a>	<a href="#"><u>Flashing Beacon and Sign Installations</u></a>
<a href="#"><u>28-1, 28-2, and 28-3</u></a>	<a href="#"><u>Utility Wire Installation Location – Storm Sewer</u></a>

## *Chapter 6*

# Transportation Studies

## 6.1 Requirements for Transportation Studies (TS)

All traffic data collected must align with industry best practices to ensure consistency across the County. The below criteria must be met:

- Locations for traffic data collection shall be determined at pre-application or equivalent meeting with Jefferson County Staff and cater to the unique circumstances of each development application. Developments with local impacts will have fewer intersections to analyze whereas regional impacts will require a greater number of intersections to be analyzed.
- Vehicle volumes must be collected for at least a 24-hour period on a Tuesday, Wednesday, or Thursday and shall not be collected during inclement weather events, holidays, or adjacent to County holidays (Thanksgiving,

Christmas, New Years, etc.). Land uses with weekend peak-hour volumes shall collect at least one weekday and full weekend volumes.

- Bicycle and/or pedestrian volumes will be required in Activity Centers as defined by the Jefferson County Comprehensive Master Plan or with proposed land uses that foster active modes of transportation. Additional vulnerable roadway users, such as equestrians, children, or seniors will require special consideration if nearby land uses are conducive to a higher volume of vulnerable roadway users.
- Transportation & Engineering may request additional data collection or Measures of Effectiveness as identified in CDOT's Traffic Analysis and Forecasting Guidelines for unique site-specific or off-site conditions.

All traffic projections must use the latest addition of the ITE Trip Generation Manual.

6.1.1 The TS categories are as follows:

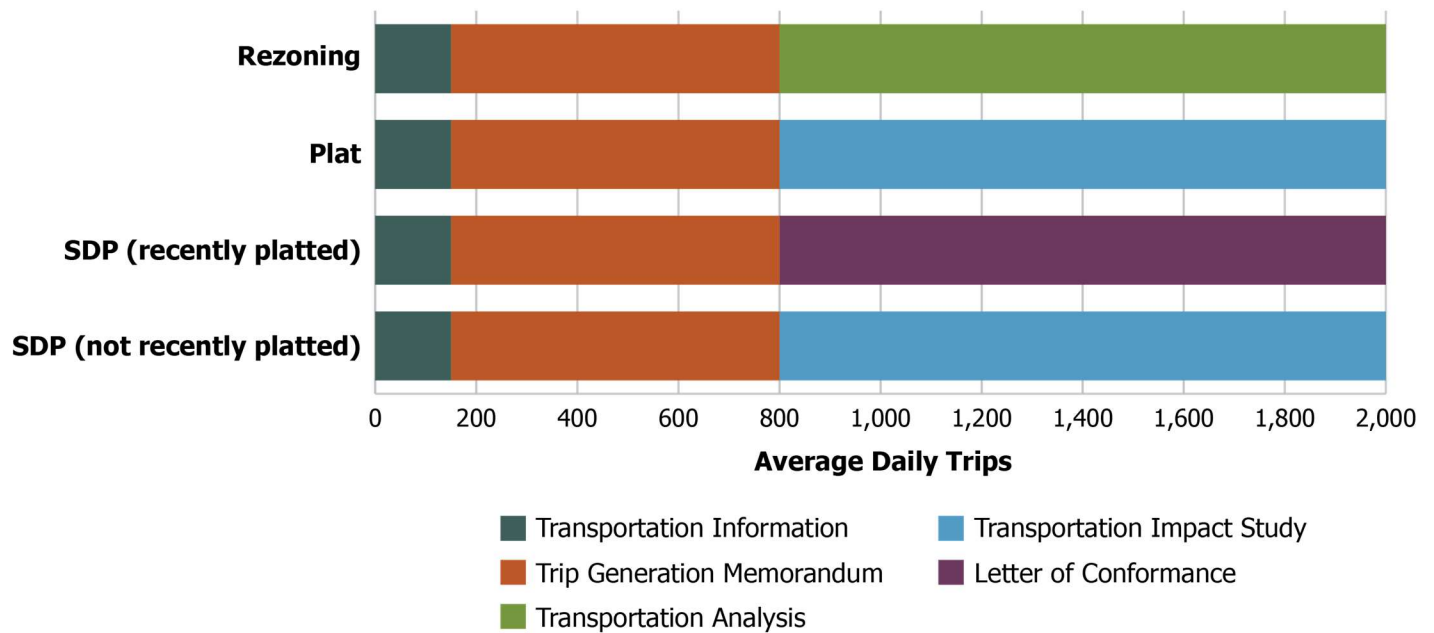
**Transportation Information:** Transportation Information shall be submitted for any development that generates fewer than 150 vehicle-trips per day. The submitted information will describe the proposed land use and estimate the expected number of daily vehicle trips. If submitting for a rezoning, provide a comparison of the existing land use and zoning to the most intense land use under the proposed zoning. If submitting for any other application type, provide a comparison of the existing land use compared to the proposed land use. This comparison shall be performed using the ITE Trip Generation Manual and/or by providing support for the expected vehicle usage of the site. The Transportation Information shall also describe any other relevant information that would impact transportation operations and safety.

**Trip Generation Memorandum:** A Trip Generation Memorandum (TGM) is required when the land uses proposed with a development are expected to generate between 150 and 800 vehicle-trips per day. The TGM should show a computation of trips generated from the proposed land use(s). The TGM for a proposed rezoning should also include a computational comparison of the maximum possible number of trips generated from the proposed land uses and the maximum possible trips generated from existing and allowed land uses. Include a table summarizing trip generation estimates.

**Transportation Analysis:** A Transportation Analysis (TA) is required during a rezoning to determine the amount and/or distribution of traffic generated from a proposed development that is expected to generate 800 average daily vehicle-trips or more. The TA should show a computational comparison of the maximum possible trips generated from the proposed land use(s) compared to the number of maximum possible trips generated from existing zoning. It should also include a percentage change in the average daily traffic (ADT) and peak hour traffic of adjacent roadways. The analysis should conceptually address potential onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development, including improvements that may already be required by County regulations.

**Transportation Impact Study:** A Transportation Impact Study (TIS) is required during a Site Development Plan (SDP) or Plat process when a proposed development is expected to generate 800 average daily vehicle-trips or more. While the trip generation from a proposed development is the main quantitative threshold, existing transportation issues such as a high crash location, complex intersection geometrics or other specific problems or deficiencies may also necessitate a TIS. The scope of the TIS should be agreed upon by the County and the applicant during the Preliminary Application process. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

**Letter of Conformance with an Approved TIS:** If a development in the Site Development Plan process is expected to generate more than 800 new vehicle trips, and there is an approved TIS on file from the last 3 years for the overall or regional development, a letter of conformance describing that the land uses proposed in the development match those assumed in the overall TIS and a copy of that TIS are required. This letter of conformance must confirm all current County regulations are met.



## Transportation Information

### 6.2.1 Responsibility

General: The applicant is responsible for providing trip generation information, from the latest addition of the ITE Trip Generation Manual, when proposing a development generating below 150 vehicle trips.

Review Process: Transportation Information for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Information with each re-submittal.

Certification: The Transportation Information should be prepared under the supervision of a qualified and experienced transportation professional who has training in traffic and transportation engineering or planning. Such supervision is not required if applicant has access to the ITE Trip Generation Manual.

### 6.2.2: Format

Transportation Information should be presented in tables, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Transportation Information.

## 6.3 Trip Generation Memoranda

### 6.3.1 Responsibility

General: The applicant is responsible for providing trip generation computation when proposing a development generating between 150 and 800 vehicle trips.

Review Process: The TGM for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the TGM with each re-submittal.

Certification: The TGM shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

### 6.3.2 Format

The TGM data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Trip General Memoranda.

## **6.4 Responsibility for Transportation Studies**

General: The impacts from a proposed development as assessed in the TS are the primary responsibility of the applicant and their engineer.

Review Process: The TS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study, if applicable.

Certification: The TS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TS shall be signed and sealed by a registered professional engineer in the State of Colorado.

## **6.5 Transportation Analyses**

### **6.5.1 Responsibility**

General: The applicant is responsible to demonstrate how transportation systems can accommodate the traffic generated by a proposed development or how the system can be improved to accommodate the traffic generated by the development.

Review Process: The TA for a proposed rezone will undergo an iterative review process in accordance with the Zoning Resolution. The applicant shall provide a letter identifying changes to the TA with each re-submittal.

Certification: The TA shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

### **6.5.2 Format**

Throughout the TA, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Transportation Analyses.

## **6.6 Transportation Impact Studies**

### **6.6.1 Responsibility**

General: The applicant and their engineer are responsible for mitigating the impacts from a proposed development as assessed in the TIS.

Review Process: The TIS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study with each re-submittal of the TIS.

Certification: The TIS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TIS shall be signed and sealed by a registered Professional Engineer in the State of Colorado.

### **6.6.2 Format**

Throughout the TIS, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review. See Appendix A detailing the format for providing Transportation Impact Studies.

# Definitions

## AASHTO

American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, current edition.

## ADT

Average Daily Traffic

## All Weather Travel Surface

An all weather travel surface is defined as an improved surface that is designed to withstand all weather conditions for typical road use and able to support emergency vehicles. The surface is required to be constructed of concrete, asphalt, recycled asphalt or a minimum of 6-inches of class 6 road base.

## Axle Load

The total load transmitted by all wheels on a single axle extending across the full width of the vehicle. Tandem axles 40 inches or less apart shall be considered as a single axle.

## California Bearing Ratio

A measure of the ability of a soil or aggregate to resist the transmission of a vertical load in a lateral direction.

## CDOT

Colorado Department of Transportation

## Dip of Natural Terrain

The dip of the natural terrain refers to the direction at which the existing ground surface slopes downward. The direction of the dip should be drawn perpendicular to the existing contour lines.

## Emulsified Asphalt Treated Base

A base consisting of a mixture of mineral aggregate and emulsified asphalt spread on a prepared surface to support a surface course.

## Equivalent Single Axle Loads (ESAL)

A numerical factor that expresses the relationship of a given axle load to another axle load in terms of their effect on a serviceability of a pavement structure. All axle loads are equated in terms of the equivalent number of repetitions of an 18,000 pound single axle.

## 18k EDLA

18,000 pound single axle Equivalent Daily Load Applications (explained in “Axle Load” and “ESAL” above).

## Flexible Pavement

A pavement structure which maintains contact with and distributes loads to the subgrade and depends upon aggregate interlock, particle friction, and cohesion for stability.

## Flowline

The transition point between the gutter and the face of the curb. For a cross or valley pan, it is the center of the pan. Where no curb exists, the flowline will be considered the edge of the outside traveled lane.



#### Grade

Rate or percent of change in slope, either ascending or descending from or along the highway. It is measured along the centerline of the highway or access.

#### Lime Treated Subgrade

Subgrade consisting of a mixture of soil, hydrated lime and water, usually mixed in place and placed to support a pavement structure.

#### MUTCD

The Manual on Uniform Traffic Control Devices and the Colorado Supplement, current editions.

#### Mountains

See “Mountains” definition in the Zoning Resolution.

#### Passing Sight Distance

The visibility distance required to allow drivers to execute safe passing maneuvers in the opposing traffic lane of a two-lane, two-way highway.

#### Pavement Structure

The combination of subbase, base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

- a. Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course.
- b. Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or subgrade to support a surface course.
- c. Surface Course: The uppermost component of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course”.

#### Plains

See “Plains” definition in the Zoning Resolution.

#### Plant Mixed Bituminous Base

A base consisting of mineral aggregate and bituminous material, mixed in a central plant, laid and compacted while hot, on a subbase or a subgrade, to support a surface course.

#### Plant Mixed Bituminous Pavement

A combination of mineral aggregate and bituminous material mixed in a central plant, laid and compacted while hot.

#### Regional Factor

A numerical factor expressed as a summation of the values assigned for precipitation, elevation, and drainage. This factor is used to adjust the structural number.

#### Roads

Public or private Rights-of-Way within the Mountain Area or as otherwise designated within this MANUAL.

#### Serviceability Index

A number indicative of the ability of the pavement to serve traffic at any particular time in its design life.

#### Sidewalk

A portion of a street designated for pedestrians and other vulnerable roadway users, in accordance with state law.

#### Signal Progression

Progressive movement of traffic at a planned rate of speed through adjacent signalized locations within a traffic control system without stopping.

#### Soil Support Value

A number which expresses the relative ability of a soil or aggregate mixture to support traffic loads through the pavement structure.

#### Speed Change Lane

A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase (acceleration lane) or decrease (deceleration lane) its speed to a rate at which it can more safely merge or diverge with through traffic.

#### Stabilometer "R" Value

A numerical value expressing the ability of a soil or aggregate to resist the transmission of vertical load in a lateral or horizontal direction.

#### Stopping Sight Distance

The minimum sight distance necessary to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

#### Storage Lane

Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during critical periods without interfering with the through lanes.

#### Streets

Public or private Rights-of-Way within the Plains Area or as otherwise designated within this MANUAL.

#### Strength Coefficient

A factor used for expressing the relative strength of each layer in a pavement structure.

#### Structural Number

A number derived from an analysis of roadbed and traffic conditions. A Weighted Structural Number is a Structural Number which has been adjusted for environmental conditions. A Weighted Structural Number may be converted to pavement structure thickness through the use of suitable factors related to the type of material being used in the pavement structure.

#### Traffic Analysis Period

A common analysis period (usually 20 years) used in geometric design.

#### Untreated Base Course

A layer or layers of base course without treatment of any kind.

#### Vulnerable Roadway User

Roadway users that are not protected by a vehicle or other shield while on a roadway and is at a greater risk for involvement in a serious injury or fatal crash. Vulnerable roadway users include, but are not limited to, bicyclists, pedestrian, and equestrians; those using mobility devices such as wheelchairs; those using micromobility devices such as electric scooters; and other forms of rolling such as roller blades and skateboards.

## Appendix A:

### Transportation Studies Formatting

## A.1 Transportation Information Format:

### Introduction and Summary

The purpose of the Transportation Information should be clearly stated. This section should concisely summarize findings and conclusions.

### Proposed Development

Provide a description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning (if applicable), and access roadways.

### Trip Generation Comparison Table

Provide a trip generation comparison table showing the traffic generated from existing land use(s) compared to the maximum potential trip generation for land uses associated with the proposed development. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Handbook, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered.

Table 1: Rezone Transportation Information

<u>Land Use Type /Zoning (Type)</u>	<u>Land Use Type</u>	<u>ITE Code</u>	<u>Unit</u>	<u>Size</u>	<u>Vehicles per day</u>
<u>Existing Land Use</u>	—	—	—	—	—
<u>Total</u>					—
<u>Existing Maximum* Zoning</u>	—	—	—	—	—
<u>Total</u>					—
<u>Proposed Maximum* Zoning</u>	—	—	—	—	—
<u>Total</u>					—
<u>Additional Trips (Proposed Zoning Total minus Existing Zoning Total)</u>					—

Table 2: Change in Land Use Transportation Information

<u>Land Use Type</u>	<u>Land Use Type</u>	<u>ITE Code</u>	<u>Unit</u>	<u>Size</u>	<u>Vehicles per day</u>
<u>Existing Land Use</u>	—	—	—	—	—
<u>Total</u>					—

<a href="#">Proposed Land Use</a>	—	—	—	—	—
<a href="#">Total</a>					—
<a href="#">Additional Trips (Proposed Land Use Total minus Existing Land Use Total)</a>					—

**[Findings](#)**

[Provide a summary of findings.](#)

## A.2 Trip Generation Memoranda Format:

### Introduction and Summary

The purpose of the TGM should be clearly stated. This section should concisely summarize findings and conclusions.

### Proposed Development

Provide a description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, and access roadways.

### Existing Conditions

Current traffic volume counts including a minimum of 24 hours of data should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected.

### Trip Generation Comparison Table

Provide a trip generation comparison table showing the traffic generated from existing land use(s) compared to the maximum potential trip generation for land uses associated with the proposed development. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Handbook, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered.

### Findings

Provide a summary of findings, including the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed.

### C. Example Outline

#### Trip Generation Memo

[Development Title]

Case Number: XX-XXXXXX XX

#### Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

#### Report Author

[Name]

[Address]

[Phone Number]

[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

**Purpose of Analysis**

**Introduction**

The purpose of this Trip Generation Memo is to evaluate the potential impacts of the proposed development to the surrounding transportation network.

**Project Overview**

[Description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, access roadways, and proposed development phasing. Site plan should not be included in this analysis.]

**Existing Roadway System**

[Include a description of the study area roadways and intersections including current traffic counts.]

**Projected Transportation Impact**

**Trip Generation**

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable]

**Table 1: Trip Generation Summary Table**

Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											
Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
Comparison Table											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

**Findings**

[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the

[transportation network\]](#)

[Existing Land Use/Proposed Intended Land Use](#)

[Existing Zoning/Proposed Zoning](#)

[\*\*Appendix\*\*](#)

[\[Insert any data used in analysis:\]](#)

[\*\*Trip Generation Calculations\*\*](#)

[\*\*Traffic Counts\*\*](#)



### A.3 Transportation Analysis Format:

#### Introduction and Summary

The purpose of the TA should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions, and recommendations of the TA.

#### Proposed Development

Provide a description of the land, parcel size and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site specific development should be described. This includes a discussion of location, proposed zoning, land use and intensity. A site plan is not necessary within a TA.

#### Existing Area Conditions

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County. Roadways that provide access to the site are included in this section. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts should include average daily traffic within the study area.

#### Projected Traffic

The main component of the TA is estimating the amount of traffic being generated from a proposed development. A trip generation comparison table showing computational comparison of the maximum possible trips generated from the proposed land uses and the maximum possible trips generated from existing and allowed land uses shall be provided. The latest addition of ITE's *Trip Generation Handbook* provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered. Include a table summarizing trip generation estimates. Calculate the percentage increase in average daily traffic with the proposed development over the existing traffic.

#### Findings and Recommendations

Summarize the proposed development, its impacts, and the possible mitigation strategies.

#### C. Example Outline

#### Rezoning Transportation Analysis

[Development Title]

Case Number: XX-XXXXXX RZ

#### Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

#### Report Author

[Name]

[Address]

[Phone Number]

[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

[Cert Number/Seal and Signature of Certified Transportation Professional (PE, AICP-CTP, ITE-PTP) (If applicable)]

**Purpose of Analysis**

**Introduction**

The purpose of this Transportation Analysis is to evaluate the potential impacts of the proposed zoning to the surrounding transportation network. If the proposed zoning is approved, the Applicant will be required to submit a Transportation Impact Study to determine specific mitigation measures and must satisfy County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates at the time of Site Development Plan (SDP) and/or Preliminary and Final Plat (PF).

**Project Overview**

[Description of the project site including size, location, current land use, intensity, existing zoning, and proposed zoning. Site plan should not be included in this analysis.]

**Study Area**

[Description of the study area and impacted roadways and intersections. The study area limits should be described and mutually agreed to between the applicant and the county. The study area should not include roadways proposed interior to the development.]

**Existing Roadway System**

[Include a description of the study area roadways and intersections including existing traffic counts, lane geometry, posted speed limits, current traffic control at intersections, presence of pedestrian and bicycle infrastructure, availability of on-street parking, and whether a roadway is private or public.]

**Projected Transportation Impact**

**Trip Generation**

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable during rezoning]

**Table 1: Trip Generation Summary**

Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											

<u>Total</u>											
<u>Existing Maximum* Zoning</u>											
<u>Total</u>											
<u>Proposed Maximum* Zoning</u>											
<u>Total</u>											
<u>Comparison Table</u>											
<u>Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)</u>											

\*Maximum potential trip generation based on the existing and proposed zoning

### Analysis

[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the transportation network. Provide the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed. Level of Service (LOS) calculations are not required with a TA.]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

### Recommendations

[Summarize the anticipated public improvements and strategies and/or recommendations to mitigate potential negative impacts to the transportation network in the study area]

### Table 2: Anticipated Public Improvements

Summary of the anticipated public improvements per County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates (shoulders, sidewalks, curb and gutter, bicycle infrastructure, etc.) if the zoning is approved and the applicant proceeds to subsequent development processes.

<u>Location</u>	<u>Improvements</u>

### Table 3: Potential Mitigation Strategies

Summary of potential strategies and/or recommendations that show an ability to mitigate traffic impacts from the proposed rezoning to the study area.

[List strategies that can address potential impacts of increased trip generation from the proposed zoning. Impacts should be those that are common for the location type and the level of trip generation increase. Recommendations should generally indicate if strategy is feasible at the location indicated.]

<a href="#">Location</a>	<a href="#">Strategy</a>	<a href="#">Recommendation</a>

[Appendix](#)

[\[Insert any data used in analysis\]](#)

[Trip Generation Calculations](#)

[Traffic Counts](#)

## **A.4 Transportation Impact Study Format:**

### **Introduction and Summary**

The purpose of the TIS should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions, and recommendations of the TIS.

### **Proposed Development**

Provide a description of the land parcel size, general terrain features and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site-specific development should be described. This includes a discussion of land use and intensity, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

### **Existing Area Conditions**

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County, during the Preliminary Application process or prior to submittal. Roadways that provide access to the site as well as future roadways included in the study area are included in this section. Existing intersections within the study area as well as geometrics and traffic signals should be identified. The existing and proposed land uses of the site should be identified. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts should include average daily traffic and intersection peak hour turning movements within the study area.

### **Background Traffic**

Background traffic growth estimates should be based on the most recent regional Travel Demand Model available. Overly conservative projections of background growth will not be accepted. If a growth model is not available for the study area, a reasonable growth rate considering area development potential shall be agreed upon by the applicant and the County during the Preliminary Application process. Growth rates above 2% per year will not be considered.

Trips generated by other approved developments within the study area, that were not included in the traffic counts collected, may be added to the background growth and referenced in the TIS. However, the combined background growth rate from area development and growth modelling shall not exceed an average of 2% per year.

### **Projected Traffic**

One of the most critical elements of the TIS is estimating the amount of traffic being generated. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar land uses are available, an analysis of the proposed land use based on the site's capacity may be considered. Include a table summarizing trip generation estimates.

Trip Distribution: The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

Trip Assignment: The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3-year projected and 20-year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

Internal Trips: Trips captured internally by a proposed development may be applicable depending on the land use. The

internal capture rates used should be based on the current version of the ITE's Trip Generation Handbook.

Pass-by trips: Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway. Pass-by trips shall still be applied to the site's driveways and any local roadways between the site and the roadway from which the trips are diverted. Pass-by trip reductions should not be made to the overall trip generation prior to trip assignment.

### **Transportation Analysis**

Capacity analysis is required for each of the major street and site access locations (signalized and un-signalized) within the study area. A clearer understanding of both the transportation related implications of the project and the necessary improvements to ensure acceptable operating conditions should result from this section of the TS. In addition, the following County plans and program and factors shall be considered in the transportation analysis: Major Thoroughfare Plan, Bicycle Plan and Traffic Impact Fee Program.

#### Factors:

- Safety
- Neighborhood Impacts
- School Zone Traffic Control
- Traffic Control Needs
- Transit Needs or Impacts
- Transportation Demand Management
- Circulation Patterns
- On-site Parking Adequacy and Off-site Parking Facilities
- Pedestrian and Bicycle Movements/Continuity of Facilities
- Other vulnerable roadway users applicable to proposed or nearby land uses
- Service and Delivery Vehicle Access
- Emergency and Fire Apparatus Access

Transportation Safety: The initial review of existing conditions within the TIS area shall include analysis of crash data from the 3 most recent years available. Any intersection experiencing Level of Service of Safety (LOSS) III or IV, or above average crashes on the state-specific Safety Performance Functions, will need additional analysis. The proposed site plan should ensure that the internal circulation system and external access points improve pedestrian and bicyclist safety and minimize vehicle/pedestrian and vehicle/bicyclist conflict points. Additional vulnerable roadway users shall be considered if applicable to a proposed land use or adjacent to existing land uses.

Transportation Operations: Impacts on transportation operations shall be measured based on the definitions contained in the current version of the *Highway Capacity Manual (Transportation Research Board)*. For each analysis period studied (typically 3 and 20 year periods) and for each phase of the project a projected total traffic volume must be estimated for each critical intersection and roadway segment being analyzed. The projected total traffic volumes (consisting of the summation of existing traffic, background growth traffic, background development traffic and site traffic) will be used in the next step-capacity analysis of future conditions.

Signalized Intersections: Level of Service (LOS) is based on roadway system characteristics that include:

- traffic volume
- lane geometry
- percentage of trucks
- peak hour factor

- number of lanes
- signal progression
- ratio of green time to cycle time (G/C)
- roadway grades
- parking conditions
- bicycle and pedestrian flows

The LOS categories are established in the *Highway Capacity Manual*. In general, LOS ratings of A to D are acceptable for the overall intersection and individual movements while E & F ratings must be mitigated. There are a number of software programs that can determine highway capacity.

*Unsignalized Intersections:* LOS for multi-way stop controlled intersections and driveway intersections must be determined by computing or measuring control delay. Where capacity analysis shows a LOS of D or worse for the overall intersection or any individual movements, mitigation must be provided. Mitigation could be a traffic signal, roundabout, turn restriction, or other measure to improve LOS. An analysis must be completed to determine the proposed measure mitigates the failing LOS. Any proposed all-way stop intersection must be justified using MUTCD's guidance on multi-way stop applications. Any newly signalized intersections must be justified using MUTCD Warrant 2 (Four-Hour Vehicular Volume). Alternatively, Warrant 3 (Peak Hour Volume) may be evaluated only if the unusual cases as defined in the MUTCD apply.

*Roundabouts:* In cases where LOS analysis indicates that an unsignalized intersection is expected to be LOS D or worse, a roundabout will be assessed before consideration will be given to a proposed signalized or multiway stop intersection. Factors for consideration of a roundabout include:

- availability of right-of-way
- crash history or potential
- traffic volume
- lane geometry
- number of lanes
- roadway grades
- parking conditions
- bicycle and pedestrian flows
- level of service

Each proposed location for a roundabout will be evaluated on a case by case basis. The capacity of a roundabout must be evaluated, and appropriate analytical software programs shall be utilized.

Parking: Utilizing ITE's Parking Generation Manual as a starting point, provide an estimate of how much parking the proposed development will generate. Parking utilization rates from similar sites may aid in this analysis.

Queueing: Provide an analysis of projected 95th percentile queues to determine adequacy of existing and proposed turn lane storage lengths, and whether any through-queues block adjacent intersections.

### **Improvement Analysis**

The improvements required to accommodate existing, background and site generated traffic are summarized in this section. Intersections serving the development should be analyzed first. The analysis should include the following steps:

- Identification of critical movements and corresponding intersection approaches.
- Determine if the intersection needs new types of traffic control such as roundabout, signalization or multi-way stop control.

- [Evaluation of each critical movement under potential scenarios of adding lanes, altering signal phasing, signal timing or lane use.](#)
- [Evaluation of signal locations, phasing and timing, with particular emphasis on corridor signal progression.](#)
- [Evaluation of queue lengths for both turn and through lanes to ensure adequate storage space.](#)
- [Identification of potential improvements within the contexts of Right-of-Way availability, intersection spacing, signal progression, County design standards and practical feasibility.](#)

## **[Findings & Recommendations](#)**

[Summarize the proposed development, its impacts, and the proposed mitigation measures.](#)

### **[C. Example Transportation Impact Study Outline](#)**

#### **[Transportation Study](#)**

[\[Development Title\]](#)

[Case Number: XX-XXXXXX SD/PF](#)

—

#### **[Applicant Information](#)**

[\[Name\]](#)

[\[Address\]](#)

[\[Phone Number\]](#)

[\[Email\]](#)

—

#### **[Report Author](#)**

[\[Name\]](#)

[\[Address\]](#)

[\[Phone Number\]](#)

[\[Email\]](#)

—

[Date of Original Report: XX-XX-XXXX](#)

[Date of Revision: XX-XX-XXXX](#)

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[\[Seal and Signature of Colorado Professional Engineer\]](#)

[Page Break](#)

#### **[Executive Summary](#)**

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## Purpose of Analysis

—

## Proposed Development

### Project Location

[Insert vicinity map showing the location of the project site in relation to the surrounding transportation network]

### Project Overview

[Description of the site including size, location, land use, intensity, existing zoning, proposed zoning, access locations and proposed development phasing.]

## Existing Area Conditions

[Include diagrams and narrative of traffic counts collected]

## Background Traffic

[Include reference to source Travel Demand Model, any nearby developments considered, and diagrams of 3-year and 20-year projections]

## Projected Traffic

### Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development including any trip reduction considerations, internal trip capture rates and pass-by trips as applicable]

### Trip Generation Summary

[Table including land use, intensity, ITE Code, daily traffic volume, peak hour: in, out and total traffic volumes.]

### Trip Distribution

### Pass-by Trips (if applicable)

### Trip Assignment

### 3-Year Horizon

### 20-Year Horizon

## Transportation Analysis

### Level of Service

[LOS diagrams at all study area intersections]

### Safety

[LOSS Analysis]

### Intersection Controls

[Roundabout analysis, signal- or all-way-stop-warrant analysis]

### Parking

[\[Include parking generation and availability\]](#)

[Queueing](#)

[\[Queueing analysis at study area intersections\]](#)

### **[Improvement Analysis](#)**

[\[Describe any improvements needed to mitigate impacts\]](#)

—

### **[Conclusion and Recommendations](#)**

[\[Summarize the proposed development including site location, proposed accesses, and trip generation.\]](#)

—

### **[Appendices](#)**

[Site Plan](#)

[Traffic Counts](#)

[Growth Calculations](#)

[Nearby Development Trip Estimates\\*](#)

[Trip Generation Sheets](#)

[LOS Worksheets \(Synchro or equivalent\)](#)

[Roundabout Analysis\\*](#)

[Signal and/or All-Way Stop Warrants\\*](#)

[LOSS Worksheets](#)

[Parking Generation Sheets](#)

[Queueing Analysis Worksheets](#)

[Signal Progression Analysis\\*](#)

[\\*as applicable](#)

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3. Transportation Study Format
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  - Proposed Development
  - Existing Area Conditions
  - Projected Traffic
  - Transportation Analysis
  - Improvement Analysis
  - Findings & Recommendations
  - Appendix
  - Example Report Outline
  - Bibliography

### 1. Requirements for Transportation Studies (TS)

*General:* In considering the transportation aspects of land development, it is important to determine early in the process if and when a Transportation Study (TS) will be required. The trip generation from a proposed development is the main quantitative threshold; however, existing transportation issues such as a high crash location, complex intersection geometrics or other specific problems or deficiencies may also necessitate a TS. A TS shall be required in accordance with the Submittal Requirements Section of the Land Development Regulation.

The TS categories are as follows:

**Transportation Analysis:** A Transportation Analysis may be required by Planning and Zoning to determine the amount and/or distribution of traffic generated from a proposed development. A transportation analysis is a computation of the traffic that is generated from a proposed development that is expected to generate less than 1000 average daily trips. The analysis should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of turning lanes and bicycle/pedestrian facilities, including any other improvements which may be suggested by the analysis.

**Minor Transportation Study:** A Minor Transportation Study is required when a proposed development is expected to generate 1000 average daily trips per day or more, and the traffic impacts are localized as determined by Planning and Zoning. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other

improvements which may be suggested by the study.

**Major Transportation Study:** A Major Transportation Study is required when a proposed development is expected to generate 1000 average daily trips or more, and the traffic impacts are regional as determined by Planning and Zoning. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the widening or realigning of existing streets; the addition of new intersections or interchanges; the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

## 2. Responsibility for Transportation Studies

*General:* The impacts from a proposed development as assessed in the TS are the primary responsibility of the applicant and their engineer.

*Review Process:* The TS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study, if applicable.

*Certification:* The TS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TS shall be signed and sealed by a registered professional engineer in the State of Colorado.

## 3. Transportation Study Format

### Introduction and Summary

The purpose of the TS should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions and recommendations of the TS.

### Proposed Development

Provide a description of the land parcel size, general terrain features and location within the county. The offsite as well as site specific development should be described. This includes a discussion of land use and intensity, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

### Existing Area Conditions

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County. Roadways that provide access to the site as well as future roadways included in the study area are included in this section. Existing intersections within the study area as well as geometrics and traffic signals should be identified. The existing and proposed uses of the site should be identified in terms of various zoning categories of the County. The land use generating the most trips should be used for the analysis. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. These counts may include those for street average daily traffic and for intersection peak hour turning movements.

### Projected Traffic

One of the most critical elements of the TS is estimating the amount of traffic being generated. ITE's *Trip Generation Handbook* provides guidance on how to select between rates and equations when both are available. The national published data provided by

ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use.

~~Computer Software:~~ A number of computer software packages are available that are designed to either produce trip generation data or accept trip generation data for further analysis.

~~Trip Distribution:~~ The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

~~Trip Assignment:~~ The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3 year projected and 20 year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

~~Internal Trips:~~ Trips captured internally by a proposed development may be applicable depending on the use. The internal capture rates used should be based on the current version of the ITE's *Trip Generation Handbook*.

~~**Pass-by trips:** Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway.~~

### **Transportation Analysis**

Capacity analysis is required for each of the major street and site access locations (signalized and un-signalized) within the TS area. A clearer understanding of both the transportation related implications of the project and the necessary improvements to ensure acceptable operating conditions should result from this section of the TS. In addition, the following County Plans and Program and Factors shall be considered in the transportation analysis: County Plans and Program, Major Thoroughfare Plan, Bicycle and Pedestrian Plan and Traffic Impact Fee Program.

#### **Factors:**

- ~~Safety~~
- ~~Neighborhood Impacts~~
- ~~School Zone Traffic Control~~
- ~~Traffic Control Needs~~
- ~~Transit Needs or Impacts~~
- ~~Transportation Demand Management~~
- ~~Circulation Patterns~~
- ~~On-site Parking Adequacy and Off-site Parking Facilities~~
- ~~Pedestrian and Bicycle Movements/Continuity of Facilities~~
- ~~Service and Delivery Vehicle Access~~
- ~~Emergency and Fire Apparatus Access~~

~~**Transportation Safety:** The initial review of existing conditions within the TS area should include analysis of crash data from the 3 most recent years. Any intersection experiencing a crash rate of over 1 per million entering vehicles will need additional analysis. The proposed site plan should ensure that the internal circulation system and external access points~~

improve pedestrian and bicyclists safety and minimize vehicle/pedestrian and bicyclists conflict points.

*Transportation Operations:* Impacts on transportation operations shall be measured based on the definitions contained in the current version of the *Highway Capacity Manual (Transportation Research Board)*. For each analysis period studied (typically 3 and 20 year periods) and for each phase of the project a projected total traffic volume must be estimated for each critical intersection and roadway segment being analyzed. The projected total traffic volumes (consisting of the summation of existing traffic, background growth traffic, background development traffic and site traffic) will be used in the next step capacity analysis of future conditions.

*Signalized Intersections:* Level of Service (LOS) is based on roadway system characteristics that include:

- traffic volume
- lane geometry
- percentage of trucks
- peak hour factor
- number of lanes
- signal progression
- ratio of green time to cycle time (G/C)
- roadway grades
- parking conditions
- bicycle and pedestrian flows

The LOS categories established in the *Highway Capacity Manual*. In general, LOS ratings of A to D are acceptable while E & F ratings must be mitigated. There are a number of software programs that can determine highway capacity.

*Unsignalized Intersections:* LOS for multi-way stop controlled intersections and driveway intersections must be determined by computing or measuring control delay. Where capacity analysis shows a LOS of D or worse, an analysis should be completed to determine if a signal, roundabout, or turn restriction might be needed.

*Roundabouts:* In cases where LOS analysis indicates that an unsignalized intersection is expected to be LOS D or worse, a roundabout will be assessed before consideration will be given to a proposed signalized or multiway stop intersection. Factors for consideration of a roundabout include:

- availability of right-of-way
- crash history or potential
- traffic volume
- lane geometry
- number of lanes
- roadway grades
- parking conditions
- bicycle and pedestrian flows
- level of service

Each proposed location for a roundabout will be evaluated on a case by case basis. The capacity of a roundabout must be evaluated.

Transportation Design and Construction Manual – Amended ~~12-17-19~~[XX-XX-XX](#)

and appropriate analytical software programs shall be utilized.

### **Improvement Analysis**

The improvements required to accommodate existing, background and site-generated traffic are summarized in this section.

Intersections serving the development should be analyzed first. The analysis should include the following steps:

- Identification of critical movements and corresponding intersection approaches.
- Determine if the intersection needs new types of traffic control such as roundabout, signalization or multi-way stop control. The Transportation Study indicates that an intersection internal, adjacent or within 500 feet of the development will satisfy the MUTCD Peak Hour Warrant or Four-Hour Warrant within 20 years.
- Evaluation of each critical movement under potential scenarios of adding lanes, altering signal phasing, signal timing or lane use.
- Evaluation of signal locations, phasing and timing, with particular emphasis on corridor signal progression.
- Evaluation of queue lengths for both turn and through lanes to ensure adequate storage space.
- Identification of potential improvements within the contexts of Right-of-Way availability, intersection spacing, signal progression, County design standards and practical feasibility.

### **Findings & Recommendations**

Throughout the TS, data should be presented in tables, graphs, maps and diagrams in lieu of a narrative, for clarity and ease of review.

The examples contained in ITE's current version of Publication No. RP-020C *Transportation Impact Analysis of Site Development* is an excellent source of information.

**LAND  
DEVELOPMENT  
REGULATION  
SECTION 15 –  
REDMARKED COPY**



## Section 15 - Circulation

(orig. 7-12-05)

### A. Planning Standards

1. Street/Road Standards: Plans for streets/roads shall be prepared in accordance with the Jefferson County Transportation Design and Construction Manual and shall be approved by Planning and Zoning prior to plat recordation. (am. 7-12-05; am. 5-20-08; am. 11-24-15)
  - a. Rights-of-Way for public streets/roads, easements for private streets/roads, and emergency access easements shall be granted, conveyed and transferred in accordance with the following: (reloc. 7-12-05; am. 7-17-18)
    - (1) Public Street/Road System:
      - (a) The fee simple property owner shall be required to dedicate rights-of-way for the following: (am. 7-12-05; am. 7-17-18)
        - (a-1) Streets/roads shown on the current Major Thoroughfare Plan within or adjoining the subdivision. (reloc. 7-12-05)
        - (a-2) Proposed public streets/roads within the subdivision. (reloc. 7-12-05)
        - (a-3) Proposed public streets/roads that connect the subdivision to existing County, state or city maintained streets/roads. (reloc. 7-12-05)
        - (a-4) Existing public streets/roads, not previously dedicated, that are within or adjoining the subdivision. The dedication requirement for adjoining streets shall be for the adjoining one-half of the street, and for any portion of the opposite one-half of the street which is under the ownership of the developer. (reloc. 7-12-05; am. 7-17-18)
        - (a-5) Turn lanes, speed change lanes and tapers along adjoining property or properties required for construction and safe operation of intersections and new street/road facilities for the proposed subdivision. (reloc. 7-12-05)
      - (b) Rights of way for public streets/roads within the boundaries of the subdivision shall be dedicated to Jefferson County in accordance with the Dedication Certificate provisions in the Final Plat Section of this regulation. (orig. 7-17-18)
      - (c) Rights of way for public streets/roads exterior to the subdivision boundaries shall be conveyed to the County of Jefferson, in fee simple by general warranty deed, or another type of deed in a form acceptable to the Office of the County Attorney. Unless otherwise approved by the Office of the County Attorney, rights of way shall be free of all encumbrances, including, without limitation, liens, easements, and deeds of trust. (orig. 7-17-18)
    - (2) Private Street/Road Systems:
      - (a) The provision of access by private streets/roads shall only be permitted if the following applies: (reloc. 7-12-05)
        - (a-1) The developer has taken all actions necessary to ensure perpetual access for the benefit of each lot, tract or parcel, and to ensure that the private street/road system within the subdivision is maintained. (reloc. 7-12-05; am. 5-20-08)
        - (a-2) The developer has acquired sufficient rights, title, and interest in adjoining property to construct an exterior street/road system to connect the subdivision to public streets/roads to ensure perpetual access to each lot, tract or parcel, and establish permanent maintenance of the private streets/roads. (reloc. 7-12-05)
        - (a-3) Access to adjoining properties is not necessary unless required pursuant to A.1.c.(5). (am. 7-12-05; am. 7-17-18)
      - (b) Each private street/road within the subdivision boundary shall be designated as a "Utility, Drainage and Emergency Access Easement" on the plat. This Utility, Drainage and

Emergency Access Easement will be dedicated to Jefferson County in accordance with the Dedication Certificate provisions in the Final Plat Section of this regulation. (orig. 7-17-18)

(3) Exterior Emergency Access Easements:

- (a) Emergency Access Easements shall be conveyed to Jefferson County for required exterior emergency access connections where the developer does not have the necessary rights to ensure perpetual access for the benefit of each lot, tract or parcel within the development boundary. (am. 7-17-18)
- (b) Emergency Access Easements shall be conveyed to Jefferson County by easement deed in a form acceptable to the Office of the County Attorney. The following shall apply to the dedication of the Emergency Access Easements: (am. 7-17-18)
  - (b-1) The easement shall be for emergency and service vehicle access, and drainage and utility purposes. (orig. 7-17-18)
  - (b-2) The easement shall not obligate the County to provide maintenance services. (am. 7-17-18)
  - (b-3) The easement deed shall expressly state that it conveys to the County an easement for each of the following purposes: (i) passage of service vehicles and passage of all vehicles and pedestrians during an emergency; (ii) drainage; and (iii) utilities. (am. 7-12-05; am. 7-17-18)
  - (b-4) The easement shall be from the fee simple property owner or the owner of a prior easement that expressly provides that it can be assigned or conveyed to the County. (orig. 7-17-18)
- (4) Public street/road right-of-way widths and private street/road easement widths shall be provided in accordance with the templates in the Transportation Design and Construction Manual. Additional rights-of-way/easements may be required at locations such as, but not limited to, roundabouts, interchanges, acceleration, deceleration, turn or climbing lanes, cut and fill slopes, sidewalks, trails, medians, traffic signs, and drainage structures, and for maintenance. (reloc. 7-12-05; am. 11-24-15; am. 7-17-18)

b. Street/Road Design

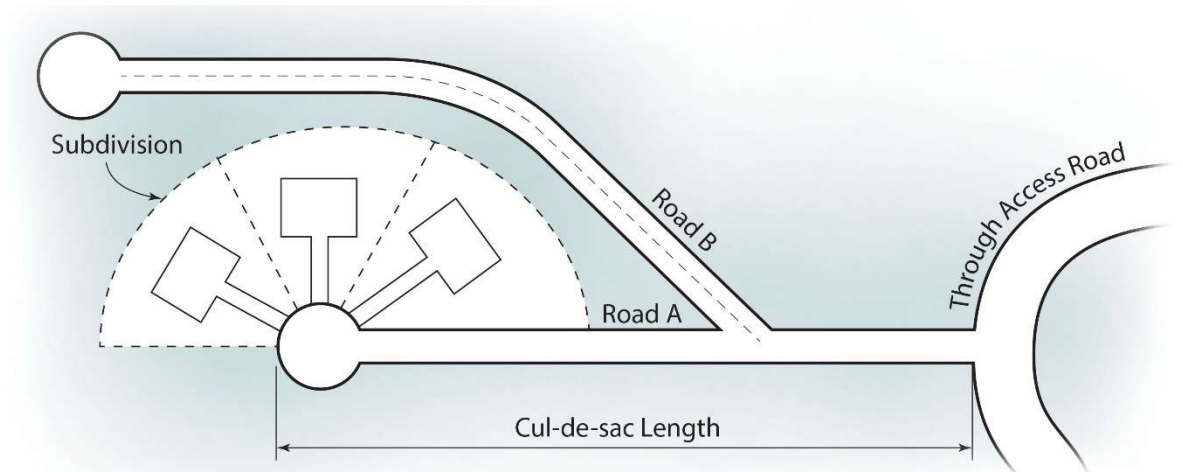
- (1) Streets/roads, whether public or private, shall be designed in accordance with the current American Association of State Highway and Transportation Officials (AASHTO) Standards unless modified by the Jefferson County Transportation Design and Construction Manual. (reloc. 7-12-05; am 11-24-15)
- (2) Paving of streets/roads within the proposed development and streets/roads connecting the proposed development with other County, state or city paved streets/roads shall be in accordance with the following: (reloc. 7-12-05; am. 12-5-06)
  - (a) New street/roads to be maintained by the County, state or city shall be constructed to the appropriate public street/road template standard, which includes paving. (orig. 12-5-06)
  - (b) Existing unpaved County maintained streets/roads shall be constructed to the appropriate public template standard (which includes paving) for a length that is equal to the development impact on the street/road system. For residential development, the development impact shall not exceed a maximum of 4% per lot. If the development impact to a street/road exceeds 80%, then paving for the entire length will be required. The impact on a street/road system will be determined using the following formulas. (reloc. 7-12-05; am. 12-5-06)

**Development Impact (%) = Proposed ADT / (Existing ADT + Proposed ADT)**

**Paving Requirement = Length of Unpaved Section X Development Impact (%)**

- Length of Unpaved Section is the distance from the development access point(s) to the paved street/road. (orig. 12-5-06)
- Proposed ADT is the number of trips generated by the proposed development. (orig. 12-5-06)

- Existing ADT is the number of actual trips on the street/road. Existing ADT shall be determined using a traffic counting device located on the gravel portion of the street/road immediately adjacent to the paved section. (orig. 12-5-06)
- (c) Should the County choose to accept a cash-in-lieu of construction payment for the paving requirement, the required paving contribution shall be calculated using following:
- Appropriate public street/road template width
  - Minimum 5" full depth asphalt surface
  - Current County cost for asphalt in place at the development location
- The County shall use the cash-in-lieu of construction monies for any improvement on the street/road as deemed necessary or desirable by the County. (orig. 12-5-06)
- (d) All private roads and all non-maintained roads in County right-of-way shall be paved if the sum of the existing and proposed ADT on the roads exceeds 150. The paving requirement will apply to that portion of the roads that exceeds 150 ADT (reloc. 7-12-05; am. 12-5-06)
- (e) All private streets shall be paved. (orig. 7-17-18)
- c. Patterns: Street/road patterns shall be planned consistent with the dedication and design requirements and the following: (reloc. 7-12-05)
- (1) Street/road patterns shall induce traffic flow appropriate to the function of the streets/roads. Long, straight and other local street alignments conducive to speeds in excess of 30 M.P.H. shall be avoided. In areas where that is not possible traffic calming measures such as bump outs, neckdowns shall be incorporated at approved intervals to effectively slow down design speeds. (reloc. 7-12-05; am. 7-17-18)
- (2) Cul-de-sacs may be used when meeting the following criteria:
- (a) Does not exceed 1 mile in length and serves no more than 30 existing plus proposed single family residential units (including platted lots) or obtain approval from ~~the fire protection district~~ Planning and Zoning for alternate standards that provide acceptable fire protection and safety mitigation measures concerning access and water. (orig. 11-24-15; am. 7-17-18; am. XX-XX-XX)
- (b) Serves no more than 100 multi-family units or obtain approval from Planning and Zoning ~~the fire protection district~~ for alternate standards that provide acceptable fire protection and safety mitigation measures concerning access and water. (orig. 11-24-15; am. 7-17-18; am. XX-XX-XX)
- (c) Cul-De-Sac length is measured from the maximum street/road length of the developable lot within the proposed subdivision to the beginning of the cul-de-sac. (orig. 7-17-18)



- (3) Streets/roads shall be planned and designed to minimize grading and scarring of the terrain, and not create erosion and drainage problems. (reloc. 7-12-05)

- (4) Streets/roads shall be continuous and conform in alignment and grade with existing, planned or platted streets/roads with which they are to connect. (reloc. 7-12-05)
- (5) Streets/roads shall extend to the subdivision boundary lines as deemed necessary by Planning and Zoning for the connection with adjacent lands. Public streets/roads so extended shall be dedicated as collector streets/roads unless a template for a local street/road is approved by Planning and Zoning. Private streets/roads may be extended to the subdivision boundary provided said private streets/roads are equivalent to public streets/roads for the connection with adjacent lands, if approved by Planning and Zoning (reloc. 7-12-05; am. 5-20-08; am. 7-17-18)
- (6) Streets/roads that extend to the boundary line shall be provided with a turn-around. Temporary portions of the turn-around shall be labeled as tracts to facilitate the ultimate reversion of the same. If lots are not dependent upon the extended streets/roads for access, the right-of-way, not including a turn-around, shall be dedicated, but construction of the extended street/road will not be required. (reloc. 7-12-05)
- (7) Streets/roads shall intersect one another at right angles or as nearly at right angles as topography and other limiting factors permit. (reloc. 7-12-05)
- (8) Intersection spacing shall conform to the Jefferson County Transportation Design and Construction Manual. (am. 7-12-05; am. 5-20-08; am. 11-24-15; am. 7-17-18)
- (9) Traffic calming physical devices, such as speed bumps and raised crosswalks shall require approval from the fire protection district and conform to current County policies and procedures. All other traffic calming devices are considered non-physical devices, such as bumpouts, pedestrian refuges and the like, are allowed subject to approval by Planning and Zoning. (orig. 11-24-15)
- (10) Subdivisions shall have a street/road system that provides primary and secondary access to existing County, state or city maintained streets/roads, except that secondary access is not required for developments with access provided it meets the cul-de-sac requirements as set forth in this Section. The minimum distance between the centerlines of the primary and secondary access streets/roads shall be in accordance with the spacing provision. The provision of emergency access in-lieu of secondary access shall only be permitted if the following applies: (am. 7-12-05; am. 11-24-15)
  - (a) Secondary full-time access is not needed for transportation operations and maintenance and level of service to provide appropriate vehicular access and circulation control. (am. 7-12-05; am. 7-17-18)
  - (b) The developer has taken or agrees to take all actions necessary to ensure that an emergency access has been dedicated to the County and that an emergency access system is maintained. (reloc. 7-12-05)
  - (c) The developer has taken or agrees to take all actions necessary to ensure that the emergency access will be closed always, except during emergency situations, to vehicle traffic. (reloc. 7-12-05)
  - (d) The applicable fire protection district has approved the plans for the emergency access facilities and appurtenances thereto. (reloc. 7-12-05)
  - (e) Access to adjoining properties is not required pursuant to A.1.c.(5) of this Section. (am. 7-12-05; am. 7-17-18)
  - (f) The emergency access street/road is designated as an "Emergency Access Easement" on the plat and the developer has complied with A.1.a.(2)(b) and A.1.a.(3) of this Section for any portion of the emergency access system exterior to the subdivision. (am. 7-12-05)
- d. Names: Streets/roads shall be named in accordance with the following: (reloc. 7-12-05)
  - (1) Plains: Names of all streets shall be in full conformance with the metropolitan grid system as shown on the Official Jefferson County Base Maps. (reloc. 7-12-05)
  - (2) Mountains: Names of all roads shall be sufficiently different from previously adopted road names. (reloc. 7-12-05)

- e. Street/Road Improvements: Street/road improvements shall be provided for the following: (reloc. 7-12-05)
  - (1) Streets/roads interior to the development. (reloc. 7-12-05)
  - (2) The adjoining one-half of contiguous [arterial](#), collector and local streets/roads including streets/roads adjoining park and school lands created by the plat. (reloc. 7-12-05; am. 7-17-18; am. XX-XX-XX)
  - (3) If existing pavement on the opposite one-half of the street/road does not match with and tie to the required pavement section on the adjoining one-half, then a pavement overlay on part of the opposite one-half shall be required. If the existing pavement cross section is higher than the approved pavement cross section, then the existing pavement on the opposite one-half shall be adjusted or reconstructed to the approved height. (reloc. 7-12-05; am. 7-17-18)
  - (4) If the opposite side one-half of the street/road is not paved to current Jefferson County standards or does not exist, the developer shall be responsible for a 24-foot total pavement width plus the opposite side shoulder. If existing pavement on the opposite one-half of the street/road does not match with and tie to the required pavement section on the adjoining one-half, then a pavement overlay on part of the opposite one-half shall be required. If the existing pavement cross section is higher than the approved pavement cross section, then the existing pavement on the opposite one-half shall be adjusted or reconstructed to the approved height. (reloc. 7-12-05; reloc. 7-17-18)
  - (5) Street(s)/road(s) connecting the subdivision with existing Jefferson County, state or city maintained street(s)/road(s). The pavement width of the connecting street/road shall be the same as the street(s)/road(s) within the subdivision with which they connect. Shoulders shall be provided if curb/gutter and sidewalks are not required. (reloc. 7-12-05)
  - (6) ADA ramps shall be provided including the appropriate receiving ramp even if the entire construction is not adjoining the property. (orig. 7-17-18)
- f. Applicants shall not be required to comply with A.1.e.(2), A.1.e.(3) and A.1.e.4 regarding adjoining street/road improvements when: (am. 7-12-05; am. 7-17-18)
  - (1) The proposed ADT is less than 50 where access is proposed to an existing paved street/road. (reloc. 7-12-05)
  - (2) The sum of the existing ADT plus the ADT from the proposed development will not exceed 150 where access is proposed to an existing gravel street/road. (reloc. 7-12-05)
- 2. Driveway Standards: Access from a street/road to 1 residential lot, tract, parcel or structure, or to 1 nonresidential lot, tract, parcel or structure shall meet or exceed the standards set forth below. Access to 2 or more residential or nonresidential lots, tracts, parcels or structures shall be provided by a street/road that conforms to the requirements of this Regulation. (am. 7-12-05; am. 5-20-08; am. 11-24-15)
  - a. Driveways within the lots/tracts shall be provided from the property line to the building site without: (reloc. 7-12-05)
    - (1) Creating erosion or drainage problems. (reloc. 7-12-05)
    - (2) Crossing sewage disposal leaching fields. (reloc. 7-12-05)
  - b. Driveway design shall facilitate all emergency vehicle movement. (reloc. 7-12-05)
  - c. Access shall be provided within residential and nonresidential areas to adjoining residential and nonresidential areas respectively as required by Planning and Zoning when such provisions would reduce or limit access onto a street/road. (am. 7-12-05; am. 4-4-06; am. 5-20-08; am. 12-21-10)
- 3. Curb and Gutter Standards: Curb and gutters or ditches shall be provided for subdivisions in the plains areas in accordance with the Jefferson County Transportation Design and Construction Manual and the following: (reloc. 7-12-05; am. 11-24-15)
  - a. 6" vertical curb and gutter (with detached sidewalk) or a 4-inch mountable curb and gutter (with attached or detached sidewalk) shall be provided along all local streets, unless otherwise approved by Planning and Zoning. (am. 7-12-05; am. 4-4-06; am. 12-21-10; am. 7-17-18)
  - b. A 6-inch vertical curb and gutter shall be provided along all collector and arterial streets and along

- all streets adjoining public and semipublic tracts and multifamily and nonresidential lots. (reloc. 7-12-05)
- c. Ditches may be provided along streets in lieu of curb and gutters where all of the following criteria are met: (reloc. 7-12-05)
    - (1) Streets are classified as local or collector (ADT less than 8,000). (reloc. 7-12-05; am. 7-17-18)
    - (2) Street grades are no less than 2 percent and no greater than 4 percent. (reloc. 7-12-05)
    - (3) Minimum lot frontage is 100 feet. (reloc. 7-12-05)
  - d. Planning and Zoning may approve roadside ditches in lieu of curb and gutter if it is determined that the curb and gutter cannot be designed to drain properly or if it will cause drainage problems in the area. (orig. 7-17-18)
4. Sidewalk Standards: Sidewalks shall be provided for developments in the Plains area in accordance with the Jefferson County Transportation Design and Construction Manual and the following: (reloc. 7-12-05; am 11-24-15; am. 7-17-18)
- a. A 5-foot wide sidewalk (with combination curb and gutter) or a 5-foot wide detached sidewalk or trail shall be provided along local streets adjoining residential developments, unless otherwise approved by Planning and Zoning. (am. 7-12-05; am. 4-4-06; am. 12-21-10; am 11-24-15; am. 7-17-18)
  - b. A 5-foot attached or detached sidewalk shall be provided along all local and collector streets adjoining nonresidential and multifamily developments. (am. 7-12-05; am. 4-4-06; am. 12-21-10; am 11-24-15; am. 7-17-18)
  - c. A 6-foot wide detached sidewalk shall be provided along all minor arterial and major collector streets. (orig. 11-24-15)
  - d. An 8-foot wide detached sidewalk shall be provided along all principal arterial and parkway streets. (am. 7-12-05; am. 4-4-06; am. 11-24-15; am. 7-17-18)
  - e. Curb ramps shall be provided at all intersections. Mid-block ramps shall be provided at all "T" intersections. Mid block pedestrian ramps should be considered where there is an adjacent pedestrian path. (reloc. 7-12-05; am. 7-17-18)
  - f. Sidewalk easements shall be provided and dedicated when the sidewalk is not within a dedicated street right-of-way. (reloc. 7-12-05)
  - g. Adjacent bus stops shall be upgraded to comply with current RTD bus stop requirements. (orig. 7-17-18)
5. Traffic Signal Contributions:
- a. A contribution toward a future traffic signal will be required if the following conditions are met:
    - (1) The development generates over 1000 average daily trips or 100 trips in a peak hour period; and (orig. 7-17-18)
    - (2) The Transportation Study indicates that an intersection internal, adjacent or within 500 feet of the development will satisfy the MUTCD Peak Hour Warrant or Four Hour-Warrant within 20 years. (orig. 7-17-18)

If the above conditions are met, then the applicant shall provide a contribution representing the proportional percentage of the site that is within 500 feet to the intersection requiring future traffic signal improvements. For illustrative purposes only, if the site is at the corner of one quadrant of the intersection the contribution shall be 25% of the traffic signal for the intersection. The contribution should be a cash-in-lieu payment, which will be returned to the applicant if conditions change or the traffic signal is no longer warranted within the original 20-year period. (orig. 7-17-18)

## **B. Construction Specifications**

- 1. Street/Road and Curb/Gutter/Sidewalk Standards: Construction shall be in accordance with the approved Plans and meet the criteria of the Jefferson County Transportation Design and Construction Manual. (am. 7-12-05; am. 12-21-10; am. 11-24-15)

**ZONING  
RESOLUTION  
SECTION 16 –  
REDMARKED COPY**

## Section 16: Land Disturbance

(orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 10-12-04;  
am. 4-20-10; am. 11-20-12; am 6-1-19)

### A. Purpose

The purpose of this section is to:

1. Protect the water quality of the County's drainageways and surface waters; (orig. 10-12-04; am. 12-6-22)
2. Protect life, property and the environment from loss, injury and damage by stormwater runoff, erosion, sediment transport, ponding, flooding, landslides, accelerated soil creep, settlement and subsidence, excessive dust, and other potential hazards caused by grading, construction activities, and denuded soils; (orig. 10-12-04)
3. Allow a temporary land use for land disturbance activities; and (orig. 8-25-86; am. 9-24-91; am. 3-23-99; am. 10-12-04)
4. Establish performance standards to:
  - a. Define grading, drainage, erosion and sediment control, and waste disposal requirements; (orig. 10-12-04)
  - b. Ensure mitigation of adverse impacts; and (orig. 10-12-04)
  - c. Ensure the reclamation of disturbed land. (orig. 10-12-04)

### B. General Provisions

1. Performance Standards:

All Land Disturbance Activities must conform to the performance standards as detailed in this section. These standards apply whether or not a Land Disturbance Permit is required. (orig. 10-12-04; am. 12-6-22)

2. Activities Requiring a Land Disturbance Permit (Grading Permit or Notice of Intent):

It shall be unlawful for any person, firm or corporation to do or authorize any land disturbance in the unincorporated area of Jefferson County without first obtaining a Land Disturbance Permit from the County to authorize temporary land disturbance activities unless specifically exempted by this section. The applicant, the landowner, and the contractor are responsible if a land disturbance activity is not in accordance with the performance standards, or if a land disturbance activity is undertaken beyond the scope of the Land Disturbance Permit without County approval. Land disturbance activities must be completed in compliance with the approved plans. (orig. 8-25-86; am. 9-24-91; 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 12-6-22)

- a. Land Disturbance Activities will require a Grading Permit if one the following apply: (orig. 10-12-04; am. 12-6-22)

(1) The disturbed area is equal to or greater than 0.5 acres. (orig. 6-1-19; am. 12-6-22)

(2) Land disturbance activities with or in advance of a building permit with less than 0.5 acres of land disturbance, where the applicant is requesting relief of a regulatory requirement, including all performance standards related to grading, drainage and circulation. (orig. 6-1-19; am. 12-6-22; reloc. XX-XX-XX)

(23) 5,000 or more cubic yards of earthen material is stored on a property and the material is not actively being used on said property. An active use would be construction associated with an active building permit for a primary structure. (orig. 12-6-22)

- b. Land disturbance activities that require a Notice of Intent to be submitted with, or in advance of, a Building Permit application include the following: (orig. 10-12-04; am. 6-1-19; am. 12-6-22)

~~(1) Land disturbance in accordance with lot grading, erosion and sediment control plans approved with plats; (orig. 10-12-04; am. 11-24-15; am. 6-1-19) or~~

(21) Land disturbance associated with new start building permits for primary structures. (orig. 6-1-19)



(2) Land disturbance associated with access to detached living space where either the access does not exist or has not previously been approved as access to living space. (orig. XX-XX-XX)

~~(3) This Notice of Intent process shall only apply to land disturbance activities that meet the regulatory requirements, including all performance standards related to grading, drainage and circulation; otherwise, a Grading Permit is required.~~ (orig. 6-1-19; am. 12-6-22; am. XX-XX-XX)

3. Activities exempt from the Requirement for a Grading Permit

Land disturbance activities that are exempt from Grading Permit requirements shall comply with the specific requirements, if any, listed in the applicable exemption provision below. In addition, land disturbance associated with activities listed within this exemption section must still be in compliance with the performance standards set forth in this section, unless specifically stated otherwise. The applicant, landowner and the contractor are responsible if land disturbance activity is not in accordance with these performance standards. The following land disturbance activities are permissible without obtaining a Grading Permit: (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 10-12-04; am. 4-20-10; am. 6-1-19; am. 12-6-22)

- a. Projects which involve less than 0.5 acres of disturbed area. Individual lots in subdivision developments under the same ownership, involving less than 0.5 acres of disturbed area, shall not be considered separate projects if they are contiguous or within 0.25 mile of each other. Any series of related projects or connected projects on one site, which together exceed the 0.5 acre limitation shall be considered a single project and shall be required to obtain a Grading Permit. (orig. 9-24-91; am. 12-17-02; am. 10-12-04; am. 7-12-05; am. 11-24-15; am. 6-1-19)
- b. Land disturbance work being done pursuant to and in conformance with an approved grading plan in conjunction with an approved recorded Plat, Site Development Plan, Minor Adjustment or Exemption from Platting. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 4-27-04; am. 10-12-04)
- c. Tillage of agricultural land is exempt from all permit requirements. Agricultural uses of land zoned agricultural, other than tillage, which disturb greater than 0.5 acres is exempt from the filing requirements, provided a conservation plan for the proposed grading activities using the United States Department of Agriculture Soil Conservation Service standards is approved by the Jefferson Conservation District. A copy of the conservation plan shall be submitted to Planning and Zoning prior to the commencement of grading activities. The County may enforce the conditions of the conservation plan under the enforcement provisions of this section. (orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 11-24-15; am. 6-1-19; am. 12-6-22)
- d. Trenching incidental to the construction, maintenance and installation of approved underground pipelines, electrical or communication facilities, and drilling or excavation for approved wells if the total area of land disturbance is less than one acre. Construction activities associated with the installation of the onsite wastewater treatment system (OWTS) shall not be exempt. Construction of access required to complete the trenching or for future maintenance shall not be exempt. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 10-12-04; am. 4-20-10; am. 11-20-12; am. 11-24-15; am. 12-6-22)
- e. Land disturbance for utility installation or maintenance within a County owned or County maintained Right-of-Way if the total area of land disturbance is less than one acre. These activities require a County Right-of-Way and Construction Permit. (orig. 8-8-95; am. 10-12-04; am. 11-20-12)
- f. Land disturbance or excavations in accordance with plans incorporated in a mining permit, reclamation plan or sanitary landfill approved by the County. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 10-12-04)
- g. County capital improvement or County maintenance projects within Right-of-Way or County property if the total area of land disturbance is less than one acre. (orig. 12-17-02; am. 10-12-04; am. 11-20-12; am. 12-6-22)
- h. Maintenance and cleaning of existing ditches, lakes, ponds, storm sewer system, and water storage reservoirs with a total area of land disturbance is less than one acre. (orig. 8-25-86; am. 10-12-04; am. 6-1-19)
- i. Land disturbance for culvert installation or maintenance within a County owned, public ROW or County maintained Right-of-Way if the total area of land disturbance is less than one acre and the culvert is intended to convey stormwater only. (orig. 6-1-19)

- j. Maintenance and resurfacing of existing streets/roads, runways, sidewalks/trail systems, parking lots/loading areas, and railroad beds. (orig. 9-24-91; am. 10-12-04)
- k. Performance of emergency work necessary to prevent or mitigate an immediate threat to life or property when an urgent necessity arises. The person performing such emergency work shall notify Planning and Zoning promptly of the problem and work required. If the emergency work would not otherwise be exempt from a Grading Permit, a Grading Permit shall be obtained as soon as possible. (orig. 8-25-86; am. 9-24-91, 8-8-95; am. 4-27-04; am. 10-12-04; am. 5-20-08)
- l. Enlargements to parking areas less than 0.5 acre larger than the original area of existing parking facilities for commercial, industrial and institutional uses. Stormwater detention and water quality must be provided for in accordance with the Storm Drainage Design and Technical Criteria Manual. (orig. 4-27-04; am. 10-12-04; am. 11-24-15; am. 6-1-19)
- m. Land disturbance for natural surface trails that are less than one acre are exempt. Land disturbance over one acre associated with the construction of natural surface trails shall follow the procedure outlined below prior to commencement of any trail construction. The land disturbance associated with the construction of natural surface trails shall conform with the performance standards of this section and the current Jefferson County Natural Surface Trail Guide. (orig. 4-20-10; am. 11-20-12; am. 11-24-15; am. 7-17-18)
  - (1) Plans are submitted showing the location and overall scope of the trail construction project, including a description of the proposed construction phasing. (orig. 4-20-10; am. 7-17-18)
  - (2) A detailed construction schedule is provided for each phase of the construction project. (orig. 4-20-10)
  - (3) The applicant proposes a construction guide that includes typical construction procedures that will be used during the construction of trails, including erosion and sediment control measures. (orig. 4-20-10)
  - (4) Planning and Zoning has reviewed the construction guide and has determined that the construction procedures will be sufficient to assure compliance with the grading performance standards of this section, and state or county erosion and sediment control standards. (orig. 4-20-10)
  - (5) The applicant shall stake the proposed trail alignment and shall coordinate a site visit with County Staff to review the alignment. If Staff identifies areas where trail alignment should be adjusted to assure conformance with the performance standards and the construction guide, then a new plan showing the new alignment shall be submitted. (orig. 4-20-10)
  - (6) The applicant agrees to implement the construction procedures identified within the guide and agrees that the county has the authority to inspect and require field alterations if the typical construction procedures identified in the guide are not being properly implemented. The applicant also agrees that failure to implement the construction standards of the guide or the field alterations directed by Planning and Zoning may result in the issuance of a zoning violation in accordance with this Resolution; and may result in the exemption from the grading permit requirements being revoked for future phases of the trail construction project. (orig. 4-20-10)
  - (7) The applicant submits the standard Grading Permit fee to cover the cost of the review and approval of the construction guide, and the inspection of each phase of the construction process. (orig. 4-20-10)

The procedures outlined in this section shall not apply to trail construction in special flood hazard areas that have been identified as a part of the Jefferson County Floodplain Overlay District. The appropriate floodplain development permit and grading permit will be required for construction activities occurring within special flood hazard areas. (orig. 4-20-10; am. 6-1-19)

- n. Any work within State or Federal lands including Rights-of-Way and/or permanent easements held by said agencies. This exemption does not relieve these entities from completing a floodplain development permit in accordance with the Floodplain Overlay District Section of this regulation. (orig. 7-17-18)
- o. Onsite disturbance through the Land Disturbance Permit may not be required for properties that are covered by a separate Municipal Separate Storm Sewer System (MS-4) permit through the State of

Colorado, as determined by Planning & Zoning. (reloc. and am. 5-21-19)

4. Exemptions, Waivers, Variances and/or Exclusions

Any exclusions, exemptions, waivers, and variances included in the regulatory mechanism must comply with the terms and conditions of the MS4 Permit (COR090000). (orig. 6-1-19)

5. Denial of other Permits

Building Permits or Certificate of Occupancy shall not be issued while an unresolved grading, drainage or floodplain violation is ongoing on the subject property or within a common plan of development. (orig. 8-25-86; am. 9-24-91, am. 8-8-95; am. 12-17-02; am. 7-17-18; am. 6-1-19; am. 12-6-22)

6. Permission of other Agencies or Owners

The issuance of a Grading Permit or the submission of a Notice of Intent shall not relieve the applicant of the responsibility for securing other permits or approvals required by any other division or agency of Jefferson County or other public agency or for obtaining any easements or authorization to work within an existing easement or for removing or transporting earth materials on property not owned by the applicant. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 10-12-04; am. 12-6-22)

7. Construction and Permits

For construction within County Right-of-Way, the Grading Permit or Notice of Intent must be accompanied by an Access Permit and/or a Right-of-Way Use and Construction Permit in accordance with plans approved by the County. For construction outside of County Right-of-Way, the Grading Permit must be accompanied by a Construction Permit in accordance with the plans approved by the County. The applicant shall obtain applicable permits from the County prior to commencing field work. All other applicable requirements shall be followed including the Transportation Design and Construction Manual. (orig. 8-8-95; am. 12-17-02; am. 10-12-04; am. 11-24-15; am. 7-17-18; am. 12-6-22)

8. Liability

Neither the issuance of a Grading Permit nor the submission of a Notice of Intent under the provisions of this section nor compliance with the provisions hereof or with any conditions imposed in this section shall relieve the applicant from responsibility for damage to any person or property or impose any liability upon the County for damage to any person or property. (orig. 8-25-86; am. 12-17-02; am. 10-12-04)

9. Restricted Activities

- a. No blasting, processing, crushing, or off-site hauling or other similar treatment of a commercial mineral deposit may occur in the permit area. (orig. 9-24-91; am. 10-12-04)
- b. Any activity to construct any street/road to be dedicated to the County shall be undertaken pursuant to the Land Development Regulation and the Transportation Design and Construction Manual and in accordance with plans approved by the County. (orig. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15)
- c. No Grading Permit shall be issued for any land disturbance activity which exceeds the minimal amount of grading necessary for the uses legally allowed at the time of permit application. Land disturbance activities for uses that require rezoning are unlawful. (orig. 8-8-95; am. 3-23-99; am. 10-12-04)
- d. When there is a grading plan approved in conjunction with a Plat, Site Development Plan, Minor Adjustment or an Exemption from Platting, it shall be unlawful to grade in a manner that is not consistent with the approved grading plan. (orig. 8-8-95; am. 3-23-99; am. 10-12-04; am. 7-17-18)
- e. Any construction or development activity in a drainage easement or tract must either be in compliance with the original approved drainage report or comply with the Storm Drainage Design and Technical Criteria. (orig. 10-12-04)

10. Grading Concurrent with Platting

- a. When a property is in a platting process, grading activities may commence prior to Plat approval by the Board of County Commissioners provided all of the following conditions are satisfied: (orig. 3-23-99; am. 10-12-04)
  - (1) The zoning is final and recorded. (orig. 3-23-99)

- (2) The subdivision proposal has received approval by the Planning Commission or a recommendation of approval by the Planning Commission. (orig. 3-23-99; am. 10-12-04, am. 12-6-22)
  - (3) The grading and sediment and erosion control plans have received staff approval, either through the Final or Preliminary and Final Plat process. The grading plans shall not include permanent facilities such as curb, gutter, sidewalk, asphalt, etc. The installation of drainage facilities is allowed as approved by Planning and Zoning. (orig. 3-23-99; am. 10-12-04; am. 11-24-15)
  - (4) The Final Plat application has been received and accepted as complete by staff or the Planning Commission has recommended approval of the Preliminary and Final Plat. (orig. 3-23-99; am. 10-12-04; am. 11-24-15)
  - (5) Grading within a Floodplain Overlay District may be permitted if a Floodplain Development Permit has been issued. (orig. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15; am. 7-17-18)
  - (6) No waivers or alternative standards/requirements or variances related to grading requirements are being requested or are necessary in conjunction with the Final or Preliminary and Final Plat application. (orig. 3-23-99; am. 10-12-04; am. 11-24-15)
  - (7) The applicant has submitted a letter to the County indicating a request to commence land disturbance activities prior to Final or Preliminary and Final Plat approval and acknowledging that grading prior to Platting is done at their own risk, that grading changes may be required upon Final or Preliminary and Final Plat approval, and that the County shall not be held responsible for changes emanating from or costs associated with any changes that may be required as a result of Final or Preliminary and Final Plat approval. (orig. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15)
  - (8) A Performance Guarantee has been accepted by the County in accordance with the Land Development Regulation. (orig. 10-12-04)
  - b. When grading activities are authorized prior to Plat approval by the Board of County Commissioners, the grading shall comply with the Land Development Regulation and with any previously approved grading plans. (orig. 3-23-99; am. 12-17-02; am. 10-12-04; am. 11-24-15)
  - c. Any land disturbance activity permitted pursuant to this section may be subject to additional requirements or alterations depending on approval conditions imposed by the Board of County Commissioners during the Plat review. (orig. 3-23-99; am. 10-12-04)
11. Grading Concurrent with the Processing of a Site Development Plan or Minor Adjustment
- a. When a property is in a Site Development Plan or Minor Adjustment process, grading activities may commence prior to approval by Planning and Zoning provided all of the following conditions are satisfied: (orig. 11-24-15; am. 7-17-18)
    - (1) The zoning is final and recorded. (orig. 11-24-15)
    - (2) The grading and sediment and erosion control plans have received staff approval. The grading plans shall not include permanent facilities such as curb, gutter, sidewalk, asphalt, etc. The installation of drainage facilities is allowed as approved by Planning and Zoning. (orig. 11-24-15)
    - (3) Grading within a floodplain overlay district may be permitted if a Floodplain Permit has been issued. (orig. 11-24-15; am. 7-17-18)
    - (4) No alternate standards/requirements or variances related to grading requirements are being requested or are necessary in conjunction with the Minor Adjustment or Site Development Plan application. (orig. 11-24-15)
    - (5) The applicant has submitted a letter to the County indicating a request to commence land disturbance activities prior to Minor Adjustment or Site Development Plan approval and acknowledging that grading prior to approval is done at their own risk, that grading changes may be required upon Minor Adjustment or Site Development Plan approval, and that the County shall not be held responsible for changes emanating from or costs associated with any changes that may be required as a result of Minor Adjustment or Site Development Plan approval. (orig. 11-24-15)

- (6) A Performance Guarantee has been accepted by the County in accordance with the Land Development Regulation. (orig. 11-24-15)
- b. When grading activities are authorized prior to Minor Adjustment or Site Development Plan approval by Planning and Zoning, the grading shall comply with the Land Development Regulation and with any previously approved grading plans. (orig. 11-24-15; am. 7-17-18)
- c. Any land disturbance activity permitted pursuant to this section may be subject to additional requirements or alterations depending on approval conditions imposed by Planning and Zoning during the Minor Adjustment or Site Development Plan review. (orig. 11-24-15; am. 7-17-18)

### **C. Submittal Requirements**

The following submittal documents are required for Land Disturbance Permit Applications. (orig. 8-25-86; am. 7-17-18; am. 6-1-19)

1. An application form signed by the fee simple owner of the property or by the lessee, licensee or easement holder if the activity is to be undertaken pursuant to that interest. Grading Permit, Notice of Intent, and Natural Surface Trail application forms are available from Planning and Zoning. (orig. 10-12-04; am. 5-20-08; am. 6-1-19)
2. A cover letter describing the proposed activities. Not Required for Notice of Intent Applications. (orig. 10-12-04; am. 5-20-08; am. 6-1-19)
3. A nonrefundable application fee in an amount established by the Board of County Commissioners. (orig. 8-25-86; am. 9-24-91; am. 5-3-94)
4. A copy of the recorded deed for the parcel, tract or lot. (orig. 12-6-22)
5. Proof of Access in accordance with the Access Standards in the General Provisions and Regulations Section of this Zoning Resolution. (orig. 6-1-19)
6. A grading, erosion and sediment control plan in accordance with the Plans and Specifications of this Section. (orig. 8-25-86; am. 6-1-19)
7. A geologic and/or soils investigation report in accordance with the Plans and Specifications of this Section is required if there are any geological hazards including highly erodible soils or commercial mineral deposits within or immediately adjacent to the grading site or when the final cut or fill slopes are proposed to be steeper than 2H:1V or if infiltration is a component of the drainage system. (orig. 8-25-86; am. 9-24-91, 8-8-95; am. 12-17-02; am. 10-12-04; am. 6-1-19; am. 12-6-22)
8. A drainage report or drainage letter in conformance with the requirements of the Storm Drainage Design and Technical Criteria. (orig. 10-12-04; am. 11-24-15; am. 6-1-19; am. 12-17-19)
9. Construction plans, details and supporting calculations for retaining walls, if applicable, in accordance with the Performance Standards of this Section. For Notice of Intent Applications, the applicant will need to apply for a separate miscellaneous permit for retaining walls greater than 36 inches high. (orig. 10-12-04; am. 6-1-19)
10. Drainage Easements may be required to be dedicated to the County for all permanent control measures. The applicant shall provide a legal description and exhibit (signed and stamped by a Professional Land Surveyor) when applicable. Not Required for Notice of Intent Applications. (orig. 12-17-19)
11. A cost and/or quantity estimate (Exhibit A) in accordance with the Improvement Security requirements of this Section, for all the work associated with the project. Reference the example Exhibit A on the Planning and Zoning website. Not Required for Notice of Intent Applications. (orig. 10-12-04; am. 7-12-05; am. 7-17-18; am. 6-1-19; am. 12-17-19; am. 12-6-22)

Note: An improvements security may be required in accordance with the Security requirements of this Section. The typical improvement security will be a letter of credit or cash escrow. If required the improvement security will need to be submitted prior to approval of the Land Disturbance application. (orig. 10-12-04; am. 7-17-18; am. 6-1-19; 12-17-19)

12. A completed N-1 Form stating that the proposed construction and grading are in conformance with the Land Disturbance requirements of this Section and, if applicable, the approved overall grading plan for the subdivision. Only Required for Notice of Intent Applications. (orig. 6-1-19)

Note: A completed N-2 Form is required prior to issuance of a Certificate of Occupancy. (orig. 6-1-19)

### **D. Procedures**

1. Notice of Intent Procedures: A Notice of Intent (NOI) shall be submitted with, or in advance of, a building permit application for a primary structure that depicts the phased grading, erosion and sediment control measures for that lot/parcel. The NOI shall certify that the Plans are in conformance with the Jefferson County Zoning Resolution (ZR), the Land Development Regulation (LDR), the Storm Drainage Design and Technical Criteria (SDDTC), and The Transportation Design and Construction Manual (TDCM). Any requests for relief of these standards shall require the submittal of a Grading Permit. If applicable, the NOI shall state that the project will be in conformance with the approved construction documents with that subdivision. A completed Form Letter N-1 stating that the proposed construction and grading are in conformance with the approved overall grading plan and Land Disturbance Performance Standards shall be submitted to Planning & Zoning prior to issuance of the Building Permit. Form Letter N-1 shall be completed by a Colorado registered professional engineer. (orig. 6-1-19; am. 12-6-22)

Process Steps		Processing Time Frames	
Process from Plan Submittal to Acceptance of NOI			
Plan Submittal Intake	7 calendar days (Staff confirms the land disturbance permit qualifies as an NOI and required submittal items have been received)	Example timeframe: 19 Days to acceptance of NOI if processing time frames are met. May take longer if issues arise.	
Applicant Action is Required	Varies, 5 calendar days used for example timeframe		
Plan Resubmittal and NOI Acceptance	7 calendar days (Staff confirms required submittal items have been received)		
Final Close Out			
Permit Monitoring until submittal of N-2	2 years maximum		

#### **Plan Submittal Intake**

- a. Sufficiency Review:

The applicant shall electronically submit all the applicable documents identified in the Submittal Requirements of this Section as a complete package, and not in a fragmentary manner for review by the Case Manager. (orig. 12-6-22)

The Case Manager shall have 7 calendar days to review the submittal and either accept the application or respond to the applicant explaining any deficiencies in the submittal documents (including the appropriate application fees). A submittal that is not complete in terms of the type of documents required will not be accepted. (orig. 12-6-22)

Resubmittal Sufficiency Review (if required): The Case Manager shall have 7 calendar days to review the resubmittal and either accept the application or respond to the applicant explaining any deficiencies in the submittal documents. (orig. 12-6-22)

#### **Plan Resubmittal and NOI Acceptance:**

- b. The final documents shall be comprised of the Submittal Requirements of this Section. (orig. 12-6-22)

The applicant shall have a maximum of 180 calendar days to respond to the comments from the case manager, or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180-calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause. (orig. 12-6-22)

- c. The Case Manager shall have 7 calendar days to review the resubmitted documents and shall accept the application if it is complete in form and has all the required information described in the Notice of Intent N-1 Form that provides certification from a Colorado registered professional engineer stating that the submitted plans are in conformance with the Jefferson County Zoning Resolution (ZR), the Land Development Regulation (LDR), the Storm Drainage Design and Technical Criteria (SDDTC), the Transportation Design and Construction Manual (TDCM), and the notes, restrictions and supporting documents of any associated approved Preliminary and Final Plat. The owner, contractor or engineer shall also certify that the specified control measures will be installed prior to land

disturbance and that control measures will be adequately maintained throughout the process and shall sign the N-1 Form. (orig. 12-6-22)

**Permit Monitoring:**

- d. Once the work associated with the accepted Notice of Intent is complete, the applicant shall submit a completed N-2 Form which provides certification from a Colorado registered professional engineer stating that all grading work was completed in conformance with the final accepted Grading, Erosion and Sediment Control (GESC) Plan, Drainage Report and N-1 submitted with the project application. If amendments to the accepted plans were made resulting in grading activities that were not completed in conformance with the final accepted plans, then the N-2 Form shall be submitted in conformance with the Amendments procedure of this Section. (orig. 12-6-22)

**Permit Limitations:**

- e. The permit shall be limited to work shown on the approved plans. Such plans shall contain guidelines, conditions, and/or restrictions as are necessary to comply with the performance standards. At any time during the plan review or in the event unforeseen conditions arise during completion of the project, the County may require revision of the plans as necessary to ensure compliance with the performance standards. (orig. 12-6-22)

**Amendments:**

- f. Modifications to the final accepted plans requires submittal of the revised plans and the completed N-2 Form which provides certification from a Colorado registered professional engineer stating that deviations from the accepted plans have occurred and that the revised plans and work has been completed in conformance with the Jefferson County Zoning Resolution (ZR), the Land Development Regulation (LDR), the Storm Drainage Design and Technical Criteria (SDDTC), the Transportation Design and Construction Manual (TDCM), and the notes, restrictions and supporting documents of any associated approved Preliminary and Final Plat. If the appropriate certification cannot be provided and the modifications to the plans do not conform to the Jefferson County Standards and Regulations for land disturbance permits described in this section, revised plans shall be submitted and reviewed by Planning & Zoning through an ~~Grading Permit Application~~ [Administrative Review process](#) where requests for relief from standards will be evaluated. (orig. 12-6-22)

**Validity:**

- g. The acceptance of plans and specifications by the County shall not be construed as an approval of any violation of the provisions of this section or of any other applicable laws, rules or regulations and shall not prevent the County from thereafter requiring the correction of errors in said plans and specifications or from preventing work being carried on thereunder in violation of this section or any other applicable law, rule or regulation. The issuance of a Land Disturbance Permit prior to any Plat approval shall in no way bind the Planning Commission or the Board of County Commissioners in the approval or denial of a Plat application, and the applicant's grading activities are at the applicant's risk. (orig. 12-6-22)

**Time Limits:**

- h. The work associated with the permit shall be completed within 2 years of the date of acceptance unless an extension has been granted by Planning and Zoning. A request for an extension shall be submitted in writing no later than 10 calendar days prior to the expiration of the permit. Planning and Zoning may grant an extension to the permit up to 1 year. Additional extensions may be granted by Planning and Zoning to allow the establishment of permanent erosion and sediment control measures. (orig. 12-6-22)
2. Grading Permit Procedures: If the applicant complies with all given time frames, submits a complete Grading Permit application and complies with all requirements of this regulation, the estimated time to reach the Determination Phase of the process is 66 calendar days from the date of the 1st referral, depending on the amount of disturbance for the proposed grading activity. (orig. 5-20-08; am. 7-17-18; am. 6-1-19; am. 12-6-22)

Process Steps	Processing Time Frames
<b>Steps prior to 1<sup>st</sup> Referral</b>	
Sufficiency Review and Referral Distribution or Deficiency Response	7 calendar days
Resubmittal Sufficiency Review (if necessary)	7 calendar days

Process from 1 <sup>st</sup> Referral to Determination		
1 <sup>st</sup> Referral and Staff Response	21 calendar days (14 day referral, 7 days for Staff response)	Example timeframe: 66 Days to determination if processing time frames are met. May take longer if issues arise.
Applicant's Response to 1 <sup>st</sup> Referral	Varies, 14 calendar days used for example timeframe	
Sufficiency Review and Referral Distribution	7 calendar days	
2 <sup>nd</sup> Referral and Staff Response	14 calendar days (7 day referral, 7 days for Staff response)	
Submittal of Final Documents by applicant	Varies - 10 calendar days used for example timeframe	
Determination		
Determination	7 days	

If an applicant is going to request relief from a standard in the Regulations, then a request for relief of the standard may be submitted for consideration. In order to avoid processing delays, it is recommended that a request for relief from a standard be submitted early in the development process. Requests for relief of a standard are subject to different specific processing timeframes, which may add to the length to the processing of the development application. (orig. 5-20-08; am. 7-17-18; am. 6-1-19)

Notification is required at the time of the 1<sup>st</sup> Referral in accordance with the notification provisions of this section. (orig. 6-1-19)

Proof of Access: The Director of Planning and Zoning may allow the 1<sup>st</sup> Referral to be sent without meeting the access criteria proof of access requirements, if in his/her opinion the circumstances related to proving access should be finalized during the processing of the application. (orig. 4-20-10; am. 12-21-10; am. 6-1-19)

#### **Steps Prior to 1<sup>st</sup> Referral**

a. Sufficiency Review and Referral Distribution (1<sup>st</sup> Referral):

The applicant shall electronically submit all the applicable documents identified in the Submittal Requirements of this Section as a complete package, and not in a fragmentary manner for review by the Case Manager.

The Case Manager shall have 7 calendar days to review the submittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents (including the appropriate referral fees). A submittal that is not complete in terms of the type of documents required will not be sent out on referral. (orig. 7-17-18; am. 12-6-22)

Resubmittal Sufficiency Review (if required): The Case Manager shall have 7 calendar days to review the resubmittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents. (orig. 7-17-18; am. 12-6-22)

#### **Process from 1<sup>st</sup> Referral to Determination**

b. 1<sup>st</sup> Referral and Staff Response:

The referral agencies shall have 14 calendar days to respond in writing to the application. An extension of no more than 30 calendar days may be agreed to by the applicant. (orig. 5-20-08; am. 7-17-18; am. 6-1-19)

The Case Manager shall have 7 calendar days, after the end of the referral period, to provide the applicant with a Staff response inclusive of other referral responses. The response from the Case Manager will include an opinion as to whether the case should proceed forward to the Final Documents phase or if revised documents should be submitted for a subsequent referral process. (orig. 5-20-08; am. 7-17-18)

c. Applicant's Response to 1<sup>st</sup> Referral:

For the application to be processed in accordance with the example timeframe in the table above, the applicant shall have 14 Calendar days to address in writing any issues identified by the Case Manager or any referral agency and resubmit revised documents for the 2<sup>nd</sup> referral. (orig. 5-20-08; am. 7-17-18)



Regardless of the example timeframe, the applicant shall have a maximum of 180 calendar days to respond to the referral comments or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180 calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause. (orig. 5-20-08; am. 12-21-10; am. 7-17-18)

d. Sufficiency Review and Referral Distribution (2<sup>nd</sup> Referral):

The Case Manager shall have 7 calendar days to review the submittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents. A submittal that is not complete in terms of the type of documents required will not be sent out on referral. All resubmittal documents shall be submitted as a complete package, and not sent in a fragmentary manner. (orig. 7-17-18; am. 12-6-22)

Resubmittal Sufficiency Review (if required): The Case Manager shall have 5 calendar days to review the resubmittal and either send the application out on referral or respond to the applicant explaining any deficiencies in the submittal documents. (orig. 7-17-18)

e. 2<sup>nd</sup> Referral and Staff Response:

The referral agencies shall have 7 calendar days to respond in writing to the 2<sup>nd</sup> referral. An extension of no more than 30 calendar days may be agreed to by the applicant. (orig. 5-20-08; am. 7-17-18)

The Case Manager shall have 7 calendar days after the end of the referral period to provide the applicant with a Staff response inclusive of referral agency responses. The response from the Case Manager will include an opinion as to whether the case should proceed forward to the Final Documents phase or if revised documents should be submitted for a subsequent referral process. (orig. 7-17-18)

f. Applicant's Response to 2<sup>nd</sup> Referral Comments:

The applicant shall have a maximum of 180 calendar days to respond to the referral comments, or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180 calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause. (orig. 5-20-08; am. 12-21-10; am. 7-17-18)

g. Additional Referrals and Responses:

For the 3<sup>rd</sup> Referral, and for any subsequent referrals thereafter, the processing of the application shall follow the same steps identified above in the Sufficiency Review and Referral Distribution (2<sup>nd</sup> Referral) process, the 2<sup>nd</sup> Referral and Staff Response process and the Applicant's Response to 2<sup>nd</sup> Referral process. (orig. 5-20-08; am. 7-17-18)

h. Final Documents:

The final documents shall be comprised of the stamped and signed grading plans and other final documents as identified by the Case Manager. In addition to submitting the final documents electronically, the applicant shall submit hard copies of the plans as specified in the case managers response to the last referral. (orig. 5-20-08; am. 6-1-19)

The applicant shall have a maximum of 180 calendar days to respond to the comments from the case manager, or the application will be considered withdrawn. The applicant will then have to file a new application with the required fees and documents. The Director of Planning and Zoning may extend this 180-calendar day maximum response deadline for additional 180 calendar day periods if, in his/her opinion, the delay in response is for good cause.

i. Determination:

The Case Manager shall have 7 calendar days to review the Final Documents and shall approve, conditionally approve or deny the application. An application shall be approved if it is complete in form, has all required information, includes appropriate control measure for all stages of construction, including final stabilization, the control measures meet the requirements of the MS4 Permit and the provisions of this section. Otherwise, it shall be denied. Any approval or denial shall be in writing with the reasons for denial specifically identified. Annotations on the plans shall be considered sufficient detail of the reasons for denial. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04;

am. 10-12-04; am. 6-1-19).

j. Request for Reconsideration:

If an application is denied or conditionally approved, the applicant may request in writing, within 21 calendar days after the decision, a reconsideration of the decision by Planning and Zoning. The request for reconsideration shall state specific reasons or changes for the reconsideration. Planning and Zoning shall act upon the request for reconsideration within 10 working days of its receipt. Failure to act shall constitute denial of the request for reconsideration. No appeal to the Board of Adjustment shall be permitted unless a request for reconsideration was previously filed and denied. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 5-20-08)

k. Appeals:

If Planning and Zoning denies the request for reconsideration, the applicant may submit a written appeal to the Board of Adjustment. The appeal must be received by the secretary of the Board of Adjustment within 30 calendar days of the date of denial. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 4-27-04; am. 10-12-04; am. 12-14-04; am. 5-20-08)

l. Permit Limitations:

The permit shall be limited to work shown on the approved plans. Such plans shall contain guidelines, conditions, and/or restrictions as are necessary to comply with the performance standards. At any time during the plan review or in the event unforeseen conditions arise during completion of the project, the County may require revision of the plans as necessary to ensure compliance with the performance standards. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 5-20-08)

m. Amendments:

Modifications to the approved plans are subject to an Administrative Review process. Modifications shall comply with the Plans and Specifications requirements and the performance standards as outlined in this Section, unless relief is granted through the appropriate process. (orig. 8-25-86; am. 3-23-99; am. 10-12-04; am. 7-17-18; am. 6-1-19)

n. Validity:

The approval of plans and specifications shall not be construed as an approval of any violation of the provisions of this section or of any other applicable laws, rules or regulations and shall not prevent the County from thereafter requiring the correction of errors in said plans and specifications or from preventing work being carried on thereunder in violation of this section or any other applicable law, rule or regulation. The issuance of a Grading Permit prior to any Plat approval shall in no way bind the Planning Commission or the Board of County Commissioners in the approval or denial of a Plat application, and the applicant's grading activities are at the applicant's risk. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04)

2. Grading Permit Inspections

- a. Upon approval by Planning and Zoning, the approved plans will be referred to an Engineering Inspector for permit issuance. (orig. 10-12-04; am. 5-20-08; am. 4-20-10; am. 7-17-18)
- b. The County may inspect the site and perform any necessary tests from time to time to ensure compliance with the permit conditions. (orig. 7-17-18).
- c. Final inspections shall confirm that the completed structural and/or non-structural water quality control measure operates in accordance with the approved plans. (orig. 6-1-19)
- d. All applicable development sites must have operational permanent water quality control measures at the completion of the site. In the case where permanent water quality control measures are part of future phasing, the permittee must have a mechanism to ensure that all control measures will be implemented, regardless of completion of future phases or site ownership. In such cases, temporary water quality control measures must be implemented as feasible and maintained until removed or modified. All temporary water quality control measure must meet one of the design standards in the MS4 Permit. For the purpose of this section, completion of a site or phase shall be determined by the issuance of a certificate of occupancy, use of the completed site area according to the site plan, payment marking the completion of a site control measure, the nature of the selected control measure or equivalent determination of completion as appropriate to the nature of the site. (orig. 6-

1-19)

- e. Time Limits: The work associated with the permit shall be completed within 2 years of the date of permit issuance, unless an extension has been granted by Transportation and Engineering. A request for an extension shall be submitted in writing no later than 10 calendar days prior to the expiration of the permit. Transportation and Engineering may grant an extension to the permit up to 1 year. Additional extensions may be granted by Transportation and Engineering to allow the establishment of permanent erosion and sediment control measures. (orig. 8-25-86; am. 9-24-91; am. 8-8-94; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 5-20-08; am. 10-13-09; am. 7-17-18)

## **E. Plans and Specifications**

### **1. Grading, Erosion and Sediment Control Plan**

The proposed grading, erosion and sediment control plan and specifications shall demonstrate compliance with the performance standards and shall be prepared on sheets 24 inches by 36 inches, or as otherwise approved by Planning and Zoning, and stamped and signed by a Colorado registered professional engineer. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18; am. 6-1-19)

For graded areas between 0.5 and one acre, the County may waive the requirement for a topographic map and the requirement that the grading plans be prepared, stamped and signed by a Colorado registered professional engineer, where the applicant demonstrates an engineered grading plan and/or topographic map is not necessary to comply with the performance standards set forth herein. (orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04; am. 7-17-18; am. 6-1-19)

The grading, erosion and sediment control plan shall include the following unless waived or exempted by Planning and Zoning herein. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18; am. 6-1-19)

- a. A map which shows the items listed below. Acceptable map scales are 1 inch to 10, 20, 30, 40, 50, 60 or 100 feet. (orig. 8-25-86; am. 9-24-91; am. 10-12-04)
  - (1) A vicinity map (not to scale) indicating the location of the site relative to the principal roads, lakes or dams, and watercourses in the area. (orig. 8-25-86; am. 9-24-91)
  - (2) A title block which includes the title of the Grading Plan, purpose and nature of the grading project and, if applicable, states the use of earth material to be removed from the site. The name of the engineer who prepared the plans should also be included in the title block. (orig. 8-25-86; am. 9-24-91)
  - (3) The complete site boundary and locations of any easements and Rights-of-Way traversing and adjacent to the property, appropriately labeled and dimensioned. (orig. 8-25-86)
  - (4) The location of existing roads, buildings, wells, pipelines, watercourses and other structures, facilities and features of the sites, and the location of all improvements on adjacent land within 50 feet of the site's boundary. (orig. 8-25-86)
  - (5) The location and nature of known or suspected highly erodible soils or geologic hazard areas. (orig. 8-25-86; am. 9-24-91)
  - (6) A topographic map which shows the affected area. The map shall show affected areas outside the permit boundaries, such as drainages. Contour lines shall be at 5-foot intervals or at an interval of greater detail if necessary to accurately show topographic features and drainage patterns, and the configuration of the ground before and after grading. The existing and final contours shall be shown at 2-foot intervals for subdivisions within the plains area and contours at 5-foot intervals for subdivisions within the mountain areas including the method utilized to obtain all contour intervals. Contours shall be accurate to within one-half (1/2) contour interval and elevations shall be based on United States Geologic Survey (USGS) sea level datum. Except for access permits, USGS quad maps shall not be accepted as evidence for topographic contours. (orig. 8-25-86; am. 9-24-91; am. 3-23-99; am. 10-12-04; reloc. 12-6-22)
  - (7) The location, extent and finished surface slopes of all final cut and fill lines. (orig. 8-25-86)
  - (8) The 100-year flood plain boundaries. (orig. 8-25-86)
  - (9) The location of any existing or proposed flood control facilities, wells or Onsite Wastewater Treatment System in the vicinity of the permit area. Temporary access to the well and Onsite Wastewater Treatment System shall be depicted. (orig. 8-25-86; am. 9-24-91; am. 7-17-18; am. 6-1-19)

- (10) The location where any earth materials and topsoil will be stockpiled. Include estimated stockpile volume. If the stockpile will reach into adjacent properties, approval from the property owner shall be required. (orig. 8-25-86; am. 9-24-91; am. 7-17-18)
- (11) The north arrow, the scale, and the date. (orig. 8-25-86)
- (12) The general location and character of vegetative cover on the site and the location of all major rock outcrops. (orig. 8-25-86; am. 9-24-91)
- b. Typical cross sections (not less than two) of all existing and proposed graded areas taken at intervals not exceeding 200 feet and at locations of maximum cuts and fills where such cuts and/or fills exceed 10 feet in height. (orig. 8-25-86; am. 9-24-91)
- c. A table of the volume of cut, volume of fill, volume of material to be exported offsite, the steepest proposed slopes, the total area of land disturbance, the existing impervious area, the proposed impervious area (total impervious area for the site) and the area of land disturbance treated by a water quality control measure per the SDDTC. An example of this table is shown below and the table shall be placed on page 1 of the plan set. (orig. 8-25-86; am. 9-24-91; am. 6-1-19; am. 12-6-22)

Total Area of Land Disturbance	acres
Volume of Cut	cy
Volume of Fill	cy
Volume of Material to be Exported Offsite	cy
Existing Impervious Area	acres
Proposed Impervious Area	acres
Area of Land Disturbance Treated by a Permanent Water Quality Control Measure	acres
Steepest Proposed Slope	H:V

- d. The projected schedule of operations, including the following dates. The schedule dates must correspond to the permitted construction timeframe following approval: (orig. 8-25-86; am. 12-6-22)
- (1) Commencement of work, including days and hours of operation. (orig. 8-25-86; am. 9-24-91)
  - (2) Start and finish of rough grading. (orig. 8-25-86)
  - (3) Completion of work in any watercourse. (orig. 8-25-86)
  - (4) Completion of grading, erosion and sediment control measures (Best Management Practices, BMP's). (orig. 8-25-86; am. 10-12-04; am. 6-1-19; am. 12-6-22)
  - (5) Maintenance schedule for grading, erosion and sediment control BMP's. (orig. 9-24-91; am. 10-12-04; am. 6-1-19)
  - (6) Completion of any required landscaping. (orig. 8-25-86)
- e. The proposed grading, erosion and sediment control plan shall include permanent and, if applicable, temporary erosion and sediment control BMP's. The plans shall identify all structural and non-structural control measures for the applicable construction activities. The plan must contain installation and implementation specifications or a reference to the document with installation and implementation specifications for all structural control measures. A narrative description of non-structural control measures must be included in the plan. Revegetation plans shall include the seed mixture(s) including species and variety, type of seedbed preparation and method of seeding, seeding rates, seeding dates, type and application rates of fertilizer and mulch, and irrigation facilities and methods if applicable. Seed mix shall be based on the Jefferson Conservation District recommendations and/or a Planning and Zoning approved alternative. Seeding alone is not erosion control until vegetation is established. Seeding shall be combined with applicable erosion control

structural BMP's until vegetation is established. (orig. 9-24-91; am. 10-12-04; am. 7-12-05; am. 7-17-18; am. 6-1-19)

- f. At a minimum, initial and final construction phases are required for all grading, erosion and sediment control plans. (orig. 7-17-18)
- g. Clearly and legibly show BMPs on the plan and include standard notes and associated details for the BMPs shown on said plan. (orig. 7-17-18; am. 6-1-19)
- h. If a Grading Permit Application requires an Improvement Security, a detailed improvements list is required. If the Grading Permit Application does not require an Improvement Security, the quantity of each erosion and sediment control BMP shall be provided. (orig. 6-1-19; am. 12-17-19; am. 12-6-22)

## 2. Soil/Geologic Investigation Report

If a soils and/or geologic investigation report is required by the County, it shall be prepared and signed by a qualified professional geologist or Colorado registered professional engineer. The report shall contain all the following as they may be applicable to the subject site: (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04)

- a. A site map showing the topographic features of the site and locations of all soil borings and test excavations. (orig. 8-25-86)
- b. A classification of the soil types, laboratory test data, and consequent evaluation regarding the distribution and nature of existing soils. (orig. 8-25-86; am. 9-24-91)
- c. A description of the geology of the site and adjacent areas when pertinent to the site. (orig. 8-25-86)
- d. A suitably scaled map and cross sections showing all identified areas of historic or potential instability within and adjacent to the permit area. An evaluation of the stability of natural slopes and any proposed cut and fill slopes. (orig. 8-25-86; am. 9-24-91)
- e. A description of known or inferred groundwater or excessive moisture conditions. (orig. 8-25-86; am. 9-24-91)
- f. A description of the soil and geologic investigative techniques employed. (orig. 8-25-86)
- g. A log for each soil boring and test excavation showing elevation at ground level and the depth of each soil or rock strata. (orig. 8-25-86)
- h. Recommendations for grading procedures and specifications, including methods for excavation and subsequent placement of fill. (orig. 8-25-86)
- i. Recommendations for mitigation of geologic hazards and constraints. (orig. 8-25-86; am. 12-6-22)
- j. The time of year the field work was done and a list of references and other supportive data. (orig. 8-25-86)
- k. Soil parameters to be used in the design of retaining walls. (orig. 9-24-91; am. 12-6-22)
- l. Infiltration testing shall be completed for each control measure that utilizes infiltration. At least two tests per control measure are required. The testing shall be at an appropriate elevation and location to adequately evaluate the underlying strata. A Factor of Safety of 2 shall be applied to the final infiltration rate to account for infiltration degradation over time (orig. 12-6-22)

## 3. Materials Handling Plan

The proposed materials handling plan shall include BMP's for controlling waste and spill prevention and containment. (orig. 10-12-04)

## F. Performance Standards for All Land Disturbance Activities

- 1. Control measures must prevent pollution or degradation of state waters. Control measures must also be appropriate for the specific construction activity, the applicable pollutant sources, and phase of construction. Appropriate control measures must be implemented prior to the start of construction activity, must control potential pollutants during each phase of construction, and must be continued through final stabilization. Appropriate structural control measures must be maintained in operational condition. (orig. 6-1-19)

2. Control measures must be selected, designed, installed, implemented, and maintained to provide control of all potential pollutants, such as but not limited to sediment, construction site waste, trash, discarded building materials, concrete truck washout, chemicals, sanitary waste, and contaminated soils in discharges to the MS4 and/or waterways. At a minimum pollutant sources associated with the following activities (if part of the applicable construction activity) must be addressed: (orig. 6-1-19; am. 12-6-22)
  - a. Land disturbance and storage of soils. (orig. 6-1-19)
  - b. Vehicle tracking. (orig. 6-1-19)
  - c. Loading and unloading operations. (orig. 6-1-19)
  - d. Outdoor storage of construction site materials, building materials, fertilizers, and chemicals
  - e. Bulk storage of materials. (orig. 6-1-19)
  - f. Vehicle and equipment maintenance and fueling. (orig. 6-1-19)
  - g. Significant dust or particulate generating processes. (orig. 6-1-19)
  - h. Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, and oils. (orig. 6-1-19)
  - i. Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment. (orig. 6-1-19)
  - j. Dedicated asphalt and concrete batch plants. (orig. 6-1-19)
  - k. Other areas or operations where spills can occur. (orig. 6-1-19)
  - l. Other non-stormwater discharges including construction dewatering not covered under the Construction Dewatering Discharges general permit and wash water that may contribute pollutants to the MS4 and/or waterways. (orig. 6-1-19)
3. No Impedance to Natural Water Flow
  - a. No work shall be done which may obstruct, impede or interfere with the flow of storm water in overland flows, natural drainageways, unimproved channels or watercourses, or improved ditches, channels or canals in such a manner as to cause flooding that adversely impacts adjacent and downstream properties. Any activity taking place in an area zoned Floodplain Overlay District shall meet the requirements of the Floodplain Overlay District section of this Zoning Resolution. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 7-17-18)
  - b. Construction equipment shall be kept out of watercourses except when necessary to perform work on the approved plans. Where in-channel work is designated on approved plans, precautions shall be taken to stabilize the work area during construction to minimize erosion. The channel, including bed and banks, shall be stabilized immediately after in-channel work is completed. (orig. 9-24-91; am. 6-1-19)
  - c. Where a drainageway will be crossed by construction vehicles regularly during construction, a temporary crossing shall be provided. A permit may be required from the U.S. Army Corps of Engineers and the Environmental Protection Agency prior to any disturbance in waters of the United States or federally regulated wetlands. (orig. 9-24-91; am. 12-17-02; am. 10-12-04)
4. Excavation

Excavations shall be constructed and/or protected so that they are stable and do not endanger life or property. (orig. 8-25-86; am. 9-24-91)
5. Excavation Slope
  - a. The slope of cut surfaces of permanent excavations shall not be steeper than 2 horizontal to 1 vertical (approximately 25 degrees). Steeper slopes may be permitted for grading permits with the approval of the County, provided it can be adequately demonstrated in a soils/geologic report that such slopes are stable and will not undergo accelerated erosion. The County may require the excavation to be made with a cut face flatter in slope than 2 horizontal to 1 vertical (2H:1V) if soils/geologic information submitted shows that flatter slopes are necessary for stability, adequate revegetation or maintenance. Cut slopes shall be rounded into the existing terrain to produce a contoured transition from cut face to natural ground. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)
  - b. The slope of cut surfaces which are 5 feet in height or less and are in competent bedrock may be

steeper than 2H:1V, but shall be no steeper than 1 1/2H:1V. Steeper slopes may be permitted for grading permits with the approval of the County, provided it can be adequately demonstrated in a soils/geologic report that such slopes are stable and will not undergo accelerated erosion. (orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)

6. Fill Placement

Completed fills shall be stable masses of well-integrated material bonded to adjacent materials and to the materials on which they rest. Proper drainage and other appropriate measures shall be taken to ensure continuing integrity of fills. Earth materials shall be used which have no more than minor amounts of organic substances. (orig. 8-25-86)

7. Fill Compaction

The County will require fills to be compacted to a minimum of 90 percent of maximum density as determined by ASTM D1557 unless prior approval by the County has been granted. ASTM D698 may be used for clays with a high plasticity index. The standard for fill compaction shall not apply to fills of less than 50 cubic yards which are placed on natural terrain with a slope flatter than 5H:1V, are less than 5 feet in depth, are not intended to support structures, and do not obstruct a drainage course. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04; am. 7-17-18)

8. Ground Preparation for Fill Placement

The ground surface shall be prepared to receive fill by removing vegetation, topsoil, and other unsuitable materials. (orig. 8-25-86)

9. Fill Slopes

The slope of all permanent fills shall not be steeper than 2H:1V. Steeper slopes may be permitted for grading permits with the approval of the County, provided it can be adequately demonstrated in a soils/geologic report that such slopes are stable and will not undergo accelerated erosion. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)

10. Driveways and Private Streets/Roads

- a. All street, road and driveway construction shall meet the Transportation Design and Construction Manual standards. (orig. 12-17-02; am. 10-12-04; am. 11-24-15)
- b. For private streets/roads and driveways including turnarounds the maximum allowable vertical disturbance from the toe of fill to the top of cut measured perpendicular to the existing contours shall be 25 feet in vertical height. Planning and Zoning may approve vertical disturbance heights greater than 25 feet for grading permits where it is determined that slopes shall be sufficiently stabilized and restored to be congruent with surrounding conditions to the maximum extent practicable and the alignment of the driveway has been placed in the optimal location to allow for minimal disturbance. (am. 7-17-18; am. 6-1-19)

Relief for grading permits will also be considered if the applicant demonstrates that the proposed grading plan results in less overall land disturbance and that the relief is necessary to comply with the Preservation of Existing Terrain and Vegetation and Impact Mitigation Standards below. In determining whether to approve or disapprove the request, all technical evaluations, relevant factors, standards specified in other sections, and whether the applicant has adequately addressed the provisions of this Zoning Resolution shall be considered. (orig. 8-8-95; am. 11-12-02; am. 12-17-02; am. 7-1-03; am. 10-12-04; am. 3-26-13; am. 11-24-15; am. 7-17-18; am. 6-1-19)

- (1) Parking areas adjacent to building structures and drainage facilities not a part of the streets/roads will not be considered as vertical disturbance. (reloc. 7-17-18)

- c. Widths (including shoulders) of driveways and private streets/roads shall conform to the Transportation Design and Construction Manual. (orig. 8-8-95; am. 11-12-02; am. 11-24-15)

11. Protection of Adjacent Structures

Foundations or flatwork which may be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against lateral movement. Fills or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by such fill or surcharge. (orig. 8-25-86)

12. Setbacks

- a. Setbacks for all grading, erosion and sediment control activities shall be at least 7 feet from property boundaries and at least 25 feet from off-site occupied structures. Planning and Zoning may waive setback requirements for land disturbance provided it can be adequately demonstrated that activities occurring within setback limitations will not adversely affect adjacent property or structures. A letter prepared by a Colorado registered professional engineer will be required that addresses the following: (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 4-27-04; am. 5-20-08; am. 6-1-19; am. 12-6-22)
  - i. Identify any potential issues caused by grading, erosion and sediment control activities relating to existing infrastructure, drainage patterns or visual and safety impacts. (orig. 12-6-22)
  - ii. Provide justification and rationale demonstrating that there will be no adverse impacts to adjacent property owners as a result of the proposed land disturbance. (orig. 12-6-22)
- b. Grading for streets/roads and driveways is exempt from setback requirements if it can be adequately demonstrated that grading activities will not adversely affect adjacent properties or structures in terms of, but not limited to, runoff and slope stability. (orig. 9-24-91; am. 7-17-18)

### 13. Stormwater

Any required drainage and infiltration structures and devices shall be designed and constructed in accordance with standards and criteria established in the Storm Drainage Design and Technical Criteria and as listed below. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 10-12-04; am. 7-17-18; am. 6-1-19)

- a. Drainage Structures and Devices: All drainage facilities shall be designed to carry surface and subsurface water to the nearest adequate street, storm drain, and natural watercourse or other juncture. (orig. 8-25-86)
- b. Water Accumulation: All finished areas shall be graded and drained such that water will not pond or accumulate except where the end use is a pond, reservoir infiltration area or structure or detention basin. Drainage shall be affected in such a manner that it will not cause erosion or endanger the stability of any cut or fill slope or any building or structure. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18)
- c. Protection of Adjoining Property: When surface drainage is discharged onto any adjoining property, it shall be discharged in such a manner that it will not cause an increased hazard to the stability of any cut and fill slope or any building or structure. (orig. 8-25-86; am. 9-24-91)
- d. Subsurface Drainage: Cut and fill slopes shall be provided with subsurface drainage as necessary for stability. (orig. 8-25-86)

### 14. Erosion and Sediment Control

The following shall apply to the control of erosion and sediment from land disturbance activities: (orig. 8-25-86; am. 10-12-04)

- a. To the maximum extent practicable and in conformance with F.1., above, implementation of the erosion and sediment control plan shall precede grading activities. (orig. 9-24-91; am. 10-12-04; am. 12-6-22)
- b. Upon completion of land disturbance activities, disturbed areas, except for rock cuts and fills, shall be stabilized by adequate vegetative cover consisting of at least 70% of pre-existing vegetation conditions or other permanent soil erosion control measures which prevent accelerated erosion. (orig. 8-25-86; am. 9-24-91; am. 10-12-04; am. 7-17-18)
  - (1) Cuts and fills accomplished for all roads, driveways and other vehicular access shall be stabilized with adequate vegetative cover or other permanent soil erosion control measures which prevent accelerated erosion, unless the cut is in competent bedrock. (orig. 9-24-91)
  - (2) No project shall cause accelerated or increased off-site erosion. (orig. 9-24-91; am. 10-12-04)
- c. To the maximum extent practicable, sediment caused by accelerated soil erosion shall be removed from runoff water before leaving the site. (orig. 9-24-91; am. 10-12-04)
- d. All land disturbing activities shall be designed, constructed, and phased in such a manner as to minimize the exposure of disturbed areas and to prevent accelerated soil erosion to the maximum extent practicable. (orig. 9-24-91; am. 10-12-04)



- e. Cut and fill slopes shall be stabilized, and surface water damage to cut and fill slopes shall be prevented. (orig. 8-25-86)
  - f. Fugitive dust emissions shall be controlled using the best available control technology as defined by the Colorado Department of Public Health and Environment as of the date of permit issuance. (orig. 8-25-86; am. 9-24-91)
  - g. All temporary and permanent soil erosion and sediment control practices shall be maintained and repaired as needed to assure continued performance of their intended function in accordance with the details in the approved grading plans. (orig. 9-24-91; am. 10-12-04; am. 7-17-18)
  - h. All topsoil, where physically practicable, shall be salvaged and no topsoil shall be removed from the site except as set forth in the approved plans. Topsoil and overburden shall be segregated and stockpiled separately. Topsoil and overburden shall be redistributed within the graded area after rough grading to provide a suitable base for areas which will be seeded and planted. Runoff from the stockpiled area shall be controlled to prevent erosion and resultant sedimentation of receiving water. (orig. 8-25-86; am. 9-24-91)
  - i. Runoff shall not be discharged from the site in quantities or at velocities substantially above those which occurred before land disturbance except into drainage facilities whose design has been specifically approved by the County prior to the permit approval. (orig. 8-25-86; am. 3-23-99; am. 12-17-02; am. 10-12-04)
  - j. The landowner and/or contractor shall take reasonable precautions to ensure that vehicles do not track or spill earth materials on to streets/roads and shall immediately remove such materials if this occurs. (orig. 8-25-86; am. 12-17-02; am. 10-12-04)
  - k. Should an increase in sediment discharge occur or become imminent, the landowner and/or contractor shall immediately take all necessary steps to control such discharge. The landowner and/or contractor shall take prompt action to resolve emergency problems. (orig. 8-25-86; am. 12-17-02; am. 10-12-04)
  - l. Permanent or temporary soil stabilization measures shall be applied to disturbed areas within 14 days after final grade is reached on any portion of the site. Soil stockpiles shall be permanently or temporarily stabilized within 14 days if the stockpile is not being actively utilized for construction purposes. Soil stabilization measures shall be applied within 14 days to disturbed areas which may not be at final grade, but will be left dormant for longer than 60 days. (orig. 9-24-91; am. 7-17-18)
15. Geologic, Floodplain, Wildfire, and Dipping Bedrock Hazards
- Any activity taking place in an area zoned Geologic Hazard Overlay District or Floodplain Overlay District, or Wildland Urban Interface Overlay District, or Dipping Bedrock Overlay District shall meet the requirements of the appropriate sections of this Zoning Resolution. Land disturbance activities shall not create or aggravate unstable slopes, rockfall, landslide, or subsidence hazards or increase the risk of wildfire, flooding, or dipping bedrock hazards. (orig. 8-8-95; am. 3-23-99; am. 10-12-04; am. 10-4-22)
16. Preservation of Existing Terrain and Vegetation and Impact Mitigation
- a. Grading for cut and fill slopes shall not result in a staircase effect, except that retaining walls are permitted per paragraph "e." below. The edges of graded areas shall blend into the surrounding natural terrain/topography and contour of the land. (orig. 8-8-95; am. 11-12-02)
  - b. The proposed grading shall occur in such a manner that it avoids, to the extent practicable, all rock outcroppings, existing trees over 6 inches in caliper, vegetation over 8 feet in height, and riparian, wetland and critical wildlife areas. If from the original documentation and/or field investigation it appears that a less impactful alternative exists, the County may require the grading plan to be revised. (orig. 8-8-95; am. 12-17-02)
  - c. Excess material shall be graded in a manner which is similar to the natural topography and shall not be cast over the side of cut or fill slopes. (orig. 8-8-95; am. 11-12-02)
  - d. Cut slopes that are in rock and are intended to be left exposed shall be graded to obtain a natural looking appearance, to the extent possible, in form to blend with surrounding terrain. (orig. 8-8-95; am. 11-12-02; am. 10-12-04)
  - e. Retaining walls shall not exceed a maximum height of twelve (12) feet and shall be faced with stone or constructed with textured earth colored material that is identified in the grading plan. If a series of

retaining walls is required, the horizontal distance between walls shall be a minimum of 4 feet. The minimum distance between walls shall be increased to 6 feet if either wall exceeds 8 feet in height. Retaining walls greater than 36 inches in height shall be constructed in accordance with the design prepared by a Colorado registered professional engineer. The design may require consultation with a geotechnical engineer, shall consider such factors as expansive soils, steep slopes and vehicles or structures near the walls, and shall include the following: (orig. 8-8-95; am. 11-12-02; am. 12-17-02; am. 7-1-03; am. 10-12-04; am. 7-17-18)

- (1) Construction plans indicating how the proposed wall height will vary along its length. (orig. 10-12-04)
  - (2) Details with elevations showing top and bottom of wall for critical points along the wall length. (orig. 10-12-04)
  - (3) Supporting calculations that demonstrate an adequate factor of safety (minimum 1.5) for bearing capacity, overturning, sliding, and internal stability, including surcharge loads due to sloping backfill, adjacent vehicles and structures. When global stability analysis is required the minimum factor of safety is 1.3 for both the temporary and permanent conditions. (orig. 10-12-04; am. 12-6-22)
- f. The site shall be designed to use existing topography and existing vegetation to screen site disturbance. (orig. 8-8-95; am. 10-12-04)
  - g. Revegetation plans shall be similar to existing vegetation and feature the prominent use of plants which are indigenous to the area or as approved by the County. Seeding methods such as hydroseeding, drilling, seeding and raking in, or other seeding method may be required when necessary to quickly and effectively establish a groundcover for areas where other types of seeding may be ineffective. (orig. 8-8-95; am. 11-12-02; am. 10-12-04)
  - h. Any permanent erosion control and drainage improvements that are installed, as a result of land disturbance activities shall be designed to complement and blend with the natural topography of the land. (orig. 8-8-95; am. 10-12-04)
  - i. Where possible, turnouts shall be provided with the narrowest permissible road to minimize the extent of land disturbance. (orig. 11-12-02; am. 10-12-04)
  - j. When the grading operations encounter remains of prehistoric people's dwelling sites, remains, or artifacts of historical, paleontological or archaeological significance, the operations shall be temporarily discontinued. The developer shall notify Planning and Zoning, and the developer shall promptly contact the proper authorities to determine the disposition thereof. If required by state or federal authorities, the developer shall preserve the area of historical, paleontological or archaeological significance for a maximum period of 30 days to allow authorities to excavate and recover the items of significance. (reloc. 12-6-22)
17. Materials handling BMP's are required. At a minimum, BMP's shall include controlling waste such as discarded building materials, concrete truck washout, chemicals, litter and sanitary waste, as applicable. In addition, spill prevention and containment BMP's for construction materials, waste and fuel shall be provided, as applicable. (orig. 10-12-04)
  18. Maximum allowable height of a temporary stockpile is 50 feet measured from existing grade. The setback of the stockpile measured from the abutting property line to the edge of the stockpile is 2 multiplied by the height of the stockpile. The edge of the stockpile shall be no closer than the grading setback (7 feet from the abutting property line). The slope shall not exceed 3H:1V unless otherwise approved by Planning and Zoning for grading permits based on existing site conditions and topographic constraints. The temporary stockpile shall remain in place no longer than two years unless otherwise approved by Planning and Zoning for grading permits based on site conditions and construction duration. (orig. 11-24-15; am. 7-17-18; am. 6-1-19; am. 12-6-22)

#### **G. Improvement Security**

1. As a condition for the issuance of a Grading Permit, the County may require an improvement security in an amount necessary to ensure compliance with the performance standards in the event of default on the part of the applicant or of denial of the case by the Board of County Commissioners. Grading Permits associated with single family attached, detached or duplex residential structures with an active building permit will not require an improvement security. An improvement security is required for improvements in the Right-Of-Way or for improvements which may affect Right-Of-Way. (orig. 8-25-85; am. 9-24-91; am.

8-8-95; am. 3-23-99; am. 12-17-02; am. 7-1-03; am. 10-12-04; am. 10-13-09; am. 6-1-19; am. 12-17-19; am. 12-6-22)

- a. Except for rough grading, the amount of the security shall be 100 percent of the cost of all grading erosion and sediment control items plus 100% of the cost of the work required for public streets/roads and for private streets/roads. The amount of security for rough grading shall be 25 percent of the total cost of rough grading for all lands within the mountains and 10 percent for all lands within plains of the County. A contingency amount equivalent to 10 percent of the total cost of all work shall be added to the security amount. (orig. 3-23-99; am. 12-17-02; am. 7-17-18)
  - b. The improvement security shall be in the form of cash escrow or a letter of credit. (am. 3-23-99)
  - c. The improvement security shall remain in effect until final inspections have been made, where required, and all grading work has been accepted by the County. Final acceptance of warranted Public Improvements shall conform to the Jefferson County Land Development Regulation. Upon final acceptance of improvements or warranted Public Improvements, securities will be released. (orig. 8-25-85; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 5-20-08)
2. Any letter of credit or deposit required pursuant to this section shall be payable to the Board of County Commissioners of Jefferson County and shall be for a minimum of 2 year. (orig. 8-25-86; am. 8-8-95; am. 10-12-04; am. 5-20-08)

#### **H. Permit Completion and Closeout**

1. Notice of Intent
  - a. A completed Form Letter N-2 stating that the final construction and grading are in conformance with the approved overall grading plan and Notice of Intent shall be submitted to Planning & Zoning prior to issuance of the Certificate of Occupancy. Form Letter N-2 shall be completed by a Colorado registered professional engineer. (orig. 6-1-19)
2. Grading Permit
  - a. The conditions of approval as specified in the approval letter and/or approved plan set. (orig. 8-25-86; am. 6-1-19)
  - b. Jefferson County staff confirms that the completed control measure operates in accordance with the approved site plan. (orig. 6-1-19)
  - c. The Certificate of Occupancy for residential structures will be issued once the Grading Permit certification is accepted and the Grading Permit is closed by Jefferson County staff. (orig. 6-1-19)

#### **I. Release of Security for Grading Permits**

1. Upon completion of the following, the improvement and/or maintenance securities will be released, and/or a Certificate of Compliance will be issued. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 7-17-18; am. 6-1-19)
  - a. Applicable provisions of this section. (orig. 8-25-86)
  - b. The conditions of approval of the Grading Permit. (orig. 8-25-86; am. 6-1-19)
  - c. Final stabilization of the site, which can include established vegetation, that will prevent accelerated erosion and other erosion control measures, where required. A uniform vegetative cover with a density of at least 70 percent of pre-disturbance levels shall be considered adequate vegetative cover for erosion control measures. (orig. 8-25-86; am. 9-24-91; am. 12-17-02; am. 7-1-03; am. 10-12-04)
  - d. Receipt of proof of compaction, where the compaction standard applies. Compaction tests shall be taken under the direct supervision of a geotechnical engineer. The geotechnical engineer or his designated representative shall observe grading activities on a full-time basis and shall take sufficient compaction test to enable the engineer to determine that the site is ready for the intended uses and shall so state on the compaction report. Compaction reports shall be signed and sealed and dated by a Colorado registered professional engineer. Compaction reports shall include the moisture density curves, location of test sites, soil types(s), density results, type of test and if a failing test, retesting of the site. The engineer shall provide a complete set of all test and observations and a report stating that the grading activities have been completed in substantial conformance with the approved grading plan, the requirements of this section, and the Land Development Regulation. (orig. 9-24-91; am. 3-23-99; am. 10-12-04)

2. An as-built plan is required by the County for the following:
  - a. Land disturbance activities that occur in a Floodplain Overlay District.
  - b. Large fills (greater than 1000 cubic yards).
  - c. Retaining walls as designated on the approved plans.
  - d. The construction deviates from the approved plans.
  - e. Permanent non-structural and structural water quality control measures including dimensions, volume calculations and overall compliance with approved plans.
  - f. Other activities as required by Performance Guarantee and Warranty Section of the Land Development Regulation. Orig. 9-24-91; am. 8-8-95; am. 12-17-02; am. 10-12-04; am. 7-17-18)
3. Upon completion and acceptance of all items listed on the list of improvements and associated costs, the project performance guarantee may be reduced to the amount shown on the Exhibit A for adequate revegetation and temporary erosion and sediment control. Revegetation means that a density of at least 70 percent of the pre-disturbance levels or equivalent permanent methods have been employed. (orig. 12-17-02; am. 10-12-04)
4. However, upon failure to complete the work, failure to comply with all of the terms of the permit or failure of the erosion and sediment control measures to function properly, the County may perform the required work or cause it to be done and collect from the permittee or surety all costs incurred, including administrative and inspection costs. Any unused portion of a deposit shall be refunded to the permittee after deduction by the County of the cost of the work. (orig. 8-25-86; am. 10-12-04; am. 7-17-18)

## **J. Enforcement**

1. Inspections
 

The County may inspect the site and perform any necessary tests from time to time to ensure compliance with the permit conditions. (orig. 9-24-91; am. 8-8-95; am. 3-23-99)
2. Suspension and Revocation of Permit
 

The County may suspend, limit or revoke a permit for violation of any provision of this section, violation of the permit or misrepresentations by permit holder, his agents or his employees or independent contractors under contract with the permittee for a Notice of Intent or Grading Permit for an individual lot or within a common plan of development. The decision of the County to suspend, limit or revoke a permit may be appealed to the Board of Adjustment. No work shall be performed while an appeal is pending except as authorized by the County. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 12-17-02; am. 6-1-19)
3. Enforcement Response
  - a. The escalation process for enforcement actions includes verbal warnings, written notifications, revocation of permits, denial of plan review, withholding of permits, withholding inspections, stop work orders, issuance of zoning violations (civil process), issuance of illicit discharge violations (civil process), fines associated with the illicit discharge violation and/or using the performance guarantee to hire a separate contractor to complete the work. The escalation process does not have to occur in that order. (orig. 6-1-19; am. 12-6-22)
  - b. The escalation process for chronic and recalcitrant violators of control measure requirements includes verbal warnings, written notifications, revocation of permits, denial of plan review, withholding of permits, withholding inspections, stop work orders, issuance of zoning violations (civil process), issuance of illicit discharge violations (civil process), fines associated with the illicit discharge violation and/or using the performance guarantee to hire a separate contractor to complete the work. The escalation process does not have to occur in that order. (orig. 6-1-19; am. 12-6-22)
3. Court Action
 

Nothing in this section shall be construed to prevent the Attorney's Office, at their discretion, from filing a court action based upon a violation or potential violation of this section. (orig. 3-23-99)
4. Right of Entry
 

Whenever necessary to enforce the provisions of this section the County can enter the premises at all reasonable times to perform any duty imposed by this section. If such entry is refused, the County shall have recourse to every remedy provided by law to secure entry. If a Land Disturbance Permit is

suspended or revoked, or if a Stop Work Order has been issued, the County shall have the right to enter the site to complete the work allowed under the grading permit. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 7-17-18)

5. Stop Work Orders

When any work is being performed which is not in compliance with an approved permit and/or the provisions of this section or any other applicable law, rule or regulation, the County can order the work stopped by serving written notice on any personnel engaged in performing the work. Such person shall immediately stop such work until authorized by the County to proceed. If there are no persons present on the premises, the notice may be posted in a conspicuous place and the notice shall state the nature of the violation. The notice shall not be removed until the violation has been vacated or authorization to remove the notice has been issued. Failure to comply with any Stop Work Order is a violation of the Zoning Resolution, the Grading Permit and/or the Notice of Intent. (orig. 8-25-86; am. 9-24-91; am. 8-8-95; am. 3-23-99; am. 12-17-02; am. 10-12-04; am. 7-17-18)

6. Violations of Other Regulations

Violations of this section may also cause violations of other State and/or Federal regulations and result in additional fines and penalties. (am. 10-12-04)

**ZONING  
RESOLUTION  
SECTION 2 –  
REDMARKED COPY**

## **Section 2 - General Provisions and Regulations**

(orig. 7-28-58; am. 2-6-84; am 7-1-03)

### **A. Amendment of Underlying Zones**

Any amendment to any underlying conventional zone district, including the Planned Development Zone District, shall in no way supersede or except any existing or subsequently adopted overlay district. (orig. 6-15-76)

### **B. Modification of Lots or Structures**

No lot, or any structure thereon, shall be modified in any way which will not conform to the applicable zone district regulations, except: (orig. 7-28-58; am. 9-6-77)

1. Where the Board of Adjustment, within its authority, grants a variance; or (orig. 7-28-58)
2. Where the Director of Planning and Zoning grants an administrative exception; or (orig. 7-17-18)
3. Where a portion of property has been acquired by an authorized public entity. (orig. 7-28-58; am. 9-6-77)

### **C. Structures Per Lot**

1. Every building shall be constructed and located on a single lot or combination of lots that have been merged, and no lot shall have more than 1 main building, except as otherwise provided by this Zoning Resolution. (orig. 7-28-58; am. 9-6-77; am. 3-26-13)
2. One or more main non-residential or multi-family structures per lot are allowed pursuant to the requirements of the Land Development Regulation or the Policies and Procedures Manual. (orig. 3-8-82; am. 6-14-88; am. 12-17-02)
3. Delineation of building envelopes is not required for accessory buildings, provided that all easements and applicable setbacks are observed. (orig. 6-14-88)
4. No structure shall be placed on a zone district line where such line crosses any portion of a property except where both zone districts would allow the use, and where both zone districts have the same setback limitations. (orig. 7-1-03)

### **D. Permit Requirements**

1. Building Permit
  - a. It shall be unlawful for any person, firm or corporation to erect, construct, reconstruct or structurally alter any building or other structure without first obtaining both of the following: (orig. 5-6-46; am. 12-26-62; am. 9-6-77; am. 8-6-80; am. 5-3-94)
    - (1) Zoning approval from Planning and Zoning including payment of a nonrefundable processing fee in an amount established by the Board of County Commissioners. (orig. 5-3-94; am. 5-25-04; am. 5-20-08)
    - (2) A Building Permit from Building Safety. (orig. 5-3-94; am. 5-25-04)
  - b. A Building Permit shall not be issued unless the lot or parcel is a proper division of land in accordance with Section 30-28-101(10) et. seq. C.R.S., as amended, unless it is the result of a process that has been exempted from the term "subdivision" and "subdivided land" by the Board of County Commissioners. (orig. 4-20-10)
  - c. A Building Permit shall not be issued unless the plans and the use conform to this Zoning Resolution and are approved by Planning and Zoning and Building Safety. (orig. 5-6-46; am. 12-26-62; am. 9-6-77; am. 5-25-04; am. 5-20-08)
  - d. A Building Permit shall not be issued for properties with the following situations:
    - (1) Multiple, unmerged lots or parcels are utilized in order to meet minimum zoning requirements for lot size or the Public Health requirements at the time of permit application; (orig. 6-15-04; am. 10-13-09; reloc. and am. 7-17-18)
    - (2) Underlying setback(s) cannot be met from interior property line(s) and multiple lots are utilized as part of permit process; (orig. 6-15-04; reloc. 7-17-18)

- (3) A well is located on a separate lot or parcel where multiple lots or parcels are required to meet minimum zoning requirements at the time of permit application; (orig. 6-15-04; reloc. 7-17-18)
- (4) An accessory structure proposed on an adjoining lot where the primary structure is located on a separate lot; or (orig. 6-15-04, am. 10-25-05; reloc. 7-17-18)
- (5) An Onsite Wastewater Treatment System is located on a separate lot or parcel where multiple lots or parcels are used in combination to meet minimum zoning requirements at the time of permit application. (orig. 6-15-04; am. 10-25-05; reloc. 7-17-18)
- e. Any building, structure or use which is not in compliance with the plans or use approved by Planning and Zoning shall constitute a violation of this Zoning Resolution. (orig. 6 14 88; am. 5-25-04; am. 5-20-08)
- f. The owner, at the time of issuance of the Building Permit, and the person to whom the permit is issued shall be responsible for compliance with all setback requirements set forth in this Zoning Resolution for the building or structure covered by the permit. (orig. 9-6-77)
- g. An Improvement Location Certificate (ILC), stamped by a registered surveyor, licensed in the State of Colorado, shall be required as a site plan for all Building Permits for new or replacement structures, or modifications to the footprint of existing structures. (orig. 7-17-18; am. 1-28-25)
  - (1) However, an Improvement Survey Plat (ISP) shall be required in lieu of an ILC as a submittal item when reduced setbacks for the proposed structure were approved by either the Director of Planning and Zoning, or the Board of Adjustment. (orig. 7-17-18)
  - (2) The ILC must show the structure(s) on adjacent properties when the zone district specifies a minimum separation between buildings. (orig. 7-17-18)
- h. Verification of Setbacks Requirements (orig. 7-17-18):
  - (1) A Setback Verification Form, certified by a registered surveyor, licensed in the State of Colorado, shall be submitted to Planning & Zoning upon completion of concrete/foundation form placement, and prior to sheathing for Building Permits under the following conditions: (orig. 7-17-18; am. 1-28-25)
    - (a) Where a planned setback for a detached accessory structure is less than 3 feet in the Plains areas or 5 feet in Mountain areas from the required setback for the applicable zone district; or (orig. 7-17-18)
    - (b) Where a planned setback for an addition to a primary structure is less than 3 feet in the Plains areas or 5 feet in Mountain areas from the required setback for the applicable zone district; or (orig. 7-17-18)
    - (c) Reduced setbacks for the proposed structure were approved by either the Director of Planning and Zoning, or the Board of Adjustment. (orig. 7-17-18)
  - (2) For Building Permits for new primary structures where a setback verification form is not required, and where a proposed setback is less than 3 feet in the Plains area or 5 feet in the Mountain areas from the required minimum setback for the applicable zone district, prior to the rough framing inspection, an Improvement Location Certificate, certified by a registered surveyor, licensed in the State of Colorado, shall be submitted to Planning & Zoning to verify that the required setbacks are being met. (orig. 7-17-18)
- i. Fire Protection: A written statement from the appropriate fire protection district, indicating that the property, for which the Building Permit is applied for, is within the boundaries of the fire protection district, and will be served by said fire protection district. If the property is not located within a fire protection district, a written statement from a local government indicating that they will provide service to the property shall be required. (orig. 1-18-22; am. 1-28-25)
  - (1) The above written statement shall be submitted for new structures, additions of any size, accessory dwelling units, commercial permits and any changes that modify roads or gates. The following shall be exempted from this requirement: (Orig. 1-28-25)
    - (a) Residential interior remodels with no additional square footage, and; (orig. 1-28-25)
    - (b) Outdoor decks associated with residential structures. (orig. 1-28-25)



- j. Access Standards: Before any Building Permit for a new dwelling, commercial building, industrial building, or other main building, or to replace an existing dwelling, commercial building, industrial building, or other main building, or for additional space of 400 square feet or more, measured cumulatively, may be issued, the applicant must meet the access requirements listed below. These access standards shall be deemed to be general standards that supersede conflicting provisions in any Official Development Plan. (orig. 9-6-77; am. 12-5-95; am. 12-17-02; am. 5-20-08, am. 4-20-10)
- (1) Right of Access: Evidence must be submitted demonstrating that the applicant has a right of access to a county, state or city maintained street/road. If the applicant's property does not have direct access to a county, state or city maintained street/road, then the offsite portion of the access that connects to the county, state or city maintained street/road must be in conformance with one or more of the following: (orig. 12-5-95; am. 12-17-02; am. 7-1-03; am. 10-25-05; am. 5-20-08; am. 4-20-10)
- (a) Right-of-way that has been dedicated and accepted by the county, the state or a city, but is not maintained by the county, the state or a city. (orig. 4-20-10)
  - (b) Right-of-way that has been dedicated to the county or the public, but has not been accepted by the county, and is not maintained by the county, the state or a city. (orig. 4-20-10)
  - (c) A recorded easement that gives the applicant a right of use. Planning and Zoning will review the access information provided by the applicant and information of public record, to determine the apparent right to use the access easement. Planning and Zoning is not making a legal determination as to the right of the use, only a determination that the access is sufficient for the issuance of a building permit. (orig. 4-20-10)
  - (d) A declared access from a recorded court decree that gives the applicant a right of use. (orig. 4-20-10)
  - (e) An existing access across privately owned property that has been declared a "road of record" by the Director of Planning and Zoning. The Director of Planning and Zoning's determination of a "road of record" is a determination of an apparent right to use the access for the purpose of issuing the building permit, not a legal determination as to the right of the use. The Director of Planning and Zoning may declare an access a "road of record" if it meets the following criteria: (orig. 4-20-10; am. 3-3-15)
    - (e-1) The access serving the parcel has been used for at least twenty (20) consecutive years. (orig. 4-20-10)
    - (e-2) The access does not cross property owned by a public entity or other entity over which prescriptive rights cannot be established. (orig. 4-20-10)
    - (e-3) The applicant has made a reasonable attempt to obtain an access easement or other acceptable legal right to use the access road and has been unsuccessful. (orig. 4-20-10)
  - (f) Any access right that is not identified above but is deemed sufficient by the County Attorney's Office for the purpose of issuing a building permit. An example of when this provision may be used would be when an access crosses property that is owned by a public entity or other entity over which prescriptive rights cannot be established, and a letter of authorization for such access road is provided by such entity. (orig. 4-20-10)
- (2) Right of Access Width: The right of access width must comply with the roadway standards of the Transportation Design and Construction Manual, ~~or an alternative standard as approved by the fire protection district.~~ [The Transportation Design and Construction Manual standards for widths of streets/roads and driveways is established based on the existing and/or potential use of the access system.](#) (orig. 12-5-95; am. 12-17-02; am. 7-1-03; am. 10-25-05, am. 4-20-10; am. 11-24-15; am. 7-17-18; [am XX-XX-XX](#))

(3) Physical Location of Access: The physical location of the access must closely align with the described limits of the right of access. If the right of access is based on a centerline description, then the centerline of the physical access shall be located along the centerline description. The evaluation of the physical location of the access shall be completed to a point where the street/road connects to a county, state or city maintained street/road. Planning and Zoning will review the physical location of the access based on documents provided by the applicant, information of public record and with the use of cartographic information. If necessary to locate and clarify access, a survey may be required. Planning and Zoning is not making a legal determination as to the location of the street/road with respect to the right of access. The provisions of this section do not apply if the right of access is a "road of record". The provisions of this section may be determined not to apply to an alternate right of access approved by the County Attorney's Office. (orig. 4-20-10)

(4) Physical Standard of Access: ~~The physical access must comply with the standards of the Transportation Design and Construction Manual.~~ The evaluation of the physical access shall be completed ~~to both~~ on-site and off-site to a point where the street/road or driveway connects to a county, state or city maintained street/road. For the evaluation of the physical access standards, different requirements are established for the different building permit types as listed below~~The Transportation Design and Construction Manual standards for streets/roads and driveways is established based on the existing and potential use of the access system and does allow for alternate standards to be approved by the appropriate fire protection district. The fire protection district may require additional improvements such as fire sprinklers and cisterns as a condition of their approval of an alternate standard. If improvements are required based on this evaluation, then the following shall apply:~~ (orig. 12-5-95; am. 6-18-02; am. 12-17-02; am. 10-25-05; am. 5-20-08; am. 4-20-10; am. 11-24-15; am. XX-XX-XX)

(a) All Building Permits (except those for additions or non-habitable detached structures): The applicant's design engineer must evaluate the access, and identify any necessary improvements to bring the access into compliance with the standards of the Transportation Design and Construction Manual. The Transportation Design and Construction Manual standards for streets/roads and driveways is established based on the existing and/or potential use of the access system. (orig. XX-XX-XX)

(b) Building Permits for additions, residential interior remodels, or non-habitable detached structures: The applicant shall provide a letter from the Fire Protection District indicating if the existing access is acceptable. The Fire Protection District may add conditions to the acceptance of access as deemed necessary. (orig. XX-XX-XX)

The Transportation Design and Construction Manual details the relief process for any street/road or driveway that cannot meet the applicable access standards. (orig. XX-XX-XX)

~~(a) Design and construction compliance, through the appropriate county process, shall be required for those portions of the access that are located within county right-of-way, public right-of-way or on land under the control of the person or entity seeking the Building Permit, and for any additional requirements that the fire protection district may have as a condition for their approval of an alternate access standard. A Stop Work Order for a building permit may be issued for failure to construct the improvements required by this section in accordance with the approved plans. (orig. 12-5-95; am. 12-17-02; am. 10-25-05; am. 4-20-10)~~

~~(b) When design and construction compliance would involve construction on land that is not under the control of the person or entity for whom a Building Permit is sought, and is not located within county or public right-of-way, then the applicant shall submit a written advisory statement from the local fire protection district describing whether such portion of the private street/road and/or driveway is deemed acceptable for emergency vehicle use. If access is not deemed acceptable for emergency vehicle use by the Fire Protection District, the letter shall identify the improvements that the Fire Protection District believes are necessary for the access to be acceptable for emergency vehicle use. (orig. 5-20-08; am. 10-13-09; am. 4-20-10)~~

~~Should the Fire District deem the access not acceptable for emergency vehicle use, the applicant may choose to either: (orig. 5-20-08)~~

~~(b-1) Arrange to correct all access deficiencies and obtain a new advisory statement from the Fire Protection District stating that the access is acceptable for emergency vehicle use, or (orig. 5-20-08)~~

~~(b-2) Sign an affidavit of understanding, on a form provided by Planning and Zoning, stating that the applicant is aware that emergency services may be nonexistent, diminished, or slowed for the site and agreeing to indemnify, defend, save and hold the County, its agents and employees harmless from any claims, demands and liability resulting from or arising out of the construction, installation and use of the structures, devices or improvements by the Owner(s), their heirs, successors and assigns. If the applicant chooses this option, then both the affidavit of understanding and the statement from the Fire Protection District shall be recorded with the Jefferson County Clerk and Recorder. (orig. 5-20-08; am. 4-20-10)~~

- (5) Previous Review of Access: If the property for which the building permit is sought has gone through an approved Rezoning, Special Use, Plat, Exemption, Minor Adjustment, Site Development Plan, Grading Permit, or Notice of Intent subsequent to April 20, 2010, then the access verification that occurred during that process shall be deemed sufficient for the building permit process, unless the access being proposed for the building permit is not consistent with what was previously reviewed or the access standards of this section have been revised subsequent to the approval of the application. For Rezoning and Special Use applications, if the provisions of the Physical Standard of Access were not reviewed during the process, then those provisions must be satisfied prior to the issuance of the building permit. (orig. 4-20-10)

## 2. Miscellaneous Zoning Permit

- a. It shall be unlawful for any person, firm or corporation to erect, construct, reconstruct, structurally alter any building or structure, and/or commence any of the following activities without first obtaining a Miscellaneous Zoning Permit. The permit shall be valid for one year, all work must be completed within this time frame or a new or renewal permit will be required. Planning and Zoning may request documentation to ensure compliance with the regulations. (orig. 5-3-94; am. 3-28-00; am. 5-25-04; am. 5-20-08; am. 3-26-13)
- (1) Any structure not requiring a Building Permit, including but not limited to entry features, gazebos, retaining walls over 36 inches in height, decks less than 30 inches but greater than 12 inches in height, chicken coops, and beehives. (orig. 5-3-94; am. 3-28-00; am. 12-17-02; am. 3-26-13; am 5-10-22)
    - (a) Mini-structures that are less than 200 square feet, 14 feet or less at the peak, and do not house livestock do not require a permit (orig. 5-10-22)
  - (2) Recreation facilities, including but not limited to tennis courts, swimming pools, playgrounds, and golf courses. (orig. 5-3-94; am. 7-17-18)
  - (3) Broadcasting and receiving devices, including but not limited to private satellite dishes over 18 inches in diameter, television and/or radio towers, cellular towers, antenna, and ham radio towers. (orig. 5-3-94; am. 3-28-00; am. 12-17-02)
  - (4) Temporary structures not requiring a Building Permit, including but not limited to sales and/or security trailers, temporary buildings and/or facilities, and mobile homes. Temporary uses and/or structures, including but not limited to fireworks stands, Christmas tree sale lots, parking lot sales and seasonal produce and/or flower stands. (orig. 5-3-94; am 5-10-22)
  - (5) Home occupations as outlined in the Home Occupations Section of this Zoning Resolution. (orig. 5-3-94; am. 3-26-13)
  - (6) Group living facility for more than 3 unrelated persons. (orig. 5-25-04)
  - (7) Any gate across access that serves a parcel or parcels, a tract or tracts, or a lot or lots. A Miscellaneous Zoning Permit issued for such purpose shall first be approved by the applicable fire protection district. Access through the gate shall be granted to beneficiaries of any easements and emergency service providers. (orig. 5-10-22)
  - (8) A noise barrier fence, maximum of 8 feet in height, may be constructed adjacent to right-of-way for an arterial or higher-class street or road. (orig. 7-1-03; am. 7-17-18; reloc. 5-10-22)
- b. A Miscellaneous Zoning Permit shall not be issued unless the plans and the use conform to the

provisions of this Zoning Resolution. (orig. 5-3-94)

- c. The owner, at the time of issuance of a Miscellaneous Zoning Permit, and the person to whom the permit is issued shall be responsible for compliance with all the requirements set forth in this Zoning Resolution for the building, structure and/or activity covered by the permit. (orig. 5-3-94; am. 12-17-02)

### 3. Short-Term Rental Permit

- a. It shall be unlawful for any person, firm or corporation to operate a short-term rental without obtaining an approved Short-Term Rental Permit. In addition, the following criteria must be met before the issuance of a Short-term Rental Permit: (orig. 1-1-12)
  - (1) The property owner shall notify each adjacent property owner in writing by certified mail of the name and contact information for the 24-hour local primary and secondary contacts. If such local contacts change, the property owner shall notify the adjacent property owners and the Jefferson County Planning and Zoning Division of the new local contacts' information in writing by certified mail within five (5) business days of the change in local contacts. (orig. 1-1-12)
  - (2) The dwelling shall be equipped with operable smoke alarms, fire extinguishers and carbon monoxide alarms. An operable carbon monoxide alarm shall be installed within fifteen (15) feet of the entrance to each room used for sleeping purposes. The smoke alarms shall be installed pursuant to the current International Building Code as adopted by the Jefferson County Division of Building Safety. (orig. 1-1-12)
  - (3) The proposed short-term rental shall provide a minimum of one (1) off street parking spaces, plus one (1) additional space per sleeping room. (orig. 1-1-12)
  - (4) Proof of adequate water and sewer. (orig. 1-1-12)
  - (5) Legal access in conformance with the access requirements of this Zoning Resolution. (orig. 1-1-12)
  - (6) Proof of Fire Protection. (orig. 1-1-12)
    - (a) Outdoor fires using wood or charcoal for fuel are always prohibited. (orig. 1-1-12)
  - (7) The property owner shall provide a current sales tax license for the short-term rental issued by the Colorado Department of Revenue. (orig. 1-1-12)
- b. A permit for a short-term rental shall be obtained within thirty (30) days following review by the Board of Adjustment for approval or renewal of a special exception to allow a short-term rental of a single-family dwelling. The review of the Short-Term Rental Permit application will include but is not limited to: failure to comply with any conditions set by the Board of Adjustment on approval of the special exception for short-term rentals, complaints received by the Sheriff's Office for noise or improper parking, any active zoning violations or other impacts that cause the short-term rental to become incompatible with the surrounding land uses. (orig. 1-1-12)
- c. The owner at the time of issuance of a short-term rental permit and the person to whom the permit is issued shall be responsible for compliance with all the requirements set forth in this Zoning Resolution for the building, structure and/or activity covered by the permit. (orig. 1-1-12)
- d. Once the short-term rental permit has been issued, the owner shall provide all rental dates to the Jefferson County Planning & Zoning Division. In turn, Planning & Zoning shall provide this information to the Jefferson County Assessor and the Colorado Department of Revenue. This report shall be filed quarterly. (orig. 1-1-12)
- e. The property owner shall post the 24-hour local contact information as well as the Short-Term Renter Good Neighbor Brochure as created by the Planning and Zoning Division at a prominent location within the structure. In addition, the property owner shall provide each renter with a copy of the brochure at the time of occupancy. (orig. 1-1-12)
- f. The County may revoke a Short-Term Rental Permit at any time for failure to comply with the provisions of this Zoning Resolution concerning short-term rentals and/or confirmed violation(s) of any federal, state, or local law, ordinance, or regulation. The decision of the County to revoke a Short-Term Rental Permit may be appealed to the Board of Adjustment. No short-term rental of the subject property may occur while an appeal is pending. (orig. 1-1-12)

4. Setback Criteria from Streets/Roads: Setbacks shall be measured from the private access easements, easements associated with public street/road templates set forth in the Jefferson County Transportation Design and Construction Manual or flow line/edge of pavement of public and private streets or roads, except where Planning and Zoning finds that the private access easement functions as a shared driveway, based upon criteria including the following: (orig. 3-15-82; am. 12-17-02; am. 5-20-08; am. 10-13-09; am. 3-3-15; am. 11-24-15; am. 7-17-18)
  - a. Estimated current or projected average daily traffic (ADT); (orig. 3-15-82; am.10-13-09)
  - b. Design and topography; (orig. 3-15-82)
  - c. Providing connection between thoroughfares. (orig. 3-15-82)
  - d. Number of properties served by the easement. (orig. 7-17-18)

In the event the private access easement is determined to be functionally equivalent to a shared driveway, a minimum setback from the access easement of five (5) feet shall apply. (orig. 7-17-18)
5. General Setback Criteria:
  - a. All setbacks shall be measured from the foundation or wall; however, eaves, roof overhangs, and fireplaces may protrude 24 inches into the setback. Underground counterforts and window wells may protrude into setbacks. (am. 7-17-18)
  - b. The placement of improvements on any such zoned property may be further restricted by plat notes approved by the Board of County Commissioners in conjunction with an approved Plat, Exemption from Platting, or other process subject to the Land Development Regulations. (reloc. 7-17-18)

#### **E. Zone District Boundaries**

For purposes of determining zone district boundaries after vacation of a right of way dedicated or deeded to the County, the zoning applicable to the property abutting on either side of the right of way shall, after vacation, be deemed to extend to the centerline of such vacated right of way. (orig. 9-6-77)

#### **F. Street/Road Setbacks**

For purposes of measuring front, side and rear setbacks, all measurements shall be measured from the future right of way line when the street or road is designated on the "County Major Thoroughfare Plan". (orig. 7-28-58; am. 9-6-77; am. 12-17-02; am. 10-13-09)

#### **G. Front Yard**

1. On a through lot, the front yard requirements of the applicable zone district shall apply to each lot line fronting on a street. (orig. 5-6-46; am. 9-6-77)
2. Regardless of the location of, or the direction that any structure faces and regardless of where the main entryway into the structure is located, the front lot line of a lot shall be as indicated on the subdivision plat or if not shown on a Subdivision Plat, it shall be determined by the main route of access into the property. (orig. 7-28-58; am. 9-6-77; am. 12-17-02)
3. Every part of the required front yard shall be open and unobstructed from its lowest point to the sky, except for landscaping and fencing not prohibited by the appropriate Section of this Zoning Resolution; and except for entry features with a minimum 14 foot height clearance. (orig. 5-6-46; am. 12-26-62; am. 9-6-77; am. 8-6-80; am. 12-17-02; am 7-17-18)

#### **H. Side Yard**

Every part of the required side yard shall be open and unobstructed from its lowest point to the sky, except for landscaping, accessories such as clothes lines, swing sets up to 8 feet in height and fencing not prohibited by the appropriate Section of this Zoning Resolution. (orig. 5-6-46; am. 9-6-77; am. 8-6-80; am. 12-17-02)

#### **I. Rear Yard**

Every part of the required rear yard shall be open and unobstructed from its lowest point to the sky, except for landscaping and accessories such as clothes lines, swing sets up to 8 feet in height and fencing not prohibited by the appropriate Section of this Zoning Resolution. (orig. 5-6-46; am. 9-6-77; am. 8-6-80; am. 12-17-02)

#### **J. Fences**

1. Fences shall meet the standards set forth in the Zoning Resolution and applicable County Regulations. (orig. 5-10-22)

2. A noise barrier fence, maximum of 8 feet in height, may be constructed adjacent to right-of-way for an arterial or higher-class street or road. (orig. 7-1-03; am. 7-17-18; reloc. 5-10-22)
3. Fences on corner lots must comply with vision clearance triangle requirements. (orig. 7-17-18; reloc. 5-10-22)
4. Fences more than 42 inches in height are allowed, subject to the following development standards:
  - a. Side-to-street setback: Fence shall be set back to the edge of the sidewalk, or at least 10 feet from the flowline of adjacent streets if no sidewalk exists. (orig. 7-17-18; reloc. 5-10-22)
  - b. Front setback: Fences shall be set back to the edge of the sidewalk, or at least 10 feet from the flowline of adjacent streets if no sidewalk exists, provided the applicable zone district allows fences in the front setback. (orig. 7-17-18; reloc. 5-10-22)
  - c. Fences shall maintain a 25'x25' sight triangle for all driveways, both on-site and off-site, which is measured from the edge of driveway and the flowline of street/road. (orig. 7-17-18; reloc. 5-10-22)

#### **K. Rubbish**

The outdoor storage of rubbish is prohibited unless expressly allowed by the applicable zone district. (orig. 5-20-08)

#### **L. Height Regulation**

1. The height limitations established for each zone district shall apply to flagpoles; and radio, television or microwave towers (including antennas), except as otherwise provided within this section. Noncommercial antenna installations for home use of radio or television are excluded. (orig. 6-14-88; am. 6-7-94; am. 12-17-02; am. 4-20-10)
2. The height limitations established for any zone district, except Planned Development, shall not apply to chimneys, stacks, water towers, grain elevators, silos, elevators, monuments, dome spires, belfries, hangars and accessory symbols of government, religious, fraternal and civic organizations when attached to the respective building. (orig. 5-6-46; am. 9-6-77; am. 6-14-88; am. 4-20-10)

#### **M. Dangerous and/or Wild Animals**

1. Notwithstanding any other provision of this Zoning Resolution and except as provided in paragraphs L.2. and L.3. below, no person shall own, possess, harbor, maintain or keep any of the following species of animals, other than wildlife in existing natural habitat, on any property within any zone district (other than as specified in the Agricultural-Two (A-2) and Agricultural Thirty-Five (A-35) Zone Districts) in the unincorporated area of Jefferson County. The restrictions within this section apply to the A-2 and A-35 Zone Districts, when the property is at least 10 acres in size, and the keeping of dangerous and wild animals is done in accordance with an approved Special Use. (orig. 8-1-78; am. 3-28-00; am. 12-17-02; am. 3-26-13)
  - a. Poisonous reptiles, species of nonpoisonous snakes which ordinarily grow to more than 6 feet in length when mature, and lizards belonging to the family Varanidae; (orig. 8-1-78)
  - b. Crocodilians; (orig. 8-1-78)
  - c. All species of non-human mammals except the following: (orig. 8-1-78)
    - (1) Domestic cat (*Felis catus*); (orig. 8-1-78)
    - (2) Chinchilla (*Chinchilla laniger*); (orig. 8-1-78)
    - (3) Domestic dog (*Canis familiaris*); (orig. 8-1-78)
    - (4) Domestic ferret (*Mustela putorius furo*); (orig. 8-1-78)
    - (5) Mongolian gerbil (*Meriones unguicularus*); (orig. 8-1-78)
    - (6) Guinea pig (*Cavia porcellus*); (orig. 8-1-78)
    - (7) Hamster (*Mesocricetus auratus*); (orig. 8-1-78)
    - (8) Domestic laboratory mouse (*Mus domesticus*); (orig. 8-1-78)
    - (9) Domestic rabbit (*Oryctolagus cuniculus*); (orig. 8-1-78)
    - (10) Domestic laboratory rat (*Rattus rattus albino strain*); (orig. 8-1-78)
    - (11) Squirrel monkey (*Saimiri seinrouis*); (orig. 8-1-78)

- (12) Owl monkey (*Aotus trivirgatus*); (orig. 8-1-78)
  - (13) Woolly monkey (*Lagothrix lagothrica*); (orig. 8-1-78)
  - (14) Pygmy Goat (*Goatus Minimus*); (orig. 7-17-18)
  - (15) Miniature Pig (*Göttinger minipig*); (orig. 7-17-18)
  - (14) Domestic livestock including, but not limited to the following: horses, cattle, sheep, goats, swine, mules, donkeys, burros, llamas, alpacas, emu, and ostrich. (orig. 8-1-78; am. 12-17-02)
2. For any property zoned Agricultural-Two (A-2) and Agricultural Thirty-Five (A-35), the owner thereof shall receive Special Use approval in order to be permitted to own, possess, harbor, maintain or keep any one or more animals of the species listed in paragraph L.1. above, where the ownership, possession, harboring, maintenance or keeping of such animal(s) is necessary to a use which is otherwise in compliance with the applicable zone district regulations and is specifically for one of the following purposes: (orig. 8-1-78; am. 12-17-02; am. 3-26-13)
    - a. To be used for scientific research or for production of scientific or commercial supplies or as breeding stock in connection with a business or other commercial operation or research facility established as a use upon the premises; or (orig. 8-1-78)
    - b. To be used for purposes of public commercial exhibition, whether as a profit or nonprofit operation, such as a permanent zoological gardens or a temporary or traveling menagerie, circus, rodeo or livestock show. (orig. 8-1-78)
  3. For any property zoned Agricultural-Two (A-2) and Agricultural Thirty-Five (A-35), the owner thereof shall receive Special Use approval in order to be permitted to own, possess, harbor, maintain or keep any one or more animals of the species prohibited under paragraph L.1. above, where the applicant demonstrates a special interest and competency in caring for such an animal or animals, and where the applicant demonstrates to the satisfaction of the Planning Commission and the Board of County Commissioners that the health, safety and welfare of humans and domestic animals in the area and of the general public is adequately safeguarded. (orig. 8-1-78; am. 12-17-02; am. 3-26-13)
  4. The application for a Special Use under paragraphs: L.2. and L.3. above, shall be made to the Planning Commission. If approved by the Planning Commission, the application shall proceed to the Board of County Commissioners, which must also approve the application for the Special Use to be permitted. (orig. 8-1-78; am. 12-17-02)
  5. One criterion relevant to the determination of whether to approve the Special Use shall be the agreement by the applicant that proposed facilities for the keeping of such animal(s) will be constructed and maintained in accordance with the requirements of the Colorado Division of Wildlife. (orig. 8-1-78)

As a condition of the continued validity of any Special Use granted under paragraphs L.2 and L.3 above, the applicant must at all times ensure that adequate safeguards for the health and security of both the animal(s) and humans and domestic animals in its (their) vicinity are provided, and must at all times be in compliance with all rules and regulations of the Colorado Division of Wildlife, including permit requirements; and, in addition, the applicant must at all times keep the animal(s) securely locked in the facilities approved by the Colorado Division of Wildlife which provide such adequate safeguards. (orig. 8-1-78)

#### **N. Sexually Oriented Businesses**

1. No person may operate or cause to be operated a sexually oriented business within 1,000 feet of any of the following, whether the use or zone district listed below is unincorporated Jefferson County, an adjacent county, or within an incorporated municipality. (orig. 7-8-97)
  - a. A Religious Assembly. (orig. 7-8-97; am. 3-26-13)
  - b. A school meeting all requirements of the compulsory education laws of the state. (orig. 7-8-97)
  - c. The boundary of any zone district in which one of the primary uses is residential. (orig. 7-8-97)
  - d. A dwelling unit (single or multiple). (orig. 7-8-97)
  - e. A public park. (orig. 7-8-97)
  - f. A licensed childcare center. (orig. 7-8-97)
  - g. An establishment holding a liquor license. (orig. 7-8-97)

2. No person may operate or cause to be operated a sexually oriented business within 1,000 feet of another sexually oriented business. (orig. 7-8-97)
3. No person may cause or permit the operation, establishment or maintenance of more than one sexually oriented business within the same building or structure or portion thereof, such as in a shopping center. A sexually oriented business may include one or more types of sexually oriented business provided it has one address and is operated as a single business entity that has one sales tax license number. (orig. 7-8-97)
4. For the purposes of this section, the distance between any two sexually oriented businesses shall be measured in a straight line, without regard to intervening structures, streets, or political boundaries, from the closest exterior structural wall of each business. (orig. 7-8-97)
5. For purposes of this section, the distance between any sexually oriented business and any Religious Assembly, school, child care center, public park, establishment holding a liquor license, dwelling unit (single or multiple) or residential zone district shall be measured in a straight line, without regard to intervening structures or objects or political boundaries, from the closest exterior wall of the structure in which the sexually oriented business is located to the nearest property line of the premises of a Religious Assembly, school, child care center, an establishment holding a liquor license, or dwelling unit (single or multiple), or the nearest boundary of an affected public park or residential zone district, whichever is closest. (orig. 7-8-97; am. 3-26-13)
6. If two or more sexually oriented businesses are within 1,000 feet of one another and are otherwise in a permissible location, the sexually oriented business which was first established and continually operating at its particular location will be deemed to be in compliance with this Zoning Resolution and the later established business(es) will be deemed to be in violation of this Zoning Resolution. (orig. 7-8-97; am. 12-17-02)
7. A sexually oriented business lawfully operating is not rendered in violation of this Zoning Resolution by the subsequent location of a Religious Assembly, school, childcare center, dwelling unit (single or multiple), public park, establishment holding a liquor license, or residential zone district within 1,000 feet of the sexually oriented business. (orig. 7-8-97; 12-17-02; am. 3-26-13)
8. All sexually oriented business shall blacken their windows or arrange the business so that the interior of the business and its stock in trade cannot be viewed from the exterior of the business. (orig. 7-8-97)

#### **O. Bars and Taverns**

1. No establishment holding a liquor license may operate within 1000 feet of a sexually oriented business. (orig. 7-8-97)
2. For purposes of this section, the distance between any sexually oriented business and any establishment holding a liquor license shall be measured in a straight line, without regard to intervening structures or objects or political boundaries, from the closest exterior wall of the structure in which the sexually oriented business is located to the nearest property line of the premises of an establishment holding a liquor license. (orig. 7-8-97)

#### **P. Rural Cluster**

Permitted uses, lot and building standards, and general requirements for specific zone districts may differ from the standards specified in this Zoning Resolution for applications undergoing a rural cluster land division. When the regulations of the rural cluster process, as contained in the Land Development Regulation, conflict with any provision of this Zoning Resolution, the provision of the rural cluster process shall control. (orig. 10-13-98; am. 12-17-02)

#### **Q. Marijuana**

1. Private Marijuana Clubs are prohibited in all zone districts as principal or accessory uses, regardless of whether any such use is operated for profit or not for profit. (orig. 4-14-14)
2. Cultivation or processing of marijuana is only allowed in an enclosed, locked structure located on a residential property which constitutes the primary residence of the cultivator/processor, and only for personal use of the cultivator/processor. No more than 6 plants may be grown on each residential property for each registered medical marijuana patient or adult age 21 or older, and in no case may more than 12 plants be grown on a residential property. Nothing in this section shall be construed to prohibit the cultivation or processing of medical marijuana by a primary caregiver for his or her patients, provided that any such primary caregiver does not exceed the limitations on number of plants set forth in this section



and is growing the plants in accordance with applicable provisions of Article XVIII, Section 14 of the Colorado Constitution; C.R.S. § 25-1.5-106, as amended; and any applicable rules promulgated under state law. (orig. 4-14-14)

# **STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA – REDMARKED COPY**

# Jefferson County

## Storm Drainage Design & Technical Criteria

JEFFERSON COUNTY, COLORADO PLANNING AND ZONING DIVISION

### Revision Dates

The Storm Drainage Design and Technical Criteria was prepared by WRC Engineering, Inc. in May 1987 and was adopted by the Board of County Commissioners of Jefferson County, Colorado, and has since been amended on the following dates:

March 19, 1996

May 12, 1998

May 27, 2003

November 25, 2003

October 13, 2009

October 1, 2013 (Temporary Regulation Amendment)

April 1, 2014

November 24, 2015

July 17, 2018

June 1, 2019

December 17, 2019

XXXXX XX, XXXX

Jefferson County Planning and Zoning Division  
100 Jefferson County Parkway, Suite 3550, Golden, Colorado 80419  
303-271-8700 • <http://planning.jeffco.us>

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## Chapter 1 - General Provisions

### 1.1 Short Title

These regulations together with all future amendments will be known as the “Jefferson County Storm Drainage Design and Technical Criteria” (hereafter called *CRITERIA*) as referenced in the Jefferson County Land Development Regulation (hereafter called *LDR*) and *Jefferson County Zoning Resolution* (hereafter called *ZR*).

### 1.2 Jurisdiction

These *CRITERIA* will apply to all land within the unincorporated areas of the County, including any public lands. These *CRITERIA* will apply to all facilities constructed on County ROW, easements dedicated for public use, and to all privately owned and maintained drainage facilities, including but not limited to detention ponds, water quality facilities, storm sewers, inlets, manholes, culverts, swales and channels.

### 1.3 Purpose and Effect

Presented in these *CRITERIA* are the minimum design and technical criteria for the analysis and design of storm drainage facilities. All subdivisions, rural clusters, rezonings, site development plans, site approvals, land disturbance permits or any other proposed development or construction submitted for approval under the provisions of the *LDR* will include adequate storm drainage system analysis and appropriate drainage system design. Such analysis and design will meet or exceed the criteria set forth herein. Options to the provisions of these *CRITERIA* may be suggested by the applicant. The applicant will have the burden of showing that the options are equal or better. Policies and technical criteria not specifically addressed in these *CRITERIA* will follow the provisions of the Mile High Flood District (hereafter called MHFD) “Urban Storm Drainage *Criteria Manual*” (hereafter called *Manual*). The applicant is also referred to the Colorado Department of Transportation Standard Plans for additional design details not covered in these *CRITERIA* or the *Manual*. Drainage facilities in place or under construction at the time of *CRITERIA* adoption will be accepted without regard to the provisions of these *CRITERIA*.

### 1.4 Enactment Authority

The *LDR* has been adopted pursuant to the authority conferred within: Article 28 of Title 30 (County Planning); Article 2 of Title 43 (State, County and City Highway Systems); Article 20 of Title 29 (Land Use Control and Conservation); and other applicable sections of the CRS, as amended. As part of the authority provided by which the County promulgates the *LDR*, these *CRITERIA* are adopted by resolution.

The *LDR* refers to these *CRITERIA* being the source of County policy, guidelines, criteria and submittal requirements for storm water management issues during the development process.

### 1.5 Amendment and Revisions

These policies and criteria may be amended as new technology is developed and/or if experience gained in the use of these *CRITERIA* indicates a need for revision. Amendments and revisions will be made by resolution.

### 1.6 Enforcement Responsibility

It will be the duty of the Board of County Commissioners acting through Planning and Zoning to enforce the provisions of these *CRITERIA*.

### 1.7 Review and Approval

The County will review all drainage submittals for general compliance with these *CRITERIA*. An approval by the County does not relieve the owner, engineer or designer from responsibility of ensuring that the calculations, plans, specifications, construction and record drawings comply with these *CRITERIA*.

Per Colorado Revised Statute 32-11-221, improvements in or improvements that directly outfall to drainageways within the MHFD boundary must meet the requirements of MHFD’s Maintenance Eligibility Program. Where this is the case, the County will refer submittals to MHFD and design, construction and revegetation must be approved by MHFD.

1.8 Alternative Standard Requests & Minor Variation Requests

Alternative Standard Requests of these CRITERIA will be reviewed and approved in accordance with the applicable sections in the LDR and ZR. Any exclusions, exemptions, waivers, and variances shall comply with the terms and conditions of the MS4 permit.

1.9 Interpretation

In the interpretation and application of the provisions of these CRITERIA, the following will govern:

- 1.9.1 In its interpretation and application, the provisions will be regarded as the minimum requirements for the protection of the public health, safety, comfort, convenience, prosperity and welfare of the residents of the County.
- 1.9.2 Whenever a provision of these CRITERIA and any other provisions of the LDR or any provision in any law, ordinance, resolution, rule or regulation of any kind, contain any restriction covering any of the same subject matter, whichever restrictions are more restrictive or impose higher standards of requirements will govern.
- 1.9.3 These CRITERIA will not abrogate or annul any permits or approved drainage reports, construction plans, easements or covenants issued before the effective date of these CRITERIA.

1.10 Relationship to Other Standards

These CRITERIA are consistent with the MHFD criteria. If special districts impose a more stringent criteria, this difference is not considered a conflict. If the State or Federal Government imposes stricter criteria, standards or requirements, these will be incorporated into the County's requirement after due process and public hearing(s) needed to modify the County's regulations and standards.

1.11 Abbreviations

As used in these CRITERIA, the following abbreviations will apply:

ASP	Aluminized Steel Pipe
BMPs	Best Management Practice(s)
CDOT	Colorado Department of Transportation
CRS	Colorado Revised Statute
CMP	Corrugated Metal Pipe
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch
CUHP	Colorado Urban Hydrograph Procedure
EURV	Excess Urban Runoff Volume
FEMA	Federal Emergency Management Agency
FHAD	Flood Hazard Area Delineation
FIRM	Flood Insurance Rate Map
HDPE	High Density Polyethylene Pipe
HP	High Performance Polypropylene Pipe
JCD	Jefferson Conservation District
MDCIA	Minimized Directly Connected Impervious Area
MHFD	Mile High Flood District
MPLD	Mountain Porous Landscape Detention
NOAA	National Oceanic and Atmospheric Administration
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
USDCMUSDC	Urban Storm Drainage Criteria Manual (Manual)



## Chapter 2 - Drainage Planning Submittal Requirements

### 2.1 Introduction

Drainage reports and plans, construction drawings, specifications and as-built information will be submitted and approved as required by the *LDR* and Building Permit Procedure. All submitted reports will be clearly and cleanly reproduced. Photostatic copies of charts, tables, nomographs, calculations or any other referenced material will be legible. Washed out, blurred or unreadable portions of the report are unacceptable and could warrant resubmittal of the report. The submittal will include a declaration of the type of report submitted (i.e., Phase-I, Phase-II or Phase-III). Incomplete or absent information may result in the report being rejected for review.

A pre-application consultation is suggested of all applicants for all processing steps of the *LDR*. The applicant will consult with Planning and Zoning for general information regarding regulations, required procedures, possible drainage problems and specific submittal requirements.

### 2.2 Phase I Drainage Report

For development processes that require the submittal of a Phase I Drainage Report, a Phase I Report which complies with the requirements of Section 2.2 must be submitted by the developer or owner.

This report will review at a conceptual level the feasibility and design characteristics of the proposed development. The Phase I Drainage Report will be in accordance with the following outline and contain the applicable information listed:

#### 2.2.1 Phase I Report Contents

The following is an outline of the minimum Phase I Drainage Report requirements.

##### I. General Location and Description

###### A. Location

1. Vicinity map
2. City, County, State Highway and local streets within and adjacent to the site or the area to be served by the drainage improvements
3. Township, range, section, 1/4 section
4. Major drainageways and facilities
5. Names of surrounding developments

###### B. Description of Property

1. Area in acres
2. Ground cover (type of ground cover and vegetation)
3. Major drainageways
4. Existing major irrigation facilities such as ditches and canals
5. Proposed land use
6. Floodplains delineated by FHAD studies or on FEMA FIRM maps
7. Significant geologic features

##### II. Drainage Basins and Sub-Basins

###### A. Major Basin Description

1. Reference and include maps of major drainageway planning studies such as FHAD reports, major drainageway planning reports and FIRMs.
2. Major basin drainage characteristics, existing and planned land uses within the basin, as defined by Planning and Zoning
3. Identification of all nearby irrigation facilities which will influence or be influenced by the local drainage

###### B. Sub-Basin Description

1. Discussion of historic drainage patterns of the property in question
2. Discussion of on-site and off-site drainage flow patterns and impact on development under existing and fully developed

basin conditions as defined by Planning and Zoning

### III. Drainage Facility Design

#### A. General Concept

1. Discussion of concept and typical drainage patterns
2. Discussion of compliance with off-site runoff considerations
3. Discussion of anticipated and proposed drainage patterns
4. Discussion of the content of tables, charts, figures, plates or drawings presented in the report

#### B. Specific Details (Optional Information)

1. Discussions of drainage problems encountered and solutions at specific design points
2. Discussion of detention storage and outlet design
3. Discussion of maintenance and access aspects of the design
4. Discussion of impacts of concentrating the flow on the downstream properties

#### C. Specific Details (Required for any proposed modifications to the Floodplain Overlay District)

1. Discussion on whether the floodplain modification will affect off-site property
2. Discussion of the design of the modified watercourse, in conformance with MHFD and County requirements
3. Discussion of the location of the modified watercourse and reason for modifications
4. Discussion of any State and Federal permits that are required for the modification of the watercourse
5. Hydraulic and hydrologic calculations for the 100-year storm demonstrating that the modified watercourse will maintain the flood carrying capacity
6. Discussion of the maintenance requirements and identification of the organization responsible for maintenance
7. A developer and engineer's certifications as required for a Phase III Drainage Report

### IV. References

Reference all criteria, master plans and technical information used in support of concept.

#### 2.2.2 Phase I Drawing Contents

(a) General Location Map: Drawings may be 24" x 36" or 22" x 34". A map will be provided in sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns. The map should be at a scale of 1" = 1000' to 1" = 4000' and show the path of all drainage from the upper end of any off-site basins to the defined major drainageways. The map should identify any major facilities from the property (i.e., development, irrigation ditches, existing detention facilities, culverts, storm sewers) along the flow path to the nearest major drainageway.

Basins and divides are to be identified and topographic contours are to be included.

(b) Floodplain Information: A copy of applicable FHAD and/or FIRM maps showing the location of the subject property will be included with the report as outlined in Section 2.2.1. All major drainageways (see Section 3.2.5) will have the floodplain defined and shown on the report drawings.

(c) Drainage Plan: Map(s) of the proposed development at a scale of 1" = 20' to 1" = 100' on a 24" x 36" or 22" x 34" drawing will be included. The plan should show the following:

1. Existing topographic contours at 2-foot maximum intervals. In mountain areas, the maximum interval is 5 feet. The contours should extend a minimum of 100 feet beyond the property lines
2. All existing drainage facilities
3. Approximate flooding limits based on available information
4. Conceptual major drainage facilities including detention basins, storm sewers, swales, riprap and outlet structures in the detail consistent with the proposed development plan
5. Major drainage boundaries and sub-boundaries
6. Any off-site feature influencing development

7. Proposed flow directions and, if available, proposed contours
8. Legend to define map symbols
9. Title block in lower right corner

### 2.3 Phase II Drainage Report

The purpose of the Phase II Drainage Report is to identify and/or refine conceptual solutions to the problems which may occur on-site and off-site as a result of the development. For development processes that require the submittal of a Phase II Drainage Report, a Phase II Drainage Report which complies with the requirements of Section 2.3 must be submitted by the developer or owner. The report will be prepared by or supervised by an engineer licensed in Colorado. The report will contain a certification sheet as follows:

"This report (*plan*) for the Phase II drainage design of (*name of Development*) was prepared by me (*or under my direct supervision*) in accordance with the provisions of Jefferson County Storm Drainage Design and Technical Criteria and was designed to comply with the provisions thereof. I understand that Jefferson County does not and will not assume liability for drainage facilities designed by others."

---

Registered Professional Engineer

State of Colorado No. \_\_\_\_\_

(Affix Seal)

### 2.4 Phase III Drainage Report

The purpose of the Phase III Drainage Report is to provide final drainage design for a project including design details for drainage facilities.

For development processes that require the submittal of a Phase III Drainage Report, a Phase III Report which complies with the requirements of Sections 2.3 and 2.4 must be submitted by the developer or owner. If applicable, the Phase III Drainage Report must address comments made during review of the Phase II Report.

The report will be prepared by or under the direction of an engineer licensed in Colorado, certified as shown below in for the Phase III report. The report must contain a developer and engineer certification sheet as follows:

"This report (*plan*) for the Phase III drainage and water quality design of (*name of Development*) was prepared by me (*or under my direct supervision*) in accordance with the provisions of Jefferson County Storm Drainage Design and Technical Criteria and was designed to comply with the provisions thereof. I understand that Jefferson County does not and will not assume liability for drainage facilities designed by others."

---

Registered Professional Engineer

State of Colorado No. \_\_\_\_\_

(Affix Seal)

"(Owner/Applicant) hereby certifies that the drainage facilities for (Name of Development) will be constructed according to the design presented in this report. I understand that Jefferson County does not and will not assume liability for drainage facilities designed or reviewed by my engineer. I also understand that Jefferson County relies on the representations of others to establish that drainage facilities are designed and built in compliance with applicable guidelines, standards or specifications. Review by Jefferson County can therefore in no way limit or diminish any liability which I or any other party may have with respect to the design or

construction of such facilities."

(Owner/Applicant) \_\_\_\_\_

By: \_\_\_\_\_

Date \_\_\_\_\_

The Phase III Drainage Report will be prepared in accordance with the outline shown in Section 2.4.1. The report drawings will follow the requirements presented in Section 2.4.2 below.

Three (3) signed and stamped original copies of the approved Phase III Drainage Plan and Report will be submitted to the County for signature and retention in their files.

#### 2.4.1 Phase II and Phase III Report Contents

The Report will be in accordance with the following outline and contains the applicable information listed:

- I. General Location and Description
  - A. Location
    - 1. Vicinity map
    - 2. Township, range, section, 1/4 section
    - 3. Local streets within and adjacent to the subdivision with ROW width shown
    - 4. Major drainageways, facilities and easements within and adjacent to the site
    - 5. Names of surrounding developments
  - B. Description of Property
    - 1. Area in acres
    - 2. Ground cover (type of trees, shrubs, vegetation, general soil conditions, topography and slope)
    - 3. National Resources Conservation Service (NRCS) soils classification map and discussion
    - 4. Major drainageways
    - 5. General project description
    - 6. Irrigation facilities
    - 7. Proposed land use
- II. Drainage Basins and Sub-Basins
  - A. Major Drainage Basins
    - 1. On-site and off-site major drainage basin characteristics and flow patterns and paths
    - 2. Existing and proposed land uses within the basins if known
    - 3. Discussion of all drainageway planning or floodplain delineation studies that affect the major drainageways, such as FHAD Studies and Outfall System Planning studies
    - 4. Discussion of the condition of any channel within or adjacent to the development, including existing conditions, need for improvements and impact on the proposed development
    - 5. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions
    - 6. Identification of all irrigation facilities within the basin which will influence or be influenced by the local drainage
  - B. Sub-Drainage Basins
    - 1. On-site and off-site minor drainage basin characteristics and flow patterns and paths under historic and developed conditions
    - 2. Existing and proposed land uses within the basins
    - 3. Discussion of irrigation facilities that will influence or be impacted by the site drainage
    - 4. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions
- III. Drainage Design Criteria
  - A. Regulations: Discussion of the optional provisions selected or the deviation from the *CRITERIA*, if any, and its justification

- B. Development Criteria Reference and Constraints
  - 1. Discussion of previous drainage studies (i.e., project master plans) for the site in question that influence or are influenced by the drainage design and how the plan will affect drainage design for the site
  - 2. Discussion of the effects of adjacent drainage studies
  - 3. Discussion on drainageways and storage facilities and how they interrelate to water rights
  - 4. Discussion of the drainage impact of site constraints such as streets, utilities, light rail rapid transit, existing structures and development or site plan
- C. Hydrological Criteria
  - 1. Identify design rainfall
  - 2. Identify runoff calculation method
  - 3. Identify detention discharge and storage calculation method
  - 4. Identify design storm recurrence intervals
  - 5. Discussion and justification of other criteria or calculation methods used that are not presented in or referenced by these *CRITERIA*
- D. Hydraulic Criteria
  - 1. Identify various capacity references
  - 2. Discussion of other drainage facility design criteria used that are not presented in the *CRITERIA*
- E. Waivers from *CRITERIA*
  - 1. Identify provisions by section number for which a waiver is requested
  - 2. Provide justification for each waiver requested
- IV. Drainage Facility Design
  - A. General Concept
    - 1. Discussion of concept and typical drainage patterns
    - 2. Discussion of compliance with off-site runoff considerations
    - 3. Discussion of the content of tables, charts, figures, plates or drawings presented in the report
    - 4. Discussion of anticipated and proposed drainage patterns. Discuss how runoff is conveyed off-site to nearest adequate drainage facility. Discuss flow path and downstream capacity
  - B. Specific Details
    - 1. Discussion of drainage problems encountered and solutions at specific design points
    - 2. Discussion of detention storage and outlet design
    - 3. Discussion of storm water quality facilities
    - 4. Discussion of maintenance access and aspects of the design
    - 5. Discussion of easements and tracts for drainage purposes, including the conditions and limitations for use
  - C. Stormwater Storage Facilities
    - 1. Discuss detention pond designs, including release rates, storage volumes and water surface elevations for the EURV and emergency overflow conditions, outlet structure design, emergency spillway design, etc
    - 2. Discuss pond outfall locations and design, including method of energy dissipation
    - 3. Discuss how runoff is conveyed from all pond outfalls and emergency spillways to the nearest major drainageway, including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway
    - 4. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater storage purposes
  - D. Water Quality Enhancement BMPs
    - 1. Discuss the design of all structural water quality BMPs, including tributary areas, sizing, treatment volumes, design features, etc.
    - 2. Discuss how runoff is conveyed from all pond outfalls to the nearest adequate drainage facility, including a discussion of the flow path and capacity downstream
    - 3. Discuss the operation and maintenance aspects of the design and easements and tracts that are required for stormwater quality enhancement purposes
  - E. Additional Permitting Requirements

1. Section 404 of the Clean Water Act
2. The Endangered Species Act
3. Other local, state or federal requirements

#### V. Conclusions

- A. Compliance with Standards
  1. *CRITERIA*
  2. Major Drainageway Planning Studies
  3. *Manual*
- B. Drainage Concept
  1. Effectiveness of drainage design to control damage from storm runoff
  2. Influence of proposed development on the Major Drainageway Planning Studies recommendation(s)

#### VI. References

Reference all criteria and technical information used.

#### VII. Appendices

- A. Hydrologic Computations
  1. Land use assumptions regarding adjacent properties
  2. Initial and major storm runoff at specific design points
  3. Historic and fully developed runoff computations at specific design points
  4. Hydrographs at critical design points
  5. Time of concentration and runoff coefficients for each basin
- B. Hydraulic Computations
  1. Open channel design
  2. Detention area/volume capacity and outlet capacity calculations; depths of detention basins
  3. Water Quality Capture Volume Calculations which may include grass swale and buffer calculations (Required for Phase III)
  4. Downstream/outfall system capacity (including design storm) to major drainage system. Include a solution to mitigate downstream capacity problems from the development. See Section 3.3.3 for more information
  5. Downstream/outfall system capacity for internal, adjoining and connecting major drainageways. Include a solution to mitigate downstream capacity problems from within and adjoining the development. See Section 3.3.3 for more information
  6. Emergency spillway sizing calculations
  7. Stabilization and grade control improvements and calculations for ditches and drainageways.
  8. Energy dissipation at pipe outfalls
  9. Culvert capacities (*Required for Phase III*)
  10. Storm sewer capacity, including energy grade line (EGL) and hydraulic grade line (HGL) elevations (*Required for Phase III*)
  11. Actual street capacity as calculated using the MHFD Spreadsheet. Compare with allowable depths listed in Chapter 10 (*Required for Phase III*)
  12. Storm inlet capacity including inlet control rating at connection to storm sewer (*Required for Phase III*)
  13. Check and/or channel drop design (*Required for Phase III*)

#### 2.4.2 Phase II and Phase III Drawing Contents

A. Historic Drainage Conditions Plan: All drawings will be 24" x 36" or 22" x 34" in size. The plan should include the following:

1. A map in sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns. The map should be at a scale of 1" = 1000' to 1" = 4000' and show the path of all drainage from the upper end of any off-site basins to the defined major drainageways (see Drainage Policy). The map will identify any major construction (i.e., development, irrigation ditches, existing detention facilities, culverts, storm sewers) along the entire path of drainage. Basins and divides are to be identified and topographic contours are to be included.

2. Boundary of the proposed development at a scale of 1" = 20' to 1" = 100'

3. Existing floodplain limits for all major drainageways (see Section 3.2.3)
  4. Existing contours at 2-foot maximum intervals. In mountain areas, a maximum interval of 5 feet may be used if approved by Planning and Zoning. The contours should extend a minimum of 100 feet beyond the property lines
  5. Property lines and easements with purposes noted
  6. Existing drainage facilities and structures, including irrigation ditches, street/roadside ditches, crossspans, drainageways, gutter flow directions and culverts. All pertinent information such as material, size, shape, slope and location should also be included
  7. Overall historic drainage area boundary and drainage sub-area boundaries
  8. Definition of flow path leaving the development through the downstream properties ending at a major drainageway or adequate drainage facility
  9. Legend to define map symbols (*see Table 201 for symbol criteria*)
  10. Title block in lower right hand corner
- B. Developed Drainage Conditions Plan: Map(s) of the proposed development at a scale of 1" = 20' to 1" = 100' on a 24" x 36" or 22" x 34" drawing will be included. The plan will show the following:
1. Boundary of the proposed development at a scale of 1" = 20' to 1" = 100'.
  2. Existing and proposed contours at 2-feet maximum intervals. In mountain areas, the maximum interval is 5 feet. The contours should extend a minimum of 100 feet beyond the property lines.
  3. Property lines and easements with purposes noted.
  4. Streets, indicating ROW width, flowline width, curb type, sidewalk and approximate slopes.
  5. Existing drainage facilities and structures, including irrigation ditches, street/roadside ditches, crossspans, drainageways, gutter flow directions and culverts. All pertinent information such as material, size, shape, slope and location will also be included.
  6. Overall drainage area boundary and drainage sub-area boundaries.
  7. Proposed type of street flow (i.e., vertical or combination curb and gutter), street/roadside ditch, gutter, slope and flow directions and crossspans.
  8. Proposed storm sewers and open drainageways, including inlets, manholes, culverts and other appurtenances, including riprap protection.
  9. Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
  10. Proposed storm water quality facilities.
  11. Routing and accumulation and flows at various critical points for the initial storm runoff listed on the drawing using the format shown in Table 201.
  12. Routing and accumulation of flows at various critical points for the major storm runoff listed on the drawing using the format shown in Table 201.
  13. Volumes and release rates for detention storage facilities and information on outlet works.
  14. Location and elevations of all existing and proposed floodplains affecting the property.
  15. Location and (if known) elevations of all existing and proposed utilities affected by or affecting the drainage design.
  16. Routing of on-site and off-site drainage flow through the development.

17. Definition of flow path leaving the development through the downstream properties ending at a major drainageway or adequate drainage facility.

18. Legend to define map symbols (see Table 201 for symbol criteria).

19. Title block in lower right hand corner.

20. Detention Pond Summary as shown in Table 201.

## **2.5 Abridged Drainage Report**

When an application is under the threshold to require stormwater detention, Planning and Zoning will accept an abridged drainage report in lieu of a Phase III Drainage Report. The Abridged Drainage Report shall include the following:

1. The standard engineer's and developer's certifications in Section 2.4.
2. Calculations demonstrating that the site meets the requirements in Section 3.3.6 and 3.3.7 to not require stormwater detention and water quality.
3. Narrative and supporting calculations (as needed) demonstrating that the project will be designed to carry surface and subsurface water to the nearest adequate street/roadside ditch, storm drain and/or natural watercourse.
4. Hydraulic and hydrologic calculations for any required and existing drainage structures to demonstrate that they meet the relevant provisions in these *CRITERIA*. If no drainage structures are proposed, information shall be included stating as such.
5. Calculations for any drainageways that impact the property and determination of the required easement width and location.
6. Any other Phase III Drainage Report requirements that impact the property as necessary.

## **2.6 Drainage Letter**

When the application is under the threshold to require stormwater detention, and no stormwater features are proposed, Planning and Zoning will accept a Drainage Letter in the following format.

1. Narrative of the proposed land disturbance activity to include lot size, total impervious area and the proposed use.
2. Statement that all performance standards and applicable regulations are being met.
3. Letter signed and stamped by a Professional Engineer

## **2.7 Exception to the Requirement for a Drainage Report**

Planning Engineering will accept a letter from the applicant stating that there will be no new construction in lieu of a drainage report if all of the following conditions are met:

1. No increase in impervious area and no new construction.
2. The existing facilities on the site were constructed legally.
3. There are no drainageways that impact the property.

## **2.8 Construction Plans**

Where drainage improvements are to be constructed, the final construction plans (24" x 36" or 22" x 34") will be submitted with the Phase III Drainage Report. Approval of the final construction plans by Planning and Zoning is a condition of issuing the construction permits. Four (4) copies of the approved plans will be submitted to the County for file. The plans for the drainage improvements will include but are not limited to:

1. Storm sewers, inlets, outlets and manholes with pertinent elevations, dimensions, type and horizontal control indicated.



2. Culverts, end sections and inlet/outlet protection with dimensions, type, elevations and horizontal control indicated.
3. Channels, ditches and swales (including side/rear yard swales) with lengths, widths, cross-sections and erosion control (i.e. riprap, concrete, grout) indicated.
4. Checks, channel drops, erosion control facilities.
5. Detention pond grading, trickle channels, outlets, forebay, micropool, overflow weir and landscaping.
6. Water Quality/Detention pond cross-section including a 100-year water surface elevation, EURV elevations, micropool, forebay, outlet structure and 1-foot freeboard.
7. Stormwater quality facilities.
8. Other drainage related structures and facilities (including, alternative water quality BMP's, underdrains and sump pump lines).
9. Maintenance access considerations.
10. Overlot grading and erosion and sedimentation control plan (refer to the ZR, Land Disturbance).
11. The hydraulic grade line and energy grade line for all storm sewers will be shown on the profile sheets and calculation included in the Phase III Drainage Report.


The information required for the plans will be in accordance with sound engineering principles, these *CRITERIA* and the County requirements for subdivision designs. Construction documents will include geometric, dimensional, structural, foundation, bedding, hydraulic, landscaping and other details as needed to construct the storm drainage facility. The approved Phase III Drainage Plan will be included as part of the construction documents for all facilities affected by the drainage plan. Construction plans will be signed by a registered professional engineer as being in accordance with the County approved drainage report/drawings.

## **2.9 As-Built Drawings and Final Acceptance Certificate**


As-built drawings for drainage facilities and grading will be submitted in accordance with the Development Agreements, Warranties and Guarantees Section of the *LDR*.

Table 201  
**Drawing Symbol Criteria and Hydrology**


Review Table



A = Basin Designation  
B = Area in Acres  
C = Composite Runoff Coefficients



D = Design Point Designation



Basin Boundary

Summary Runoff Table  
*(To be placed on drainage plan)*

Design Point	Contributing Area (Acres)	Runoff 5 year (CFS)	Peak 100 year (CFS)
XX	XX • XX	XX • X	XX • X

Detention Pond Summary

Pond Number	5-year Detention Volume	100 year Detention Volume	Water Quality Volume	Total Volume	5-Year Release Rate	100-year Release Rate	100-Year Water Elevation
1	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X
2	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X
3	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X
4	X,XXX	X,XXX	X,XXX	X,XXX	X.X	X.X	XXX.X

## Chapter 3 - Drainage Policy

### 3.1 Introduction

The provisions for adequate drainage are necessary to preserve and promote the general health, welfare and economic wellbeing of the County. Drainage is a regional feature that affects all governmental jurisdictions and all parcels of property. This characteristic of drainage makes it necessary to formulate a program that balances both public and private involvement. Overall coordination and master planning must be provided by the governmental units most directly involved, but drainage must be integrated at a regional level.

When planning drainage facilities, certain underlying principles provide direction for the effort. These principles are made operational through this set of policy statements. The application of the policy in turn is facilitated by technical criteria and data.

### 3.2 Basic Principles

#### 3.2.1 Multi-Purpose Resource

*The county encourages the use of stormwater runoff as a multi-purpose resource and to require space allocation for appropriate drainage facilities in the planning of new developments.*

Stormwater runoff is a resource that is a subsystem of urbanization. This subsystem should be multi-purpose to satisfy the demands placed on water within urban development. The stormwater resource has the potential for a beneficial use if it is compatible with adjacent land uses and Colorado Water Law. Examples of beneficial use include groundwater infiltration and use in landscape features.

The planning of drainage facilities must be included in the development process. The provision for adequate drainage becomes a competing use for space along with other land uses. If adequate provision is not made in a land use plan for the drainage requirements, storm water runoff will conflict with other land uses and will result in water damages and will impair or even disrupt the functioning of other urban systems.

Drainage facilities can fulfill other purposes aside from just drainage. Facilities that are not typically designed for drainage, such as recreational areas and parking lots, can frequently be designed to provide water quantity and quality benefits.

Elimination or reduction in the size of detention and/or retention facilities is preferred where acceptable groundwater infiltration methods are used.

#### 3.2.2 Water Rights

*The county requires that analysis of impacts on water rights be included in the planning and design of proposed drainage facilities.*

When the drainage sub-system interferes with existing water rights, the value and use of the water rights are affected. Drainageways and storage facilities frequently interrelate with water rights, which must be addressed when planning new facilities to preserve their integrity.

#### 3.2.3 Major Drainageway

*The county defines a major drainageway as any drainage flow path with a tributary area of 130 acres or more.*

### 3.3 Regional and Local Planning

#### 3.3.1 Post Development Flow Conditions

*The county encourages infiltration and for post development flow conditions to be in a manner and quantity (flow rate) as to not do more harm than the predevelopment flow within the drainage basin, unless the owner/developer can obtain approval and/or easements from the affected property owner(s).*

Colorado follows the modified civil law rule that the owner of upstream property possesses a natural easement on land downstream for drainage of surface water flowing in its natural course. Natural drainage conditions can be altered by the owner of the upstream land provided the water is not sent down in a manner or quantity to do more harm to the downstream land than formerly. During the development process, if water is allowed to flow into the development in its historic manner and quantity and is discharged in the historic manner and quantity, the alterations are generally acceptable. When the development alters the natural drainage into the development in a manner

or quantity that results in more harm to the downstream land, it may violate the modified civil law rule. Likewise, if the development does not return the drainage to the natural drainage conditions or does so in a manner or quantity that results in more harm, it may violate the modified civil law rule. Development proposals that violate the modified civil law rule will not be approved unless the owner/developer obtains approvals and/or easements from the affected property owner(s).

### 3.3.2 Master Planning

*The county requires that new developments comply with adopted regional drainage master plans.*

As set forth in Section 3.2.1, drainage planning is required for all new developments. In recognition that drainage boundaries are non-jurisdictional, the County participates in the preparation of regional basin-wide master plans. These plans define major drainage facilities, including those that are required public improvements for new developments.

### 3.3.3 Drainage Problem Areas

*The county requires offsite analysis and drainage facilities for development in a drainage problem area. A drainage problem area is an area where there is no downstream outfall to a street, roadside ditch, open channel or storm sewer that meets the relevant requirements in these CRITERIA. The offsite analysis will address downstream conditions at every point along the project site boundaries where stormwater runoff will exit the property.*

*The county allows stormwater retention in drainage problem areas only if there is no other viable option, in the opinion of Planning and Zoning, available to resolve the drainage impact from the development. Stormwater retention facilities must be designed to meet these CRITERIA (storage).*

There are areas within the County where significant drainage problems exist. Any new development in those areas may compound the existing drainage problems. Depending on specific details of the drainage problem, the following techniques for reducing or eliminating negative impacts have been used successfully:

- Over-detention with reduced release rates
- Downstream improvements to the drainage system
- Reduction of impervious area
- Infiltration water quality BMPs
- Stormwater retention

### 3.3.4 Public Improvements

*The county requires the construction of improvements to the local drainage system and the major drainageway as defined by the approved Phase III Drainage Report and plan for all development.*

Public improvements associated with drainage may include improvements to both the local drainage system and the major drainageway. The local drainage system consists of curb and gutter, inlets and storm sewers, culverts, bridges, swales, ditches, channels, detention/retention areas and other drainage facilities required to convey the minor and major storm runoff to the major drainageway. The major drainageway system consists of channels, storm sewers, bridges, detention/retention areas and other facilities serving more than the development or property in question, that may be impacted by the development.

### 3.3.5 Basin Transfer

*The county does not allow the inter-basin transfer of storm drainage runoff and to maintain the historic drainage path within the drainage basin. The transfer of drainage from basin to basin is a viable alternative only in certain instances and will be reviewed on a case-by-case basis. When basin transfer is permitted, the plan must achieve historic flow conditions at the confluence of the basins and meet the requirements of post development flow conditions.*

Colorado drainage law recognizes the inequity of transferring the burden on managing storm drainage from one location or property to another. Liability questions also arise when the historic drainage continuum is altered. The diversion of storm runoff from one basin to another should be avoided unless specific and prudent reasons justify and dictate such a transfer. Prior to selecting a solution, alternatives should be reviewed. Planning and design of stormwater drainage systems should not be based on the premise that problems can be transferred from one location to another.

### 3.3.6 Stormwater Runoff Detention

*The county requires that stormwater detention and/or retention be provided for all developments except as described below. The required minimum volume and maximum release rates will be determined in accordance with the requirements of these CRITERIA. Detention/retention volumes may be reduced with the incorporation of impervious area reduction methods identified in the stormwater quality section. Regional detention and/or retention ponds may be used in satisfying storage requirements only if it can be demonstrated that the pond(s) has adequate storage capacity and that the pond(s) has been designed and constructed in accordance with the requirements of these CRITERIA.*

*When an application is under the threshold to require stormwater detention, Planning and Zoning will accept an Abridged Drainage Report or Drainage Letter in lieu of a Phase III Drainage Report. The thresholds are as follows:*

1. For single family residential development with lot sizes less than 2.5 acres, cumulative impervious areas including the structures, streets/roads/driveways (paved or unpaved) and parking areas, will not total more than 10,000 square feet. The development proposal will restrict the allowable impervious area at the time of building permit issuance so that the maximum impervious area established is not exceeded.
2. For other residential development, with lot sizes greater than 2.5 acres, cumulative impervious areas including the structures, streets/roads/driveways (paved or unpaved) and parking areas, will not total more than 20,000 square feet. The development proposal should restrict the allowable impervious area at the time of building permit issuance so that the maximum impervious area established is not exceeded.
3. For residential lots adjacent to or abutting a drainageway, detention is not required if it can be proven to have no adverse effect to downstream property owners and have sufficient capacity to handle the additional flows. At a minimum, water quality shall be addressed in accordance with this regulation.
4. For all other development with lot sizes less than 2.5 acres, cumulative impervious areas including the structures, streets/roads/driveways (paved or unpaved) and parking areas, will not total more than 10,000 square feet. The development proposal will restrict the allowable impervious area at the time of building permit issuance so that the maximum impervious area established is not exceeded.
5. For existing Roadway projects where improvements are limited due to vacant land.
6. For all Trail projects.

If the proposal is meeting these thresholds, the applicant must submit an Abridged Drainage Report or Drainage Letter as identified in Sections 2.5 and 2.6 of these CRITERIA. The Abridged Drainage Report must address water quality as specified in the Stormwater Quality section below.

### 3.3.7 Stormwater Quality

*The county requires BMPs to reduce stormwater quality pollution caused by development, unless it meets the criteria as noted in the procedure below. Regional water quality facilities may be used in satisfying the BMP requirements only if it can be demonstrated that the facility provides the required water quality capture volume and that the facility has been designed and constructed in accordance with the requirements of these CRITERIA.*

Land development and human activities affect both the quantity and the quality of stormwater discharged to receiving waters. Development increases the volume of stormwater and the pollutants leaving the project property. To remove pollutants, the collection and conveyance infrastructure must be supplemented with collection and infiltration BMPs. The increase in impermeable areas such as rooftops, parking lots and paved areas decreases the opportunity for stormwater to infiltrate and percolate into the ground, and the absence of vegetation allows for increased flow velocity and sediment erosion.

To mitigate the negative effects of land development on stormwater quality, stormwater quality improvement BMPs are required. Refer to the *Manual* for BMPs and design specifications.

A project shall not be required to provide a Step 1 and/or Step 2 BMP per the Stormwater Quality Management Chapter of this CRITERIA if the following are met:

1. Detention and/or retention is not required per Section 3.3.6.
2. The project disturbs less than one acre of ground or 1 acre per mile for linear projects.

3. The project is not part of a larger common plan of development or sale.

A common plan of development or sale is a site where multiple separate and distinct construction activities may be taking place at different times on different schedules, but still under a single plan. Examples include:

1. Phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contracts or by separate owners (e.g., a development where lots are sold to separate builders).
2. A development plan that may be phased over multiple years but is still under a consistent plan for long-term development.
3. Projects in a contiguous area, up to 1/4 mile, that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility.

Requests for relief of permanent water quality control measures for projects within the Jefferson County MS4 area will not be considered for projects that include land disturbance of one acre or greater except as listed below as an exclusion.

#### MS4 Exclusion Procedure:

Planning and Zoning may grant an administrative exclusion of the requirement for permanent water quality control measures associated with projects if one of the following apply:

(A) "Pavement Management Sites": Sites, or portions of sites, for the rehabilitation, maintenance, and reconstruction of roadway pavement, which includes roadway resurfacing, mill and overlay, white topping, black topping, curb and gutter replacement, concrete panel replacement, and pothole repair. The purpose of the site must be to provide additional years of service life and optimize service and safety. The site also must be limited to the repair and replacement of pavement in a manner that does not result in an increased impervious area and the infrastructure must not substantially change. The types of sites covered under this exclusion include day-to-day maintenance activities, rehabilitation, and reconstruction of pavement. "Roadways" include roads and bridges that are improved, designed or ordinarily used for vehicular travel and contiguous areas improved, designed or ordinarily used for pedestrian or bicycle traffic, drainage for the roadway, and/or parking along the roadway. Areas primarily used for parking or access to parking are not roadways.

(B) Excluded Roadway Redevelopment: Redevelopment sites for existing roadways, when one of the following criteria is met:

- 1) The site adds less than 1 acre of paved area per mile of roadway to an existing roadway, or
- 2) The site does not add more than 8.25 feet of paved width at any location to the existing roadway.

(C) Excluded Existing Roadway Areas: For redevelopment sites for existing roadways, only the area of the existing roadway is excluded from the requirements of an applicable development site when the site does not increase the width by two times or more, on average, of the original roadway area. The entire site is not excluded from being considered an applicable development site for this exclusion. The area of the site that is part of the added new roadway area is still an applicable development site.

(D) Aboveground and Underground Utilities: Activities for installation or maintenance of underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity. This exclusion includes, but is not limited to, activities to install, replace, or maintain utilities under roadways or other paved areas that return the surface to the same condition.

(E) Non-Residential and Non-Commercial Infiltration Conditions: This exclusion does not apply to residential or commercial sites for buildings. This exclusion applies to applicable development sites for which post-development surface conditions do not result in concentrated stormwater flow during the 80th percentile stormwater runoff event. In addition, post-development surface conditions must not be projected to result in a surface water discharge from the 80th percentile stormwater runoff events. Specifically, the 80th percentile event must be infiltrated and not discharged as concentrated flow. For this exclusion to apply, a study specific to the site, watershed and/or MS4 must be conducted. The study must show rainfall and soil conditions present within the permitted area; must include allowable slopes, surface conditions, and ratios of impervious area to pervious area; and the permittee must accept such study as applicable within its MS4 boundaries.

(F) Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped: Jefferson County may exclude sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped.

(G) Stream Stabilization Sites: Jefferson County may exclude stream stabilization sites.

(H) Trails: Jefferson County may exclude bike and pedestrian trails. Bike lanes for roadways are not included in this exclusion, unless attached to a roadway that qualifies under another exclusion in this section.

### 3.3.8 Floodplain Management

*The county requires developments that impact floodplains to comply with the floodplain regulations of the ZR and LDR.*

Although in many circumstances it may be desirable to leave the floodplain in its natural state, it is evident that development in areas encumbered by floodplains often results in alterations within the floodplain limits. The County has adopted floodplain regulations as part of its ZR and the LDR. These regulations should be referenced when alterations within floodplains are proposed.

### 3.3.9 Operations and Maintenance

*The county requires that maintenance access be provided to all storm drainage facilities to assure continuous operational capability of the system. The property owner is responsible for the maintenance of all drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures and detention basins located on their land unless modified by the development improvements agreement. Should the owner fail to adequately maintain said facilities, the county will have the right to enter said land for the purposes of operations and maintenance. All such maintenance costs will be assessed to the property owner. Where floodplains or major drainageway improvements, are in whole or in part within the MHFD boundary, the approval by MHFD is required to assure MHFD maintenance eligibility.*

An important part of all storm drainage facilities is the continued maintenance of the facilities to ensure they will function as designed. Maintenance responsibility lies with the owner of the land, except as modified by specific agreement. Maintenance responsibility will be delineated on Plats and Final Development Plans. Maintenance access for detention ponds must be adequate for maintenance and be shown on the Plats and Final Development Plans.

### 3.3.10 Drainage Easement Requirements

*Drainage easements are required for all onsite drainage facilities and for offsite drainage facilities in accordance with Section 3.3.1. All drainage easements must be dedicated to Jefferson County in a form acceptable to the County Attorney's office and must be shown on plats and/or final development plans. The county has the right to access drainage easements, and the right, but not the obligation, of construction and/or maintenance within drainage easements. Drainage easements will be kept clear of obstructions by the property owner/homeowners association/owners association or equivalent entity to the flow and/or obstructions to maintenance access.*

The easement requirements are indicated on the following table.

	Drainage Facility	Drainage Easement Width
1.	Storm Sewer/Subsurface Groundwater Collection System Mains /Interceptor	
	(a) Underdrains less than 36" dia.	20'
	(b) Underdrains equal to or greater than 36" dia.	Twice the pipe invert depth with sewer placed within the middle third of the easement (minimum width = 20')
2.	Open Channel/Swales	
	(a) $Q_{100}$ less than 1 cfs	5' minimum
	(b) $Q_{100}$ greater than or equal to 1 cfs and/or less than or equal to 20 cfs	15' minimum
	(c) $Q_{100}$ greater than 20 cfs	15' minimum (must accommodate $Q_{100}$ plus one foot of freeboard and required access)
3.	Detention/Retention/Water Quality Ponds/MPLDs/water quality features	As required to contain storage or encompass the water quality feature and associated facilities plus adequate maintenance access to the pond or feature and around perimeter.
4.	Along Side Lot Lines for Single-family Residential Subdivisions as required.	5' minimum, centered on the lot line.

### 3.3.11 Storage Facilities

*The policy of the county is to:*

- 1. Restrict development to areas outside of the reservoir's high-water line created by the design flood for the emergency spillway.*
- 2. Restrict development to areas outside of the high-water line created by the breach of a dam (excepting existing Class 1 classified dams). If the development proposal is to improve the existing dam to a Class 1 classification, plans must be approved by the reservoir owner and dam safety branch of the Colorado Division of Water Resources. The improvements to the dam must be completed, inspected*

*and approved prior to any building permit within the boundary of the plat. All construction plans required to improve a dam to a class 1, as indicated above, is the responsibility of the developer*

*3. Require developments downstream of a Class 2 dam to have the dam safety branch of the Colorado Division of Water Resources determine if the proposed development is within the high-water line created by the breach of dam. For developments downstream of a Class 3 or Class 4 dam, a breach of dam study may be required to determine the limits of the breach of dam if the dam safety branch of the Colorado Division of Water Resources does not have the information available. The dam safety branch of the Colorado Division of Water Resources must approve the required study.*

*4. Restrict development to areas outside emergency spillway paths, beginning at the dam and proceeding to the point where the flood water returns to the natural drainage course.*

The problem of dam safety and the related hazard of the emergency spillways has been brought to the attention of the public by nationwide dam failures, and is the subject of a National Dam Safety Program by the federal government. Jurisdictional dams are classified by the State Engineer as high, moderate, low or Class 1 to Class 4 structures depending on conditions downstream. Dams are classified as high hazard or Class 1 structures when, in the event of failure, there is a potential loss of life. Dams presently rated as low to moderate or Class 2 to Class 4 hazard structures may be changed to higher hazard rating if development occurs within the potential path of flooding due to a dam breach. In this case, the reservoir owners would be liable for the cost of upgrading the structure to meet the higher hazard classification.

#### 3.3.12 Inadvertent Detention Storage

*The county does not assume any reduction in peak flows for inadvertent stormwater storage created by embankments with undersized culverts when calculating downstream flows, unless such detention is covered by agreement with the county and is designed and constructed in accordance with these CRITERIA.*

*The county does not assume any reduction in peak flows for inadvertent stormwater storage due to privately owned non-flood-control reservoirs. For publicly owned water storage reservoirs, with the approval of the owner, only detention storage above the spillway crest can be used in the calculation of downstream flows.*

#### 3.3.13 Irrigation Facilities

*The policies of the county are as follows:*

- 1. To require development to direct storm runoff into historic and natural drainageways and avoid discharging into irrigation ditches, unless the discharge is approved by the ditch company or equivalent entity.*
- 2. Whenever development will alter patterns of the storm drainage into irrigation ditches by increasing flow rates, volumes or changing points of concentration, the written consent from the ditch company or equivalent entity is required.*
- 3. The discharge of runoff into the irrigation ditch will be approved only if such discharge is consistent with an adopted master drainage plan and is in the best interest of the county.*
- 4. Whenever irrigation ditches cross major drainageways within the developing area, the developer is required to design and construct the appropriate structures to separate storm runoff from ditch flows subject to the condition noted in Policy 3 above.*
- 5. Whenever physical modifications and/or relocation of irrigation ditches are proposed in conjunction with development, written consent from the ditch company or equivalent entity will be submitted. Relocated irrigation ditches will not be placed in public Rights-of-Way except for crossings of public Right-of-Way that are at right angles or as close to right angles as possible.*
- 6. If storm water is carried within an irrigation ditch, a drainage easement will be dedicated to the county and will meet the easement width set forth in Section 3.3.10 of these CRITERIA. An irrigation ditch easement will be dedicated within the development boundary at the discretion of the ditch company or equivalent entity. The irrigation ditch easement agreement will address the relinquishment of any irrigation ditches that will be abandoned within the development boundary.*
- 7. If an irrigation ditch is abandoned or terminated by the ditch company or equivalent entity, said ditch is deemed to be a natural drainageway. Modifications or alterations to the abandoned or terminated ditch are only allowed subject to approval by Jefferson County in accordance to these CRITERIA.*
- 8. To assume that an irrigation ditch does not intercept the storm runoff from the upper basin and that the upper basin is tributary to the basin area downstream of the ditch. The physical aspects of a bermed irrigation ditch structure within a development will be analyzed to*



*determine any drainage impacts of new development.*

There are many irrigation ditches and reservoirs in the county area. The ditches and reservoirs have historically intercepted the storm runoff from the rural and agricultural type basins, generally without major problems. With urbanization of the basins, however, the storm runoff has increased in rate, quantity and frequency, as well as changes in water quality. The irrigation facilities can no longer be utilized indiscriminately as drainage facilities and, therefore, policies have been established to achieve compatibility between urbanization and the irrigation facilities.

In evaluating the interaction of irrigation ditches with a major drainageway for the purpose of basin delineation, the ditch should not be utilized as a basin boundary due to the limiting flow capacity of the ditch. The ditches will generally be flowing full or near full during major storms; therefore, the tributary basin runoff would flow across the ditch.

Irrigation ditches are designed with flat slopes and limited carrying capacity, which decreases in the downstream direction. As a general rule, irrigation ditches cannot be used as an outfall point for the storm drainage system because of these physical limitations. In addition, certain ditches are abandoned after urbanization and could not be successfully utilized for storm drainage.

In certain instances, irrigation ditches have been successfully utilized as outfall points for the initial drainage system, but only after a thorough hydrological and hydraulic analysis. Since the owner's liability from ditch failure increases with the acceptance of storm runoff, the responsibility must be clearly defined before a combined system is approved.

### **3.4 Planning and Design**

#### **3.4.1 Minor and Major Drainage System**

*The county requires that all development include the planning, designing and implementation for both the minor and major drainage systems.*

*The county requires that all minor drainage systems be sized without accounting for peak flow reductions from on-site detention, unless otherwise approved by Planning and Zoning.*

Every urban area has two separate and distinct drainage systems, whether or not they are actually planned or designed. One is the Minor Drainage System and the other is the Major Drainage System, which are combined to form the Total Drainage System.

The Major Drainage System is designed to convey runoff from the 100-year recurrence interval flood to minimize health and life hazards, damage to structures and interruption to traffic and services. Major storm flows can be carried in the urban street system (within acceptable depth criteria), channels, storm sewers and other facilities.

The Minor Drainage System is designed to transport the runoff from five-year frequency events with a minimum disruption to the urban environment. Minor storm drainage can be conveyed in the curb and gutter area of the street or street/roadside ditch (subject to street classification and capacity) by storm sewer, channel or other conveyance facility.

#### **3.4.2 Storm Runoff**

*The county allows storm runoff to be determined by either the Rational method or the Colorado Urban Hydrograph Procedure (CUHP), within the limitations as set forth in these CRITERIA. For basins larger than 160 acres, the peak flows and volumes will be determined by CUHP.*

#### **3.4.3 Streets**

*The county allows the use of streets for drainage within certain limitations as defined in these CRITERIA.*

Streets are an integral part of the urban drainage system and may be used for transporting storm runoff up to design limits. The engineer should recognize that the primary purpose of streets is for traffic, and therefore the use of streets for storm runoff must be restricted.

#### **3.4.4 Floodproofing Existing Structures**

*The county encourages the floodproofing of existing structures not in conformance with the adopted floodplain regulations by utilizing the criteria presented in the "Homeowners Guide to Retrofitting, FEMA".*

Floodproofing can be defined as those measures which reduce the potential for flood damages to existing properties within a floodplain. The floodproofing measures can range from elevating structures to intentional flooding of noncritical building spaces to minimize structural

damages. Floodproofing measures are only a small part of good floodplain management which encourages wise floodplain development to minimize the adverse effects of floods.

## **Chapter 4 - Floodplain Regulations**

As set forth in the Floodplain Overlay District of the ZR and the *LDR*, the regulation of floodplains is necessary to preserve and promote the general health, welfare and economic well-being of the region.

## Chapter 5 - Rainfall

### 5.1 Introduction

Presented in this section are the design rainfall data to be used with the CUHP and the Rational Method. All hydrological analysis within the jurisdiction of these *CRITERIA* will utilize the rainfall data presented herein for calculating storm runoff.

The design storms and time intensity frequency curves for the County were developed using the rainfall data and procedures presented in the *Manual* and are presented herein for convenience.

### 5.2 Jefferson County Rainfall Zones

#### 5.2.1 Description of the Zones

A review of the isopluvial maps presented in the NOAA Atlas 14 for Colorado shows that Jefferson County can be divided into four rainfall zones. Within each zone, the precipitation values for various return periods and duration storms up to 0.4 inch within a small area of the County. These zones are delineated on Figure-501 and are discussed below:

- Zone 1: Covers the area from the east Jefferson County line to the 6000-foot contour at the foothills boundary. The point rainfall values in this zone vary less than 0.4 inch for return periods from 2-year to 100-year and for storm durations from 1 hour to 6 hours.
- Zone IIA: Covers the area from the 6000-foot contour to the 7500-foot contour and generally represents the foothills of the front range. The point rainfall values in this zone decrease from east to west by less than 0.3 inch for the storm durations and return periods noted.
- Zone IIB: Covers the area from the 7500-foot contour to a line defined by the South Platte drainage basin tributary to the town of South Platte. The point rainfall values in this zone decrease from east to west by less than 0.4 inch.
- Zone III: Covers the area tributary to the South Platte River at the town of South Platte and is bounded on the south and west by the County lines. The point rainfall values in this zone vary by less than 0.4 inch.

#### 5.2.2 Selecting the Rainfall Zone

Since some of the drainage basins will include areas from more than one zone, the following criteria will be used to select the design rainfall and intensity date. Basin area refers to the actual basin or sub-basin for which storm runoff information is being calculated and not necessarily the entire watershed area.

- a. If 50 percent or more of the basin area lies in a given zone, the data for that zone will be used.
- b. For those basins within three rainfall zones, the zone data with the largest basin area will be used.

### 5.3 Colorado Urban Hydrograph Procedure Design Storms

For drainage basins less than five square miles, a two-hour storm distribution without area adjustment of the point rainfall values will be used for the CUHP. For drainage basins between five and ten square miles, a two-hour storm distribution is used but the incremental rainfall values are adjusted for the large basin area in accordance with suggested procedures in the NOAA Atlas 14 for Colorado. The adjustment is an attempt to relate the average of all point values for a given duration and frequency within a basin to the average depth over the basin for the same duration and frequency. For drainage basins between ten and twenty square miles, a three-hour storm duration with adjustment for area will be used. The distribution for the last hour was obtained by uniformly distributing the difference between the two and three-hour point rainfall values. The adjustment for area was obtained from the NOAA Atlas for Colorado. The incremental rainfall distributions for all basin areas up to 20 square miles are presented in Table 502A through Table 502D.

### 5.4 Time-Intensity-Frequency Curves

The Time-Intensity-Frequency curves for each zone were developed by distributing the one-hour point rainfall values (Table 501) using the factors obtained from the NOAA Atlas 14 presented below:

Factors for Durations of Less Than One Hour

Duration (minutes)	5	10	15	30
Ratio to one-hour depth	0.29	0.45	0.57	0.79

Source: NOAA Atlas 2, Volume III, Colorado 1973

The point values were then converted to intensities and plotted on Figure 502. The data are also presented in Table 503.

Table 501  
Design Point Rainfall Values

One-Hour Point Rainfall (In.)					
County Zone	2-Year	5-Year	10-Year	50-Year	100-Year
Jefferson I	1.02	1.42	1.68	2.32	2.66
Jefferson IIA	0.95	1.33	1.57	2.17	2.48
Jefferson IIB	0.85	1.19	1.39	1.93	2.20
Jefferson III	0.73	1.06	1.26	1.79	2.06

Table 502A  
CUHP Design Storm for Zone I - Incremental Rainfall Depth/Return Period

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
10	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08
15	0.09	0.12	0.14	0.12	0.12	0.09	0.12	0.14	0.12	0.12	0.09	0.12	0.14	0.12	0.12
20	0.16	0.22	0.25	0.19	0.21	0.16	0.21	0.24	0.19	0.21	0.15	0.20	0.23	0.19	0.21
25	0.26	0.36	0.42	0.35	0.37	0.24	0.35	0.40	0.34	0.36	0.23	0.32	0.38	0.32	0.33
30	0.14	0.18	0.20	0.58	0.67	0.14	0.17	0.19	0.56	0.64	0.13	0.16	0.18	0.52	0.60
35	0.06	0.08	0.09	0.28	0.37	0.06	0.08	0.09	0.24	0.36	0.06	0.08	0.09	0.25	0.33
40	0.05	0.06	0.07	0.19	0.21	0.05	0.06	0.07	0.19	0.21	0.05	0.06	0.07	0.19	0.21
45	0.03	0.05	0.06	0.12	0.16	0.03	0.05	0.06	0.12	0.16	0.03	0.05	0.06	0.12	0.16
50	0.03	0.05	0.05	0.12	0.13	0.03	0.05	0.05	0.12	0.13	0.03	0.05	0.05	0.12	0.13
55	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11
60	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11
65	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11	0.03	0.04	0.05	0.07	0.11
70	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05
75	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05
80	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03
85	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.02	0.02	0.03	0.03
130											0.01	0.02	0.02	0.03	0.03
135											0.01	0.02	0.02	0.03	0.03
140											0.01	0.02	0.02	0.02	0.03
145											0.01	0.01	0.02	0.02	0.03
150											0.01	0.01	0.01	0.02	0.02
155											0.01	0.01	0.01	0.02	0.02
160											0.01	0.01	0.01	0.02	0.02
165											0.01	0.01	0.01	0.01	0.02
170											0.01	0.01	0.01	0.01	0.01
175											0.01	0.01	0.01	0.01	0.01
180											0.01	0.01	0.01	0.01	0.01
Total	1.17	1.61	1.89	2.68	3.05	1.15	1.58	1.85	2.61	3.00	1.25	1.69	1.98	2.79	3.16

\* Time in minutes

\*\* Rainfall in inches

Table 502B

**CUHP Design Storm for Zone IIA - Incremental Rainfall Depth/Return Period**

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02
10	0.04	0.05	0.06	0.08	0.07	0.04	0.05	0.06	0.08	0.07	0.04	0.05	0.06	0.08	0.07
15	0.08	0.12	0.13	0.11	0.11	0.08	0.12	0.13	0.11	0.11	0.08	0.12	0.13	0.11	0.11
20	0.15	0.20	0.24	0.17	0.20	0.14	0.20	0.23	0.17	0.20	0.14	0.18	0.21	0.17	0.20
25	0.24	0.33	0.39	0.33	0.35	0.23	0.32	0.38	0.31	0.33	0.22	0.30	0.35	0.29	0.32
30	0.13	0.17	0.19	0.54	0.62	0.12	0.17	0.18	0.52	0.60	0.12	0.15	0.17	0.49	0.56
35	0.06	0.08	0.09	0.26	0.35	0.06	0.08	0.09	0.25	0.33	0.06	0.08	0.09	0.23	0.31
40	0.05	0.06	0.07	0.17	0.20	0.05	0.06	0.07	0.17	0.20	0.05	0.06	0.07	0.17	0.20
45	0.03	0.05	0.06	0.11	0.15	0.03	0.05	0.06	0.11	0.15	0.03	0.05	0.06	0.11	0.15
50	0.03	0.05	0.05	0.11	0.12	0.03	0.05	0.05	0.11	0.12	0.03	0.05	0.05	0.11	0.12
55	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10
60	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10
65	0.03	0.04	0.05	0.07	0.10	0.03	0.04	0.05	0.07	0.10	0.02	0.04	0.05	0.07	0.10
70	0.02	0.04	0.05	0.05	0.05	0.02	0.04	0.05	0.05	0.05	0.02	0.04	0.05	0.05	0.05
75	0.02	0.03	0.05	0.05	0.05	0.02	0.03	0.05	0.05	0.05	0.02	0.03	0.05	0.05	0.05
80	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03
85	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.02	0.02	0.02	0.02
130											0.01	0.01	0.02	0.02	0.02
135											0.01	0.01	0.01	0.02	0.02
140											0.01	0.01	0.01	0.02	0.02
145											0.01	0.01	0.01	0.02	0.02
150											0.01	0.01	0.01	0.02	0.02
155											0.01	0.01	0.01	0.01	0.02
160											0.01	0.01	0.01	0.01	0.02
165											0.00	0.01	0.01	0.01	0.01
170											0.00	0.01	0.01	0.01	0.01
175											0.00	0.00	0.01	0.01	0.01
180											0.00	0.01	0.00	0.01	0.01
Total	1.12	1.55	1.83	2.516	2.86	1.09	1.54	1.80	2.46	2.80	1.15	1.59	1.87	2.57	2.93

\* Time in minutes

\*\* Rainfall in inches

Table 502C

**CUHP Design Storm for Zone IIB - Incremental Rainfall Depth/Return Period**

Time*	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
10	0.03	0.04	0.05	0.07	0.07	0.03	0.04	0.05	0.08	0.07	0.03	0.04	0.05	0.07	0.07
15	0.07	0.10	0.11	0.10	0.10	0.07	0.10	0.11	0.12	0.10	0.07	0.10	0.11	0.10	0.10
20	0.14	0.18	0.21	0.15	0.18	0.13	0.17	0.20	0.19	0.18	0.12	0.16	0.19	0.15	0.18
25	0.21	0.30	0.35	0.28	0.31	0.20	0.29	0.33	0.34	0.30	0.19	0.27	0.31	0.26	0.28
30	0.12	0.15	0.17	0.46	0.55	0.11	0.15	0.16	0.56	0.53	0.11	0.14	0.15	0.43	0.50
35	0.05	0.07	0.08	0.22	0.31	0.05	0.07	0.08	0.24	0.30	0.05	0.07	0.08	0.21	0.28
40	0.04	0.05	0.06	0.15	0.18	0.04	0.05	0.06	0.19	0.18	0.04	0.05	0.06	0.15	0.18
45	0.03	0.04	0.05	0.10	0.14	0.03	0.04	0.05	0.12	0.14	0.03	0.04	0.05	0.10	0.14
50	0.03	0.04	0.04	0.10	0.11	0.03	0.04	0.04	0.12	0.11	0.03	0.04	0.04	0.10	0.11
55	0.03	0.04	0.04	0.06	0.09	0.03	0.04	0.04	0.07	0.09	0.03	0.04	0.04	0.06	0.09
60	0.03	0.04	0.04	0.06	0.09	0.03	0.04	0.04	0.07	0.09	0.03	0.04	0.04	0.06	0.09

65	0.03	0.04	0.04	0.06	0.09	0.03	0.04	0.04	0.07	0.09	0.03	0.04	0.04	0.06	0.09
70	0.02	0.04	0.04	0.05	0.04	0.02	0.04	0.04	0.06	0.04	0.02	0.04	0.04	0.05	0.04
75	0.02	0.03	0.04	0.05	0.04	0.02	0.03	0.04	0.06	0.04	0.02	0.03	0.04	0.05	0.04
80	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.03	0.03
85	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.03	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.01	0.02	0.02	0.02
130											0.01	0.01	0.02	0.02	0.02
135											0.01	0.01	0.02	0.02	0.02
140											0.01	0.01	0.01	0.02	0.02
145											0.01	0.01	0.01	0.01	0.02
150											0.01	0.01	0.01	0.01	0.01
155											0.01	0.01	0.01	0.01	0.01
160											0.00	0.01	0.01	0.01	0.01
165											0.00	0.01	0.01	0.01	0.01
170											0.00	0.00	0.01	0.01	0.01
175											0.00	0.00	0.01	0.01	0.01
180											0.00	0.00	0.01	0.01	0.01
Total	1.03	1.40	1.60	2.21	2.60	1.00	1.38	1.56	2.61	2.56	1.05	1.43	1.67	2.31	2.66

\* Time in minutes

\*\* Rainfall in inches

Table 502D

**CUHP Design Storm for Zone III - Incremental Rainfall Depth/Return Period**

	Basins Less Than 5 Sq. Miles					Basins Between 5 and 10 Sq. Miles					Basins Between 10 and 20 Sq. Miles				
Time*	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**	2-Yr**	5-Yr**	10-Yr**	50-Yr**	100-Yr**
5	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.02	0.02
10	0.03	0.04	0.05	0.06	0.06	0.03	0.04	0.05	0.06	0.06	0.03	0.04	0.05	0.06	0.06
15	0.06	0.09	0.10	0.19	0.09	0.06	0.09	0.10	0.09	0.09	0.06	0.09	0.10	0.09	0.09
20	0.12	0.16	0.19	0.14	0.16	0.11	0.16	0.18	0.14	0.16	0.11	0.14	0.17	0.14	0.16
25	0.18	0.27	0.32	0.27	0.29	0.18	0.26	0.31	0.26	0.28	0.16	0.24	0.29	0.24	0.26
30	0.10	0.14	0.15	0.45	0.52	0.10	0.13	0.14	0.43	0.50	0.09	0.13	0.14	0.41	0.47
35	0.05	0.06	0.07	0.21	0.29	0.05	0.06	0.07	0.20	0.28	0.05	0.06	0.07	0.19	0.26
40	0.04	0.05	0.05	0.14	0.16	0.04	0.05	0.05	0.14	0.16	0.04	0.05	0.05	0.14	0.16
45	0.02	0.04	0.05	0.09	0.13	0.02	0.04	0.05	0.09	0.13	0.02	0.04	0.05	0.09	0.13
50	0.02	0.04	0.04	0.09	0.10	0.02	0.04	0.04	0.09	0.10	0.02	0.04	0.04	0.09	0.10
55	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08
60	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08
65	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08	0.02	0.03	0.04	0.06	0.08
70	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04
75	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04	0.01	0.03	0.04	0.04	0.04
80	0.01	0.02	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.02
85	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
90	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
95	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
100	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
105	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
110	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
115	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.02	0.03	0.02
120	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.02	0.03	0.02
125											0.01	0.01	0.01	0.01	0.02
130											0.01	0.01	0.01	0.01	0.01
135											0.01	0.01	0.01	0.01	0.01
140											0.01	0.01	0.01	0.01	0.01
145											0.01	0.01	0.01	0.01	0.01
150											0.01	0.01	0.01	0.01	0.01

155											0.01	0.01	0.01	0.01	0.01
160											0.01	0.01	0.01	0.01	0.01
165											0.01	0.01	0.01	0.01	0.01
170											0.00	0.00	0.01	0.01	0.01
175											0.00	0.00	0.00	0.01	0.01
180											0.00	0.00	0.00	0.00	0.01
Total	0.80	1.23	1.44	2.09	2.32	0.79	1.21	1.41	2.05	2.28	0.85	1.26	1.48	2.11	2.34

\* Time in minutes

\*\* Rainfall in inches

Table 503  
Time-Intensity-Frequency Tabulation

Duration		5 Min		10 Min		15 Min		30 Min		60 Min	
Duration Factors		0.29		0.45		0.57		0.79		1.00	
County Zone	Frequency	Depth**	Intensity*	Depth**	Intensity*	Depth**	Intensity*	Depth**	Intensity*	Depth**	Intensity*
Jefferson I	2-Yr	0.30	3.55	0.46	2.75	0.58	2.33	0.81	1.61	1.02	1.02
	5-Yr	0.41	4.94	0.64	3.83	0.81	3.24	1.12	2.24	1.42	1.42
	10-Yr	0.49	5.85	0.76	4.54	0.96	3.83	1.33	2.65	1.68	1.68
	50-Yr	0.67	8.07	1.04	6.26	1.32	5.29	1.83	3.67	2.32	2.32
	100-Yr	0.77	9.26	1.20	7.18	1.52	6.06	2.10	4.20	2.66	2.66
Jefferson IIA	2-Yr	0.28	3.31	0.43	2.57	0.54	2.17	0.75	1.50	0.95	0.95
	5-Yr	0.39	4.63	0.60	3.59	0.76	3.03	1.05	2.10	1.33	1.33
	10-Yr	0.46	5.46	0.71	4.24	0.89	3.58	1.24	2.48	1.57	1.57
	50-Yr	0.63	7.55	0.98	5.86	1.24	4.95	1.71	3.43	2.17	2.17
	100-Yr	0.72	8.63	1.12	6.70	1.41	5.65	1.96	3.92	2.48	2.48
Jefferson IIB	2-Yr	0.25	2.96	0.38	2.30	0.48	1.94	0.67	1.34	0.85	0.85
	5-Yr	0.35	4.14	0.54	3.21	0.68	2.71	0.94	1.88	1.19	1.19
	10-Yr	0.40	4.84	0.63	3.75	0.79	3.17	1.10	2.20	1.39	1.39
	50-Yr	0.56	6.72	0.87	5.21	1.10	4.40	1.52	3.05	1.93	1.93
	100-Yr	0.64	7.66	0.99	5.94	1.25	5.02	1.74	3.48	2.20	2.20
Jefferson III	2-Yr	0.21	2.54	0.33	1.97	0.42	1.66	0.58	1.15	0.73	0.73
	5-Yr	0.31	3.69	0.48	2.86	0.60	2.42	0.84	1.67	1.06	1.06
	10-Yr	0.37	4.38	0.57	3.40	0.72	2.87	1.00	1.99	1.26	1.26
	50-Yr	0.52	6.23	0.81	4.83	1.02	4.08	1.41	2.83	1.79	1.79
	100-Yr	0.60	7.17	0.93	5.56	1.17	4.70	1.63	3.25	2.06	2.06

\* Depth in inches

\*\* Intensity/hour





Figure 501  
**Rainfall Zones in  
Jefferson County**  
Rainfall Zone III extends to the southern  
boundary of Jefferson County.

## Time-Intensity Frequency Curves

Figure 502A  
**Zone I**

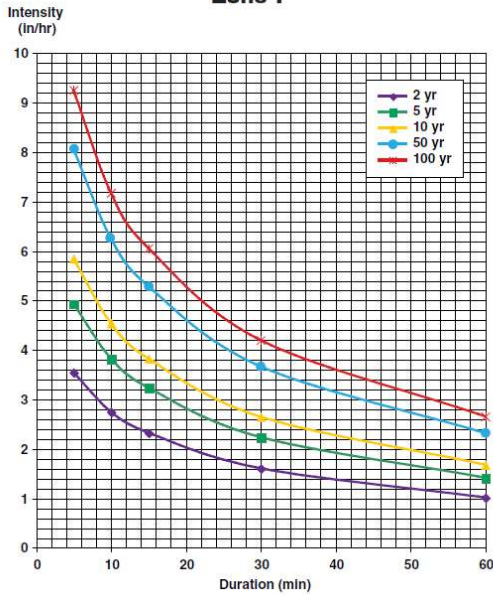


Figure 502B  
**Zone IIA**

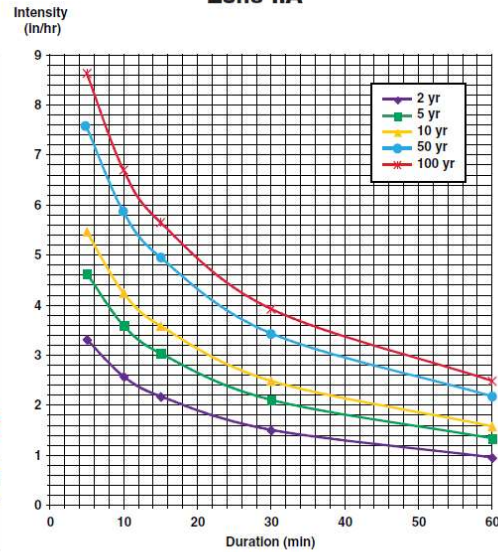


Figure 502C  
**Zone IIB**

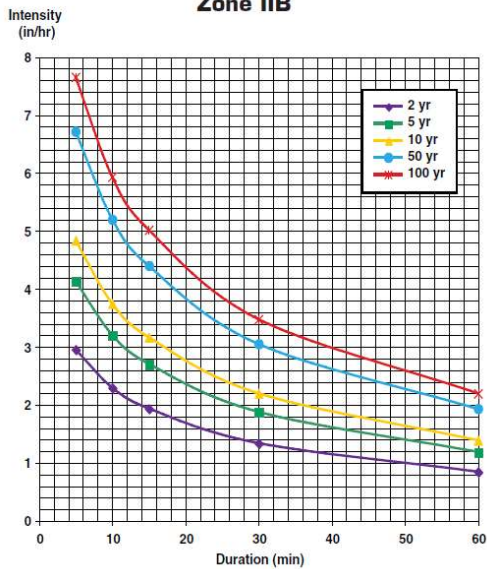
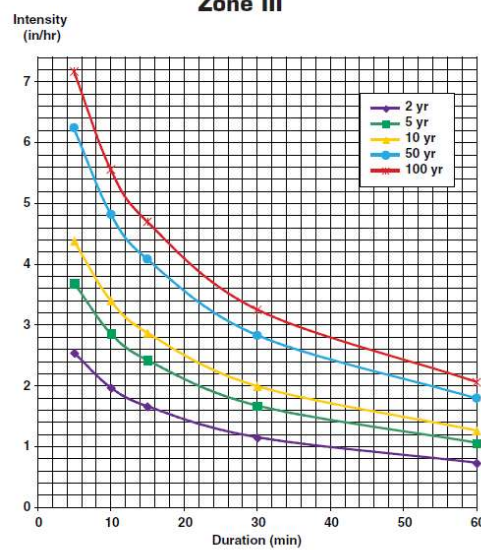


Figure 502D  
**Zone III**



## Chapter 6 - Runoff

### 6.1 Introduction

This chapter presents the criteria and methodology for determining the storm runoff design peaks and volumes to be used in the County in the preparation of storm drainage studies, plans and facility design. The details of the rainfall/runoff models are presented in the *Manual*. The specific input data requirements and modifications to the procedures are presented in this chapter.

### 6.2 Rational Method

The Rational Method, in widespread use in the Denver Region, will continue to be utilized for the sizing of storm sewers and for determining runoff magnitude from unsewered areas. The limit of application of the Rational Method is approximately 160 acres. It has been concluded that, for tributary basins in excess of 160 acres, the cost of the drainage works justifies significantly more study, thought and judgment on the part of the engineer than is permitted by the Rational Method. When the urban drainage basin exceeds 160 acres, the CUHP method represents better practice and must be used.

The procedures for the Rational Method, as explained in the *Manual*, Volume1, "Runoff", must be followed in the preparation of drainage reports and storm drainage facility designs in the County.

Standard forms and spreadsheets are available in the *MHFD Manual*. The most current versions of these software programs may be obtained through the District's web site ([www.udfd.org](http://www.udfd.org)).

### 6.3 Colorado Urban Hydrograph Procedure

CUHP was originally developed for the Denver area at the time the *Manual* was prepared. The method may be used for basins as small as five acres. However, CUHP is required for watershed areas larger than 160 acres. The procedures for CUHP, as explained in the *Manual* will be followed in the preparation of drainage reports and storm drainage facility designs in the County. The design storms to be used with the CUHP method are presented in Tables 502A-D.

### 6.4 Storm Flow Analysis

When determining the design storm flows, the engineer should follow criteria and guidelines to assure that minimum design standards and uniformity of drainage solutions are maintained throughout the County. The information presented herein will be used by the engineer in the development of design storm runoff.

#### 6.4.1 Onsite Flow Analysis

When analyzing the flood peaks and volumes, the engineer should use the proposed fully developed land use plan to determine runoff coefficients. In addition, the engineer should take into consideration the changes in flow patterns (from the undeveloped site conditions) caused by the proposed street alignments. When evaluating surface flow times, the proposed lot grading will be used to calculate the time of concentration or the CUHP parameters.

#### 6.4.2 Offsite Flow Analysis

The analysis of offsite runoff is dependent on the development status and whether the tributary offsite area lies within a major drainageway basin as defined in Section 3.2.3. In all cases, the minor system is designed for the fully developed minor storm runoff (Section 3.4.1) without the benefits of onsite detention. In some cases, credit is given for detention for the design of the major system (Section 3.3.12).

##### 6.4.2.1 Tributary Area Within a Major Drainageway Basin

(a) Where the offsite area is undeveloped, the runoff will be calculated assuming the basin is fully developed as defined by Planning and Zoning. If this information is not available, then the runoff will be calculated using the coefficients defined in the runoff chapter of the *Manual*. The most current versions of these software programs may be obtained through the District's web site ([www.udfd.org](http://www.udfd.org)).

(b) Where the offsite area is fully or partially developed, the storm runoff will be based upon the existing platted land uses and topographic features. No credit will be given for onsite detention in the offsite area for any design frequency.

##### 6.4.2.2 Tributary Area Not Within a Major Drainageway Basin

(a) Where the offsite area is undeveloped, the minor system runoff will be calculated assuming the basin is fully developed as defined by Planning and Zoning. If this information is not available, then the runoff will be calculated using the coefficients defined in the runoff chapter of the *Manual*. The most current versions of these software programs may be obtained through the District's web site ([www.ud-fcd.org](http://www.ud-fcd.org)). The major system runoff (i.e., 10-year and 100-year) may be calculated assuming the historic runoff rates computed in accordance with procedures described in Chapter 14 of these *CRITERIA*.

(b) Where the offsite area is fully or partially developed, the storm runoff will be based on the existing platted land uses and topographic features, unless onsite detention in the offsite area has been constructed and accepted by the County. However, no credit will be given for onsite detention in the offsite area for the minor system design, unless otherwise approved by Planning and Zoning.

## Chapter 7 - Open Channels

### 7.1 Introduction

This chapter addresses the technical criteria for the hydraulic evaluation and hydraulic design of open channels in the County. The information presented herein is considered to be a minimum standard. In many instances, special design or evaluation techniques will be required. Except as modified herein, all open channel criteria will be in accordance with the *Manual and Open Channel Hydraulics*, Chow, Ven T., McGraw-Hill, Inc., New York, New York, 1959

### 7.2 Channel Types

The channels in the County area are defined as natural or artificial. Natural channels include all water courses that have occurred naturally by the erosion process such as Clear Creek, Bear Creek, South Platte River, Ralston Creek, Dutch Creek, Van Bibber Creek, Big Dry Creek and Lena Gulch. Artificial channels are those constructed or developed by human effort.

#### 7.2.1 Natural Channels

The hydraulic properties of natural channels vary along the channel reach and can be either controlled to the extent desired or altered to meet given requirements. The initial decision to be made regarding natural channels is whether or not the channel is to be protected from erosion due to high velocity flows or protected from excessive silt deposition due to low velocities.

Many natural channels in urbanized and to-be-urbanized areas have mild slopes, are reasonably stable and are not in a state of serious degradation or aggradation. However, if a natural channel is to be used for carrying storm runoff from an urbanized area, the altered nature of the runoff peaks and volumes from urban development will cause erosion. Detailed hydraulic analysis will be required for natural channels in order to identify the erosion tendencies. Some onsite modifications of the natural channel, such as grade control structures, may be required to assure a stabilized condition.

The investigations necessary to assure that the natural channels will be adequate are different for every waterway. The engineer must prepare cross sections of the channel, define the water surface profile for the minor and major design flood, investigate the bed and bank material to determine erosion tendencies and study the bank slope stability of the channel under future conditions of flow. Supercritical flow does not normally occur in natural channels, but calculations must be made to assure that the results do not reflect supercritical flow.

#### 7.2.2 Grass Lined Channels

Grass lined channels are the most desirable of the artificial channels. The grass will stabilize the body of the channel, consolidate the soil mass of the bed, check the erosion on the channel surface and control the movement of soil particles along the channel bottom. The channel storage, the lower velocities and the greenbelt multiple-use benefits obtained create significant advantages over other artificial channels.

The presence of grass in channels creates turbulence which results in loss of energy and increased flow retardance. Therefore, the designer must give full consideration to sediment deposition and to scour, as well as hydraulics. Unless existing development within the County restricts the availability of ROW, only channels lined with grass will be considered acceptable for major drainageways.

For the purposes of these *CRITERIA*, sandy soils are defined as non-cohesive sands classified as SW, SP or SM in accordance with the Unified Soil Classification System.

#### 7.2.3 Composite Channels

Composite channels are a type of grass-lined channel with a distinct low-flow channel that is vegetated with a mixture of wetland and riparian species. Design of composite channels will be in accordance with the *Manual*.

#### 7.2.4 Bioengineered Channels

Bioengineered channels are a type of grass-lined channel that utilize vegetative components and other natural materials in combination with structural measures to construct natural-like channels that are stable and resistant to erosion. Design of bioengineered channels will be in accordance with the *Manual*.

#### 7.2.5. Concrete Lined Channels

Concrete lined channels for major drainageways will be permitted only where ROW restrictions within existing development prohibit grass

lined channels or any other channel lining type. The lining must be designed to withstand the various forces and actions which tend to overtop the bank, deteriorate the lining, erode the soil beneath the lining and erode unlined areas, especially for the supercritical flow conditions.

If the project constraints suggest the use of a concrete channel for a major drainageway, the applicant will present the concept with justification to Planning and Zoning for consideration of a waiver from these *CRITERIA*.

A Design Report is required for approval of a concrete lined channel. The contents of such report will be determined by Planning and Zoning. On the as-built drawings, the engineer will be required to certify that the concrete used in the lining was tested and meets the accepted specifications.

#### 7.2.6. Rock Lined Channels

Riprap lined channels are generally discouraged and will be permitted only in areas of existing development where ROW for major drainageways is limited and such limitation prohibits the use of grass lined channels. The advantage of rock lining a channel is that a steeper channel grade and steeper side slopes can be used. Rock linings (i.e., revetments) are permitted as a means of controlling erosion for natural channels. The disadvantages are the large initial cost of construction and the high maintenance costs due to vandalism.

If the project constraints suggest the use of riprap lining for a major drainageway, then the engineer must present the concept, with justification, to Planning and Zoning for consideration of a waiver from these *CRITERIA*. The design of rock-lined channels will be in accordance with the *Manual*.

### 7.3 Flow Computation

Uniform flow and critical flow computations will be in accordance with the *Manual*.

### 7.4 Design Standards for Major Drainageways

These standards cover the design of major drainageways as defined by the policy of Section 3.2.3. The design standards for open channels cannot be presented in a step-by-step fashion because of the wide range of design options available to the design engineer. Certain planning and conceptual design criteria are particularly useful in the preliminary design of a channel. These *CRITERIA*, which have the greatest effect on the performance and cost of the channel, are discussed below.

#### 7.4.1 Natural Channels

The design criteria and evaluation techniques for natural channels are:

1. The channel and overbank areas will have adequate capacity for the 100-year storm runoff.
2. Natural channel segments shall be designed to have a calculated Froude number of 0.6 for non-cohesive soils or those with poor vegetation and a maximum of 0.8 for vegetated cohesive soils for the 100-year flood peak.
3. The water surface profiles will be defined so that the floodplain can be zoned and protected.
4. Filling of the Floodplain Overlay District reduces valuable channel storage capacity and tends to increase downstream runoff peaks.
5. Roughness factors ( $n$ ), which are representative of unmaintained channel conditions, will be used for the analysis of water surface profiles.
6. Roughness factors ( $n$ ), which are representative of maintained channel conditions, will be used to determine velocity limitations.
7. Structures may be required to control erosion for both the major and the minor storm runoff and should appear as natural features by imitating surrounding vegetation and natural materials. Where possible, locate structures at principal grade changes to minimize cost of retaining structures, reduce perceived scale and appearance of mass and bulk and use existing land forms of the site. All check drops, dams or structures should, whenever feasible, use natural materials to integrate with natural landscape characteristics.
8. Plan and profile drawings of the floodplain will be prepared. Appropriate allowances for known future bridges or culverts, which can raise the water surface profile and cause the floodplain to be extended, will be included in the analysis. The applicant will contact Planning and Zoning for information on future bridges and culverts.

9. Preserve, maintain or enhance natural waterway channel boundaries and alignment in their natural condition as landscape and visual amenities, focal points for development projects and to help define "edges" in and around communities. Preserve vegetation groups, rock outcroppings, terrain form, soil, waterways and bodies of water.

With most natural waterways, erosion control structures should be constructed at regular intervals to decrease the thalweg slope and to control erosion. However, these channels should be left in as near a natural condition as possible. For that reason, extensive modifications should not be undertaken unless they are found to be necessary to avoid excessive erosion with subsequent deposition downstream.

The usual rules of freeboard depth, curvature and other rules which are applicable to artificial channels, do not apply for natural channels. All structures constructed along the channel will be elevated a minimum of one foot above the 100-year water surface. There are significant advantages which may occur if the designer incorporates into his planning the overtopping of the channel and localized flooding of adjacent areas which are laid out and developed for the purpose of being inundated during the major runoff peak.

If a natural channel is to be utilized as a major drainageway for a development, then the applicant will meet with Planning and Zoning to discuss the concept and to obtain the requirements for planning and design documentation. Approval of the concept and design will be made in accordance with the requirements of Chapter 2 of these *CRITERIA*.

#### 7.4.2 Grass Lined Channels

Key parameters in grass lined channel design include velocity, slopes, roughness coefficients, depth, freeboard, curvature, cross section shape and lining materials. Other factors such as water surface profile computation, erosion control, drop structures and transitions also play an important role. A discussion of these parameters is presented below.

##### 1. Flow Velocity

The maximum normal depth velocity for the 100-year flood peak will not exceed 5.0 feet per second for grass lined channels. The Froude number (turbulence factor) will be less than 0.8 for grass lined channels. Grass lined channels having a Froude number greater than 0.8 are not permitted. The minimum velocity, wherever possible, will be greater than 2.0 feet per second for the minor storm runoff.

##### 2. Longitudinal Channel Slopes

Grass lined channel slopes are dictated by velocity and Froude number requirements. Where the natural topography is steeper than desirable, drop structures will be utilized to maintain design velocities and Froude numbers.

##### 3. Freeboard

Except where localized overflow in certain areas is desirable for additional ponding benefits or other reasons, the freeboard for the 100-year flow will be as follows:

---

$$\text{HFB} = 0.5 + \frac{V^2}{2g}$$

where

HFB = freeboard height (feet)

V = average channel velocity (fps)

g = acceleration of gravity = 32.2 ft/sec<sup>2</sup>

The minimum freeboard will be 1.0 foot.

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##### 4. Curvature (Horizontal)

The center line curvature will have a radius twice the top width of the design flow but not less than 100 feet.

## 5. Roughness Coefficient

The variation of Manning's "n" with the retardance and the product of mean velocity and hydraulic radius, as presented in Figure 701, will be used in the capacity computation.

Retardance curve C will be used to determine the channel capacity, since a mature channel (i.e., substantial vegetation with minimal pervious maintenance) will have a higher Manning's "n" value. However, a recently constructed channel will have minimal vegetation and the retardance will be less than the mature channel. Therefore, retardance curve D will be used to determine the limiting velocity in a channel.

## 6. Cross Sections

The channel shape may be almost any type suitable to the location and to the environmental conditions. Often the shape can be chosen to suit open space and recreational needs. The limitations within which the design must fall for the major storm design flow include:

### a. Trickle Channel

The base flow will be carried in a trickle channel except for sandy soils (see Section 7.2.2). The minimum capacity will be 1.0 percent to 3.0 percent of the 100-year flow but not less than 1 cfs. Trickle channels will be constructed of concrete or other approved materials to minimize erosion, to facilitate maintenance and to aesthetically blend with the adjacent vegetation and soils. Recommended trickle channel sections are presented on Figure 703. The minimum trickle channel width will be four feet.

An alternative trickle channel treatment is of greater capacity with natural bottom and appropriate riparian vegetation types and mix along edges to reduce erosion and create wetland area. Channel alignment should vary in character with a meandering quality. Drop structures should be included where necessary and appear as natural features.

### b. Main Channel

A main channel is required for sandy soils. The side slopes must be 4:1 or flatter. The depth of the main channel is not included in the normal depth limitation. A main channel can also be used for non-sandy soils.

### c. Bottom Width

The minimum bottom width will be consistent with the maximum depth and velocity criteria. The minimum bottom width will be four feet or the trickle channel width when trickle channel is required.

### d. Easement/ROW Width

The minimum easement/ROW width will include freeboard and a 12-foot wide maintenance access road.

### e. Flow Depth

The maximum design depth of flow (outside the trickle channel area and main channel area for sandy soils) for the 100-year flood peak will be limited to 5.0 feet in grass lined channels.

### f. Maintenance Access Road

A maintenance access road will be provided along the entire length of all major drainageways with a minimum width of 12 feet. The County may require the road to be surfaced with six inches of Class 2 road base or concrete slab.

### g. Side Slopes

Main channel side slopes will be 4 (horizontal) to 1 (vertical) or flatter.

## 7. Vegetation

The grass lining for channels will be in accordance with the *Manual*.

Vegetation and landform variations are encouraged to enhance the aesthetic quality within channels as long as the functional factors mentioned below are not compromised. It is recognized that channel capacity will be increased to accommodate an increase in plant



material types and densities and variation of landform. Overstory canopy trees are allowed outside of high hazard areas.

If extensive modification or disruption is necessary, rehabilitate channel corridor to conform to or improve upon predevelopment conditions. The stream form and vegetative character should appear as it would occur under long-term natural processes. Alternative techniques that can be used to achieve these include: varying the slope and edge of channel; the use of river rock for riprap; replanting appropriately sized riparian vegetation; and introducing meandering character on flat areas and pools and rocks in steeper areas. A concentration of plant materials should be included where drainages intersect arterial streets, when feasible, to maintain and enhance visual access from roadways.

The distance on each side of any flowing or intermittent stream channel should be large enough to ensure its use as an active and passive recreational and visual amenity.

#### 8. Erosion Control

The requirements for erosion control for grass lined channels will be as defined in the *Manual*. The design of conduit outlet structures will be in accordance with the *Manual*.

#### 9. Water Surface Profiles

Computation of the water surface profile will be presented for all open channels utilizing standard backwater methods, taking into consideration losses due to changes in velocity of channel cross section, drops, waterway openings or obstructions. The energy gradient will be shown on all drawings.

### 7.5 Design Standards for Small Drainageways

These standards cover the design of channels that are not classified as a major drainageway in accordance with the policy of Section 3.2.3. Additional flexibility and less stringent standards are allowed for small drainageways.

#### 7.5.1 Natural Channels

The design criteria and evaluation techniques for natural channels are:

1. The channel and overbank areas will have adequate capacity for the 100-year storm runoff.
2. Natural channel segments shall be designed to have a calculated Froude number of 0.6 for non-cohesive soils or those with poor vegetation and a maximum of 0.8 for vegetated cohesive soils for the 100-year flood peak.
3. Roughness factors ( $n$ ), which are representative of unmaintained channel conditions, will be used for the analysis of water surface profiles.
4. Roughness factors ( $n$ ), which are representative of maintained channel conditions, will be used to determine velocity limitations.
5. Erosion control structures, such as check drops or check dams, may be required to control flow velocities, including the minor storm runoff.
6. Plan and profile drawings will be prepared showing the 100-year water surface profile, floodplain and details of erosion protection, if required.

#### 7.5.2 Grass Lined Channels

Key parameters in grass lined channel design include velocity, slopes, roughness coefficients, depth, freeboard, curvature, cross section shape and lining materials. Other factors such as water surface profile computation, erosion control, drop structures and transitions also play an important role. A discussion of these parameters is presented below.

##### 1. Flow Velocity

The maximum normal depth velocity for the 100-year flood peak will not exceed 7.0 feet per second for grass lined channels (see Section 7.2.2). The Froude number (turbulence factor) will be less than 0.8 for grass lined channels. Grass lined channels having a Froude number greater than 0.8 are not permitted. The minimum velocity, wherever possible, will be greater than 2.0 feet per second for the minor storm runoff.

## 2. Longitudinal Channel Slopes

Grass lined channel slopes are dictated by velocity and Froude number requirements. Where the natural topography is steeper than desirable, drop structures will be utilized to maintain design velocities and Froude numbers.

## 3. Freeboard

A minimum freeboard of 1 foot will be included in the design for the 100-year flow. For swales (i.e., small drainageways with a 100-year flow less than 20 cfs), the minimum freeboard requirements are 6 inches.

## 4. Curvature (Horizontal)

The centerline curvature will have a minimum radius twice the top width of the design flow but not less than 50 feet. The minimum radius for channels with a 100-year runoff of 20 cfs or less will be 25 feet.

## 5. Roughness Coefficient

The variation of Manning's "n" with the retardance (curve "C") and the product of mean velocity and hydraulic radius, as presented in Figure 701, will be used in the computation of capacity and velocity.

## 6. Cross Sections

The channel shape may be almost any type suitable to the location and to the environmental conditions. The section may also be simple V-Section for swales (i.e., Q100 less than 20 cfs). The limitations on the cross section are as follows:

### a. Trickle Channel

The base flow (except for swales) will be carried in a trickle channel for non-sandy soils. The minimum capacity will be from 1.0 percent to 3.0 percent of the 100-year flow but not less than 1 cfs. The trickle channel can be constructed of concrete, rock, cobbles or other suitable materials. For sandy soils, a main channel is required in accordance with Section 7.4.2.6(b). Factors to be considered when establishing the need for trickle channels are: drainage slope, soil type and upstream impervious area. For 100-year runoff peaks of 20 cfs or less, trickle channel requirements will be evaluated for each case. Trickle channels help preserve swales crossing residential property.

### b. Easement/ROW Width

The minimum easement/ROW width will include freeboard and should include a maintenance access.

### c. Flow Depth

The maximum design depth of flow (outside the trickle channel area and main channel area for sandy soils) for the 100-year flood peak will be limited to 5 feet in grass lined channels.

### d. Side Slopes

Main channel side slopes will be 4 (horizontal) to 1 (vertical) or flatter. Side slopes for channels with 100-year runoff peaks of 20 cfs or less will be 3 (horizontal) to 1 (vertical) or flatter.

## 7. Grass Lining

The grass lining for channels will be in accordance with the *Manual*.

## 8. Erosion Control

The requirements for erosion control for grass lined channels will be as defined in the *Manual*. The design of conduit outlet structures will be in accordance with the *Manual*.

## 9. Hydraulic Information

Calculations of the capacity, velocity and Froude numbers will be submitted with the construction drawings.

## 10. Design Example

Grass-lined channel for a watershed area under 130 acres in area.

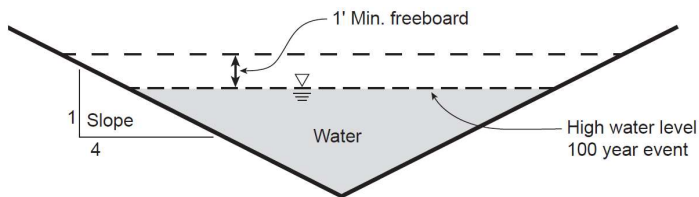
100-year flow = 30 cfs

Slope = 2%

Side Slopes = 4:1

Find the minimum easement width and the required open channel cross-section.

Channel Cross Section



Step 1: (Determine Manning's n for both the (C) and (V) curves)

To determine the Manning's n, Figure 701 will be used. To find the  $V^*R$ -value, an estimated value will have to be used to start the process. We will estimate that  $V^*R$  is about 2, which would give us a Manning's n of .05. If this estimated number is not between the (V) and (C) curves, the calculations will need to be run with the Manning's n that is computed from the graph. Using the Manning's equation  $Q = 1.49/n (AR^{2/3}S^{1/2})$ , the following information is obtained:

---

Normal Depth = 1.49'

Velocity (V) = 3.38 feet/sec

Hydraulic Radius (R) = .722

$V^*R = 2.44$

---

Manning's n (V) = .043

Manning's n (C) = .051

(From Figure 701)

Our estimate for the Manning's n was .050, which is in-between the actual (V) and (C) values; therefore, no further iterations are necessary.

Step 2: (Check limiting velocity and Froude Number with the Manning's n value from the (V) curve).

Using a Manning's n of .043, the following information is calculated from the Manning's equation:

---

Normal depth = 1.41'

Velocity = 3.79 ft/sec (under 5 ft/sec OK)

Hydraulic Radius (R) = .722

Flow cross-sectional area (A) = 7.92 ft<sup>2</sup>

Top Width (T) = 11.26'

Hydraulic Depth (D) = A/T = .7033'

Calculate the Froude Number from the equation  $Fr = V/(G \cdot D)^{.5}$

V = average velocity (ft/sec)

G = acceleration of gravity = 32.2 ft/sec<sup>2</sup>

D = Hydraulic Depth = A/T

---

The Froude number is calculated to be .796, which is under the maximum of .8.

Step 3: Use the channel capacity design curve (C curve to determine how wide the drainage easement has to be).

Using the Manning's equation with a Manning's n of .051 from the previously calculated C curve, the following were calculated:

---

Depth = 1.50'

Depth with required freeboard = 2.5'

Required width of channel = 20'

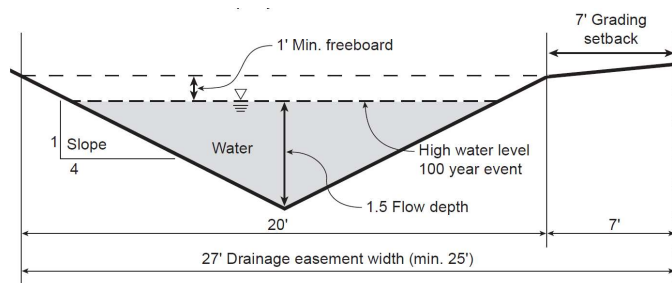
Minimum easement width for maintenance = must accommodate Q100 plus one foot of freeboard and required access

Setback from property line as defined in the ZR

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The cross-section shown below would be acceptable:

Channel Cross Section Near Property Line



### 7.5.3 Concrete Lined Channels

The criteria for the design and construction of concrete lined channels is presented below:

Storm Drainage Design and Technical Criteria – Amended 12-17-19

1. Hydraulics

a. Freeboard

Adequate channel freeboard above the designed water surface will be provided and will not be less than that determined by the following:

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$$HFB = 2.0 + 0.025 V (d)^{1/3}$$

where

HFB = freeboard height (feet)

V = velocity (fps)

d = depth of flow (feet)

---

Freeboard will be in addition to superelevation, standing waves and/or other water surface disturbances. These special situations are to be addressed in a Design Report to be submitted with the construction drawings and specifications (Section 2.7).

Concrete side slopes will be extended to provide freeboard.

b. Superelevation

Superelevation of the water surface will be determined at all horizontal curves, and design of the channel section adjusted accordingly.

c. Velocities

Flow velocities will not exceed 18 fps during the 100-year flood.

2. Concrete Materials

A Design Report will be prepared as stated in Section 7.2.5. The minimum concrete material specifications are as follows:

- a. Cement type: sulphate resistant.
- b. All concrete will meet CDOT Class B specifications.
- c. Maximum water-cement ratio: 0.50 (six gals. per sack).
- d. Admixtures: All proposed admixtures will be discussed in the Design Report.

3. Concrete Lining Section

- a. All concrete lining will have a sufficient thickness to withstand the structural and hydraulic loads.
- b. The side slopes will be a maximum of 2 (vertical) to 1 (horizontal), or a structurally reinforced wall if steeper.

4. Concrete Joints

- a. Expansion/contraction joints will be installed where new concrete lining is connected to a rigid structure or to existing concrete lining which is not continuously reinforced.
- b. Longitudinal joints, where required, will be constructed on the sidewalls at least one foot vertically above channel invert.
- c. All joints will be designed to prevent differential movement.

d. Construction joints are required for all cold joints and where the lining thickness changes.

#### 5. Concrete Finish

The surface of the concrete lining will be provided with a wood float finish. Excessive working or wetting of the finish will be avoided.

#### 6. Concrete Curing

All concrete will be cured by the application of a liquid membrane-forming curing compound (white pigmented) upon completion of the concrete finish.

#### 7. Reinforcement steel (where used)

a. Steel reinforcement will be minimum grade-40 deformed bars. Wire mesh will not be used.

b. Ratio of longitudinal steel area to concrete cross sectional area will be greater than 0.005.

c. Ratio of transverse steel area to concrete cross sectional area will be greater than 0.0025.

d. Additional steel as needed if a retaining wall structure is used.

#### 8. Earthwork

The following areas will be compacted to a least 95 percent of maximum density as determined by ASTM D-698 (Standard Effort):

a. The 12 inches of subgrade immediately beneath concrete lining (both channel bottom and side slopes).

b. Top 12 inches of maintenance road.

c. Top 12 inches of earth surface within 10 feet of concrete channel lip.

d. All fill material.

#### 9. Bedding

Provide six inches of granular bedding equivalent in gradation to 3/4" concrete aggregate (*Standard Specifications for Road & Bridge Construction*, CDOT, Current printing, Section 703.02, No. 67) under channel bottom and side slopes.

#### 10. Underdrain

Longitudinal underdrains will be provided on 10-foot centers and will daylight at the check drops. A check valve or flap gate will be provided at the outlet to prevent backflow into the drain. Weep holes will be provided in vertical wall sections of the channel.

#### 11. Safety Requirements

a. A fence will be installed, as approved by Planning & Zoning, to prevent access wherever the 100-year channel flow depths exceed three feet.

#### 7.5.4 Riprap Lined Channels

The criteria for the design and construction of riprap lined channels will be in accordance with the *Manual*.

Riprap lined channels will be designed for a turbulence factor (Froude number) less than 0.8 for the 100-year flood peaks. The riprap will be designed and constructed in accordance with Section 12.2, "Conduit Outlet Structures" of these *CRITERIA*. Freeboard requirements will be in accordance with the standards for grass lined channels defined in Section 7.4.2.3 of these *CRITERIA*.

### 7.6 Street/Roadside Ditches

The criteria for the design of street/roadside ditches is similar to the criteria for grass lined channels with modifications for the special purpose of minor storm drainage. The criteria is as follows (refer to Figure 702):

#### 1. Capacity

Street/Roadside ditches will have adequate capacity for the minor storm runoff peaks. Capacity will be as defined in Table 701. Where the storm runoff exceeds the capacity of the ditch, a storm sewer system will be required.

#### 2. Flow Velocity

The maximum velocity for the major storm flood peak will not exceed 5 feet per second

#### 3. Curvature

The minimum radius of curvature will be 25 feet.

#### 4. Roughness Coefficient

Manning's "n" values presented in Figure 701 will be used in the capacity computation for street/roadside ditches.

#### 5. Grass Lining

The grass lining will be in accordance with the *Manual*. Alternative seed mixes may be required by Planning and Zoning as recommended by the JCD.

#### 6. Cross Culvert Location

The surface drainage in a street/roadside ditch will not be carried in excess of 500 feet before being discharged into a natural drainageway. Grade changes of greater than 2% will require a cross culvert. The final location of culverts may be slightly altered by existing field conditions encountered during installation. Culverts will be installed at the slope of the natural terrain.

#### 7. Major Drainage Capacity

The capacity of street/roadside ditches for major drainage flow is restricted by the maximum flow depth allowed at the street crown (Section 3.4.4). However, the flow spread should not extend outside the street ROW.

### 7.7 Channel Rundowns

A channel rundown is used to convey storm runoff from the bank of a channel to the invert of an open channel or drainageway. The purpose of the structure is to minimize channel bank erosion from concentrated overland flow. The design criteria for channel rundowns is as follows:

#### 7.7.1 Cross-Sections

Typical cross-sections for channel rundowns are presented in Figure 704.

#### 7.7.2 Design Flow

The channel rundown will be designed to carry a minimum of the minor storm runoff or 1 cfs, whichever is greater.

#### 7.7.3 Flow Depth

The maximum depth at the design flow will be 12 inches. Due to the typical profile of a channel rundown beginning with a flat slope and then dropping steeply into the channel, the design depth of flow will be the computed critical depth for the design flow.

#### 7.7.4 Outlet Configuration

The channel rundown outlet will enter the drainageway at the trickle channel flowline. Erosion protection of the opposite channel bank will be provided by a 24-inch layer of grouted Type-L riprap. The width of this riprap erosion protection will be at least three times the channel rundown width or pipe diameter. Riprap protection will extend up the opposite bank to the minor storm flow depth in the drainageway or 2 feet, whichever is greater.

Table 701

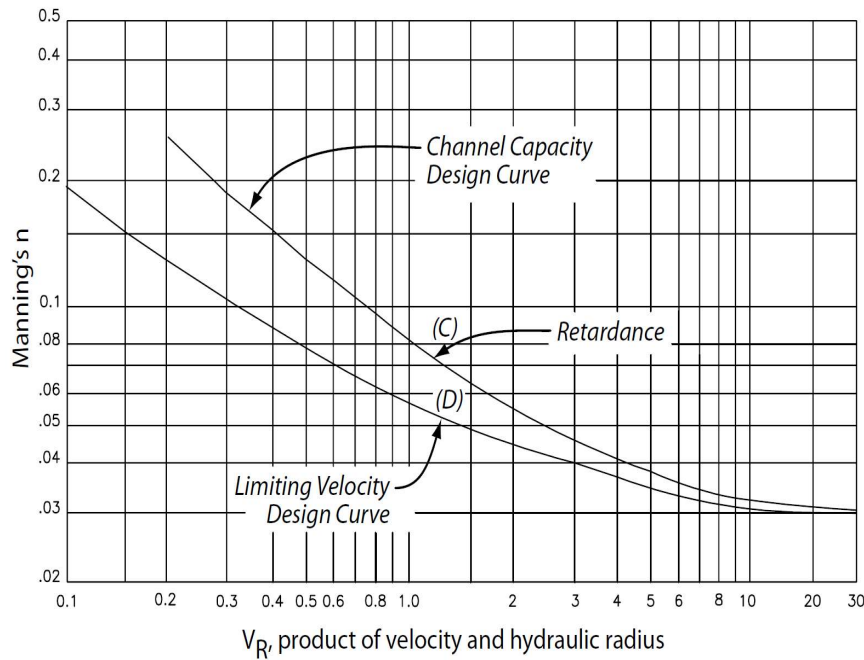
Street/Roadside Ditch Capacities

Ditch Slope	Ditch Type 1		Ditch Type 2		Ditch Type 3 (Private Road Only)	
	Capacity CFS	Velocity FPS	Capacity CFS	Velocity FPS	Capacity CFS	Velocity FPS
2%	26	4.2	36	4.16	1.9	0.95
2.50%	31	5	42	4.89	2.5	1.25
3.00%	32	5	40	5	3.2	1.6
3.50%	30	5	37	5	4	2
4.00%	28	5	33	5	4.8	2.4
5.00%	21	5	26	5	6	3.1
6.00%	17	5	22	5	8	4
7.00%	15	5	19	5	8	5
8.00%	13	5	16	5	7	5
10.00%	11	5	13	5	6	5
12.00%	9	5	11	5	5	5

- Permitted on all mountain roads and local and collector streets
- Only permitted on private and public roads in the mountains
- Only permitted on private roads in the mountains
- Only permitted on private roads where the natural terrain bears between south 60 east and south 45 west

Figure 701

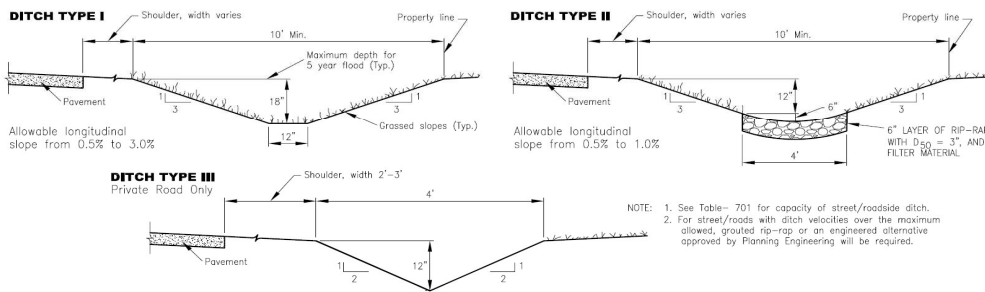
Roughness Coefficients for Grassed Channels



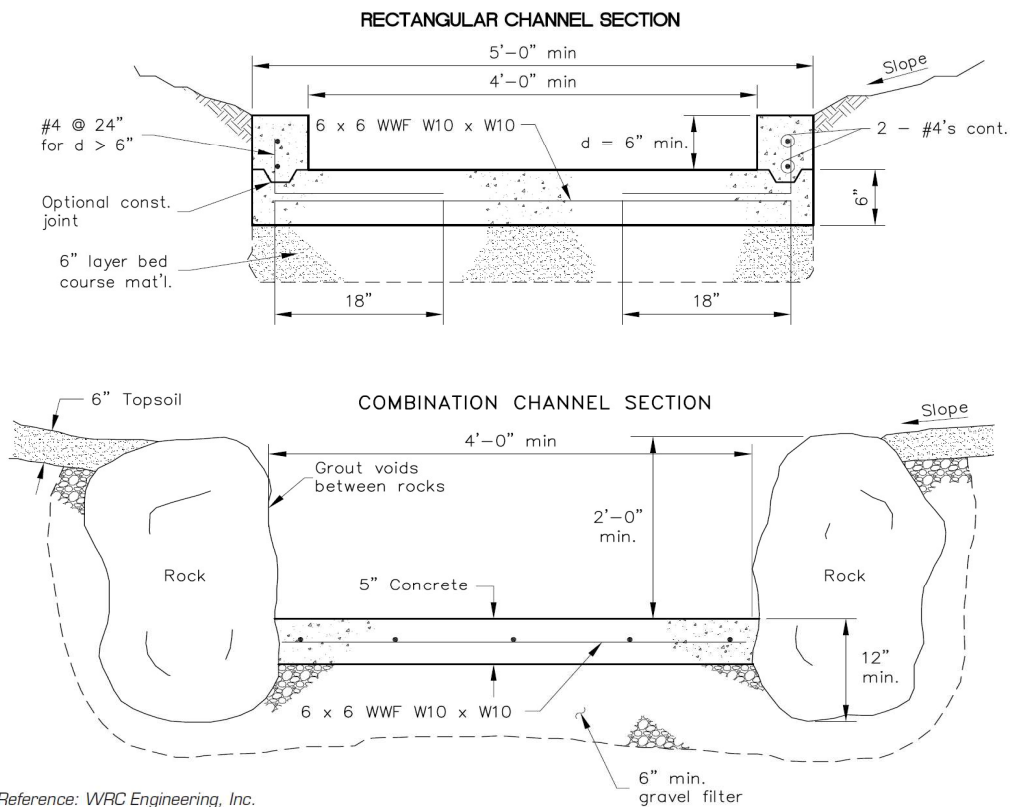
Reference: Handbook of Channel Design for Soil and Water Conservation, U.S. Department of Agriculture, Soils Conservation Service, No. SCS-TP-61 March, 1947, Rev. June, 1954.



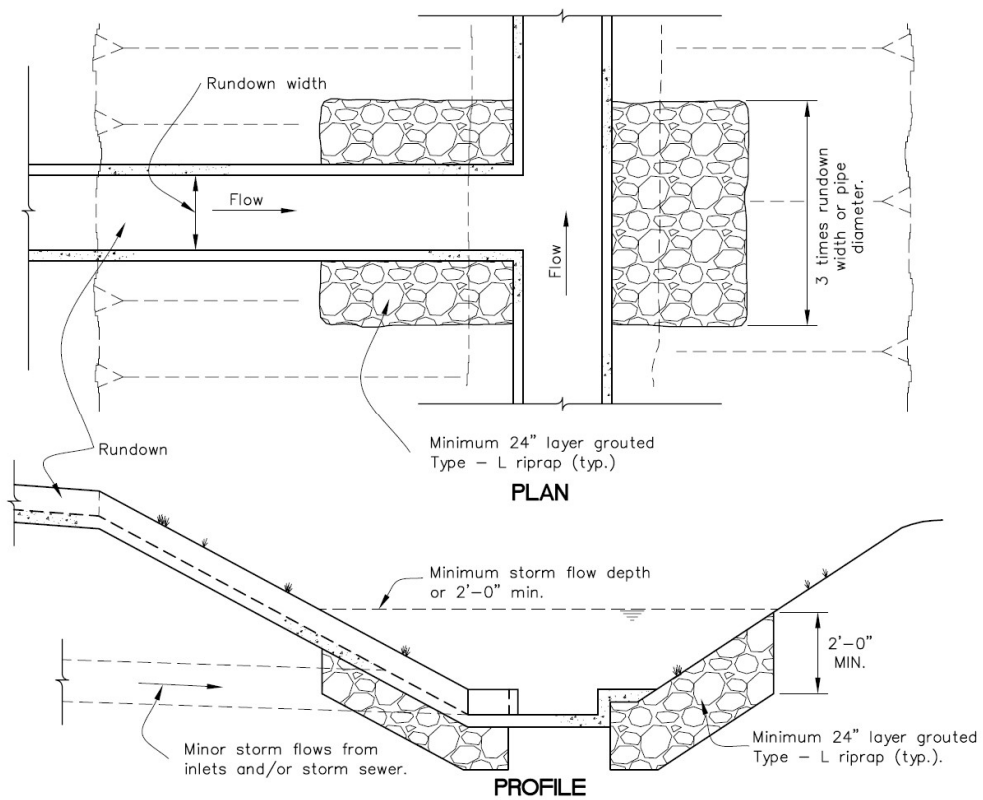
**Figure 702**  
**Street / Roadside Ditch Sections**



**Figure 703**  
**Trickle Channel Details**



Reference: WRC Engineering, Inc.



## Chapter 8 - Storm Sewers

### 8.1 Introduction

Storm sewers are a part of the Minor Drainage System, and are required when the other parts of the minor system, primarily curb, gutter and street/roadside ditches no longer have capacity for additional runoff.

Except as modified herein, the design of storm sewers will be in accordance with the "Streets, Inlets and Storm Drain" Chapter of the *Manual*. The user is referred to the *Manual* and other references cited for additional discussion and basic design concepts.

Stormwater Quality Considerations: The use of grass swales to promote infiltration is highly encouraged; since replacing storm sewer with grass swales is not always reasonable, storm sewer is still an integral part in many drainage system designs.

A number of Excel-based workbook tools are offered by UDFCD on their website ([www.UDFCD.org](http://www.UDFCD.org)).

### 8.2 Construction Materials

RCP, in accordance with ASTM C76-03, C506-02 or C507-02, and HP Pipe, in accordance with manufacturer specifications, are the only materials acceptable for use in storm sewer construction within County ROW. The minimum class of pipe will be Class II; however, the actual depth of cover, live load and field conditions may require structurally stronger pipe. CSP and HDPE pipe, in accordance with manufacturer's specifications, are only permitted in privately owned and maintained installations.

### 8.3 Hydraulic Design

Storm sewers will be designed to convey the minor storm flood peaks without surcharging the sewer. The design of the storm sewer must be checked to show that the hydraulic grade line is below the ground elevation during the major storm. To ensure that this objective is achieved the hydraulic and energy grade line calculated by accounting for pipe friction losses and pipe form losses. Total hydraulic losses will include friction, expansion, contraction, bend and junction losses. The methods for estimating these losses are presented in the following sections. The final energy grade line must be at or below the proposed ground surface if the major storm exceeds the allowable street capacity.

#### 8.3.1 Pipe Friction Losses

The Manning's "n" values to be used in the calculation of storm sewer capacity and velocity are presented below:

Pipe Roughness Coefficients

Manning's n-value		
Sewer Type	Capacity Calculation	Velocity Calculation
RCP	0.015	0.011
CSP	0.026	0.021
HDPE/HP	0.012	0.010

#### 8.3.2 Pipe Form Losses

Generally, between the inlet and outlet structures of the storm sewer system, the flow encounters a variety of configurations in the flow passageway such as changes in pipe size, branches, bends, junctions, expansions and contractions. These shape variations impose losses in addition to those resulting from pipe friction. Form losses are the result of fully developed turbulence and can be expressed as follows:

---

$$HL = K \frac{V^2}{2g}$$

where

HL = head loss (feet)

K = loss coefficient

V = average flow velocity (feet per second)

g = gravitational acceleration (32.2 ft/sec<sup>2</sup>)

---

The following is a discussion of a few of the common types of form losses encountered in sewer system design.

1. Bend Losses

The head losses for bends, in excess of that caused by an equivalent length of straight pipe, may be expressed by the relation

---

$$HL = K_b \frac{V^2}{2g}$$

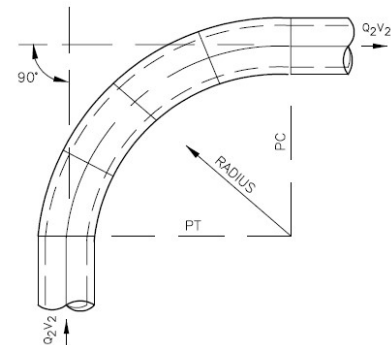
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in which  $K_b$  is the bend coefficient. The bend coefficient has been found to be a function of, (a) the ratio of the radius of curvature of the bend to the width of the conduit, (b) deflection angle of the conduit, (c) geometry of the cross section of flow, and (d) the Reynolds number and relative roughness. A table showing the recommended bend loss coefficient is presented below.

Energy Loss Coefficients - Bends

Case I-Conduit on 90 degree curves	
$\theta$	$K_b$
90	0.25
60	0.20
45	0.18
30	0.14

Note 1: Head loss applied at P.C. for length  
Note 2: Applies only to pipe 48" or greater



2. Junction and Manhole Losses

The loss coefficient  $K_b$  for bends at manholes is presented in Table 802. A junction occurs where one or more branch sewers enter a main sewer, usually at manholes. The hydraulic design of a junction is in effect the design of two or more transitions, one for each flow path. Allowances should be made for head loss due to the impact and junctions. The head loss for a straight through manhole or at an inlet entering the sewer is calculated from the following equation. The head loss at a junction can be calculated from:

---

$$HL = \frac{V_2^2}{2g} - K_j \frac{V_1^2}{2g}$$

---

where V2 is the outfall flow velocity and V1 is the inlet velocity. The loss coefficient, K<sub>j</sub>, for various junctions is presented in Table 803.

8.3.3 Storm Sewer Outlets

When the storm sewer system discharges into the Major Drainageway System (usually an open channel), additional losses occur at the outlet in the form of expansion losses. For a headwall and no wingwalls, the loss coefficient K<sub>e</sub> = 1.0 for a flared-end section the loss coefficient is approximately 0.5 or less.

8.3.4 Partially Full Pipe Flow

When a storm sewer is not flowing full, the sewer acts like an open channel, and the hydraulic properties can be calculated using open channel techniques (refer to Chapter 7). For convenience, charts for various pipe shapes have been developed for calculating the hydraulic properties (Figures 801, 802, 803). The data presented assumes that the friction coefficient, Manning’s “n” value, does not vary throughout the depth.

8.4 Vertical Alignment

The sewer grade will be such that a minimum cover is maintained to withstand AASHTO HS-25 loading on the pipe. The minimum cover depends upon the pipe size, type and class and soil bedding condition, but will be not less than 1 foot at any point along the pipe.

The minimum clearance between storm sewer and water main, either above or below, will be 12 inches. Concrete encasement of the water line will be required for clearance of 12 inches or less.

The minimum clearance between storm sewer and sanitary sewer, either above or below, will also be 12 inches. In addition, when a sanitary sewer main lies above a storm sewer, or within 18 inches below, the sanitary sewer will have an impervious encasement or be constructed of structural sewer pipe for a minimum of 10 feet on each side of where the storm sewer crosses.

8.5 Horizontal Alignment

Storm sewer alignment may be curvilinear for pipe with diameters of 48 inches or greater but only when approved in writing by Planning & Zoning. The applicant must demonstrate the need for a curvilinear alignment. The limitations on the radius for pulled-joint pipe are dependent on the pipe length and diameter, and amount of opening permitted in the joint. The maximum allowable joint pull will be ¾ inches. The minimum parameters for radius type pipe are shown in Table 801. The radius requirements for pipe bends are dependent upon the manufacturer’s specifications.

8.6 Pipe Size

The minimum allowable pipe size for storm sewers is dependent upon a practical diameter from the maintenance standpoint. The length of the sewer also affects the maintenance and, therefore, the minimum diameter. Table 801 presents the minimum pipe size for storm sewers.

8.7 Manholes

Manholes or maintenance access ports will be required whenever there is a change in size, direction, elevation, grade or where there is a junction of two or more sewers. A manhole may be required at the beginning and/or at the end of the curved section of storm sewer. The maximum spacing between manholes for various pipe sizes will be in accordance with Table 801. The required manhole size will be as follows:

Manhole Size

Sewer Diameter	Manhole Diameter
15" to 18"	4'
21" to 42"	5'
48" to 54"	6'
60" and larger	CDOT M-604-20, Page 2 of 3

Larger manhole diameters or a junction structure may be required when sewer alignments are not straight through or more than one sewer line goes through the manhole.

8.8 Checklist

To aid the designer and reviewer, the following checklist has been prepared:

- 1. Calculate energy grade line (EGL) and hydraulic grade line (HGL) for all sewers and show on the construction drawings or on a separate copy of the plans submitted with the construction drawings.
- 2. Account for all losses in the EGL calculation including outlet, form, bend, manhole and junction losses. Refer to Water Surface and Energy Grade Line Calculations for a Storm Sewer - Worksheet 801.
- 3. Provide adequate erosion protection at the outlet of all sewers into open channels.
- 4. Check for minimum pipe cover.
- 5. Check for adequate clearance with other utilities.

Table 801  
Storm Sewer Alignment and Size Criteria

Minimum Pipe Diameter

Type	Minimum Pipe Diameter	Minimum Cross-sectional area
Main trunk	18 inch	1.77 sq. feet
Lateral from the inlet	15 inch	1.23 sq. feet

Note: Minimum size of the lateral will also be based upon a water surface inside the inlet at a minimum distance of 1 foot below the grate or throat.

Diameter of Pipe	Maximum Allowable Distance between Manholes and/or Cleanouts
15" to 36"	400 feet
42" and larger	500 feet

Minimum Radius for Radius Pipe

Diameter of Pipe	Minimum Radius of Curvature
48" to 54"	28.5 feet
57" to 72"	32.0 feet
78" to 108"	38.0 feet

Reference: Urban Storm Drainage Criteria Manual, DRCOG, 1969

Table 802

**Energy Loss Coefficients - Bends at Manholes**  
Reference: Modern Sewer Design, AISI, Washington D.C., 1980

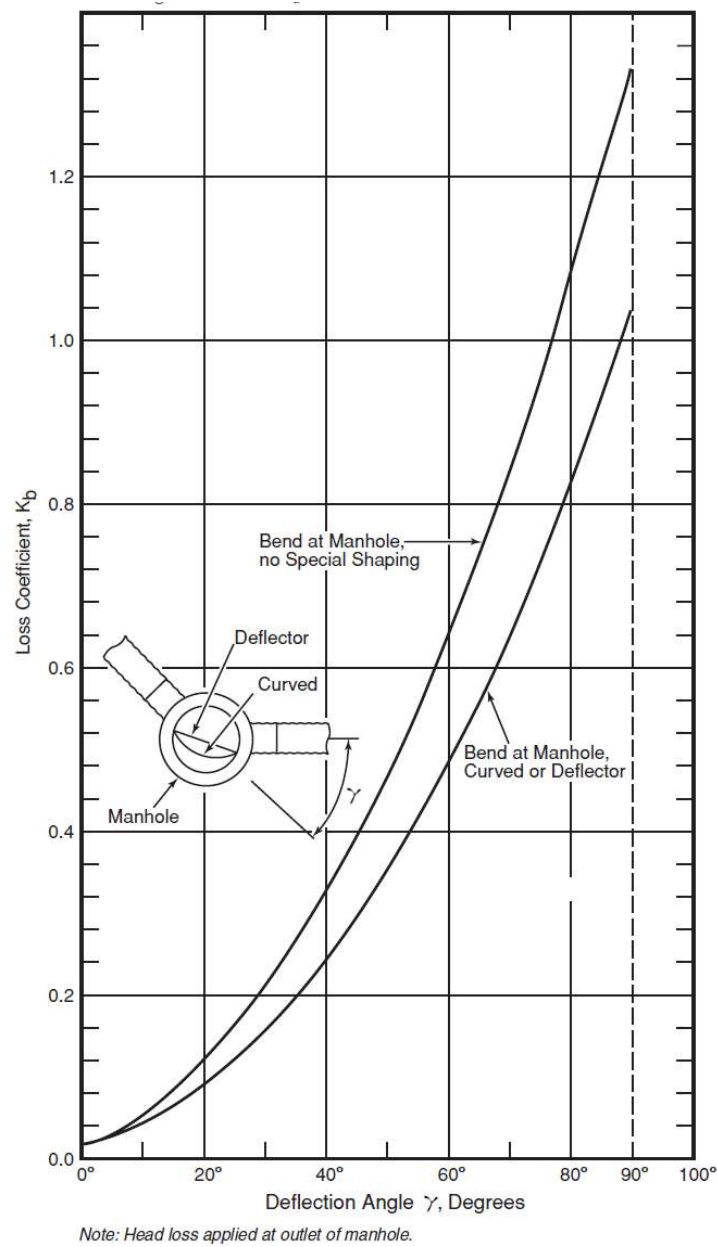


Table 803  
**Manhole and Junction Losses**  
 Reference: APWA Special Report No. 49, 1981

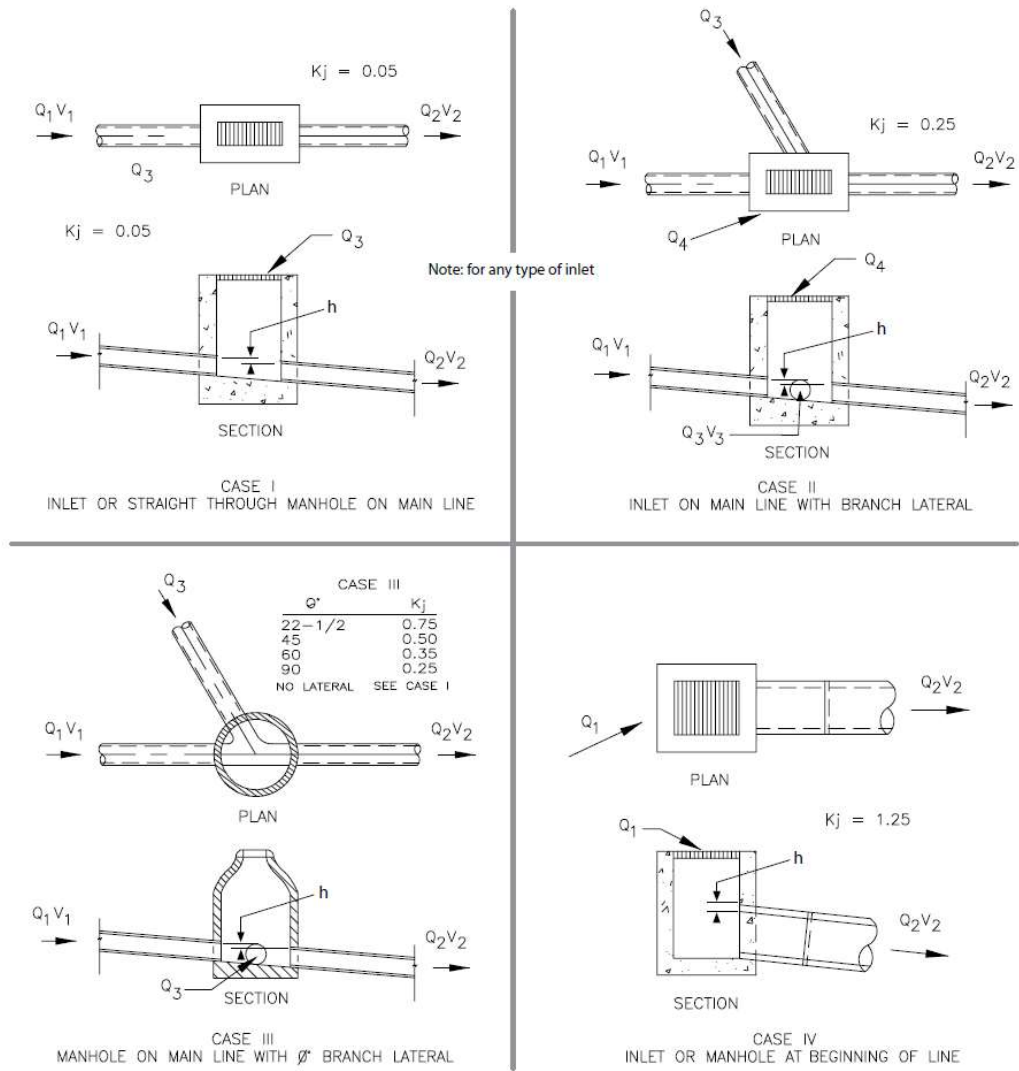


Figure - 801  
 Storm Drainage Design and Technical Criteria – Amended 12-17-19



**Hydraulic Properties of Circular Pipe**  
 Reference: Concrete Pipe Design Manual ACPA, 1970

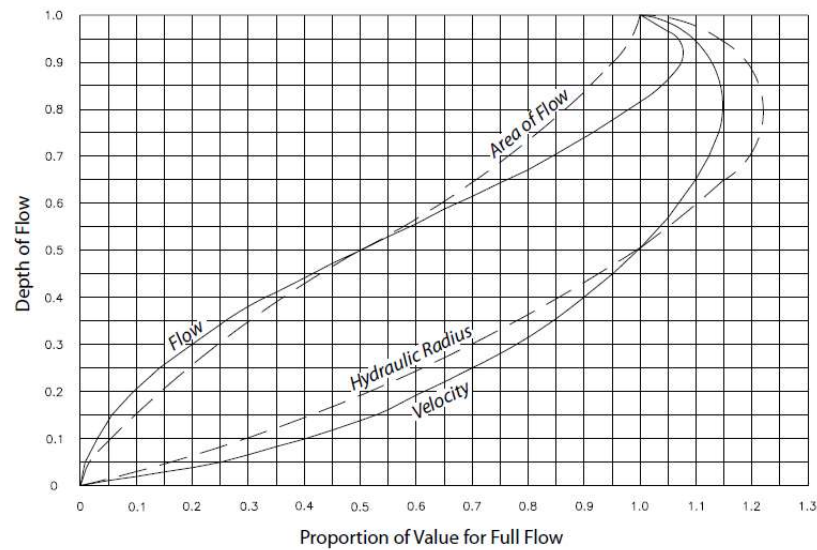


Figure 802  
**Hydraulic Properties Horizontal Elliptical Pipe**  
 Reference: Concrete Pipe Design Manual ACPA, 1970

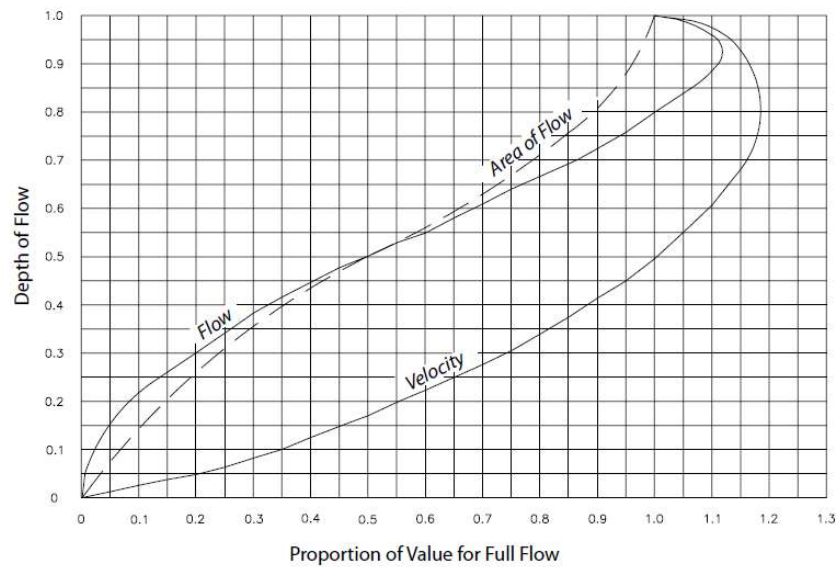
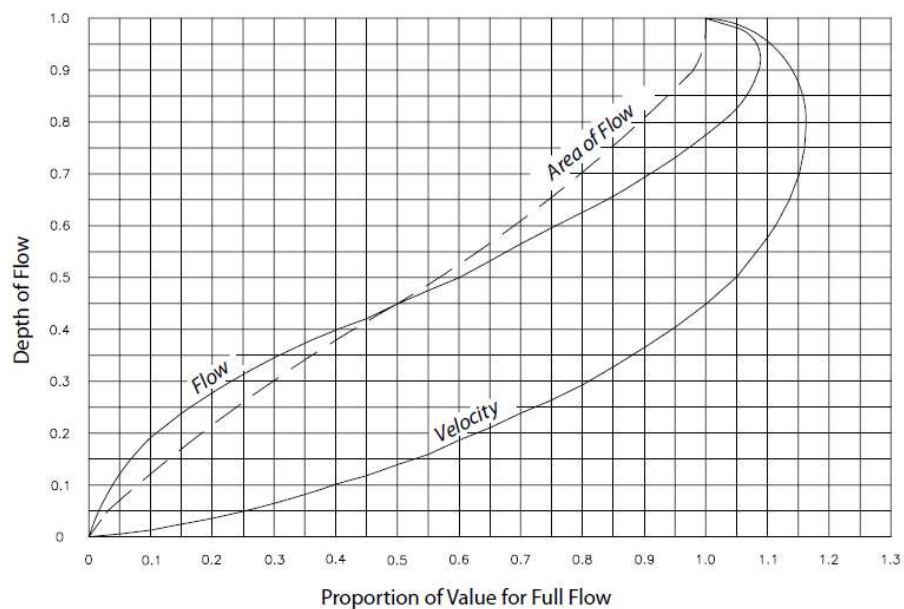


Figure 803  
 Storm Drainage Design and Technical Criteria – Amended 12-17-19

Reference: Concrete Pipe Design Manual ACPA, 1970

Reference: Concrete Pipe Design Manual ACPA, 1970



### Water Surface and Energy Grade Line Calculations for a Storm Sewer

Manning's n \_\_\_\_\_

[illegible]

$\mathfrak{C} = (2g(n^2))$	$S_f = (\mathfrak{C}H_V)$
2.21	R <sup>1.33</sup>

## Chapter 9 - Storm Sewer Inlets

### 9.1

There are four types of inlets: curb opening, grated, combination and slotted inlets. Inlets are further classified as being on a continuous grade or in a sump. The term "continuous grade" refers to an inlet so located that the grade of the street has a continuous slope past the inlet and, therefore, ponding does not occur at the inlet. The sump condition exists whenever water is restricted or ponds because the inlet is located at a low point. A sump condition can occur at a change in grade of the street from positive to negative, or at an intersection due to the crown slope of a cross street.

Presented in this chapter are the criteria and methodology for design and evaluation of storm sewer inlets in the County. Except as modified herein, all storm sewer inlet criteria will be in accordance with the *Manual*. A number of Excel-based workbook tools are offered by UDFCD on their website ([www.UDFCD.org](http://www.UDFCD.org)).

### 9.2 Standard Inlets

The standard inlets permitted for use in the County are:

Table 901

#### Standard Inlets

Inlet Type	Standard Detail	Permitted Use
Curb Opening Inlet Type R	Standard M-604-12 SD-1 (In Criteria)	All street types
Grated Inlet Type C	CDOT M-604-10	All streets/roads with a roadside or median ditch
Grated Inlet Type 13	CDOT M-604-13	Private drives, alleys or parking areas
Combination Inlet Type 13	SD-2 (In Criteria)	All street types
Slotted Inlet	Provide Manufacturer's Specifications	Private drives, alleys or parking areas
Median Inlet	SD-3 (In Criteria)	In medians

### 9.3 Inlet Hydraulics

The procedures and basic data used to define the capacities of the standard inlets under various flow conditions were obtained from the *Manual*, "Streets/Inlets/Storm Sewers". The procedure consists of defining the amount and depth of flow in the gutter, selecting the appropriate inlet type and determining the theoretical flow interception by the inlet. To account for effects which decrease the capacity of the various types of inlets, such as debris plugging, pavement overlaying and variations in design assumptions, the theoretical capacity calculated for the inlets is reduced to the allowed capacity by applying a clogging factor.

### 9.4 Inlet Spacing

The optimum spacing of storm inlets is dependent upon several factors including traffic requirements, contributing land use, street slope and distance to the nearest outfall system. The suggested sizing and spacing of the inlets is based upon the interception rate of 70% to 80%. This spacing has been found to be more efficient than a spacing using 100% interception rate. Using the suggested spacing only, the most downstream inlet in a development would be designed to intercept 100% of the flow. Also, considerable improvements in overall inlet system efficiency can be achieved if the inlets are located in the sumps created by street intersections.

### 9.5 Inlet Capacity

The hydraulic capacity of an inlet is dependent on the type of inlet and the location (on a continuous grade or in a sump).

For the continuous grade condition, the capacity of the inlet is dependent upon many factors including gutter slope, depth of flow in the gutter, height and length of curb opening, street cross slope and the amount of depression at the inlet. In addition, all of the gutter flow will not be intercepted and some flow will continue past the inlet area (inlet carryover). The amount of carryover must be included in the drainage facility evaluation as well as in the design of the inlet (see Figure 901 for example).

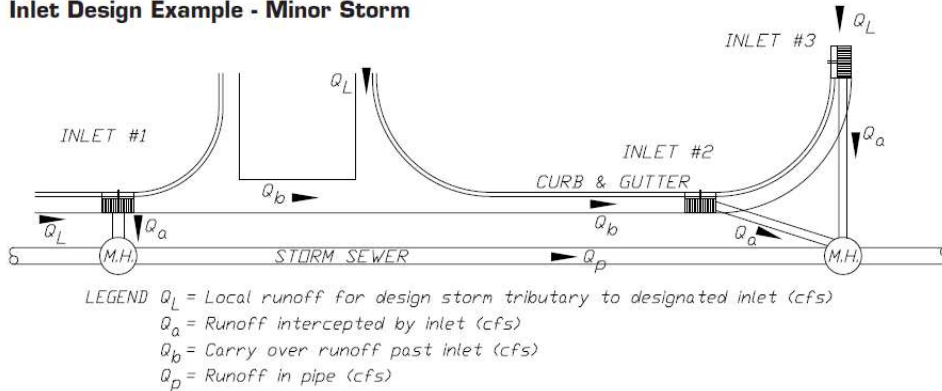
The capacity of the inlet in a sump condition is dependent on the inlet geometry and the depth of ponding above the inlet.

1. Use the Urban Drainage workbook tool (most current versions) to calculate the selected inlet capacity.
2. Calculate design peak flow, including local peak flow and carryover flow, if applicable.
3. Determine street/gutter geometry:
  - (a) Allowable depth to gutter flowline, H

- (b) Gutter width,  $W$
- (c) Gutter depression,  $a$
- (d) Street transverse slope,  $s_x$
- (e) Street longitudinal slope,  $s_o$
- (f) Manning's roughness,  $n$  (0.016)
- (g) Maximum water spread,  $T$
- 4. Determine inlet geometry:
  - (a) Inlet type
  - (b) Length of a single unit,  $L_o$  (5.00' for Type R, 3.27' for Type 13, 3.27' for combination)
  - (c) Width of a grate,  $W_o$  (n/a for Type R, 1.88' for Type 13, 1.88' for combination)
  - (d) Height of curb opening,  $H$  (6" for Type R, n/a for Type 13, 6" for combination)
  - (e) Local depression,  $a_{local}$  (3" for Type R, 0" Type 13, 2" for combination)
  - (f) Angle of throat,  $\theta$  (63.4° for Type R, n/a for Type 13, 90° for combination)
  - (g) Side width for depression pan,  $W_p$  (3.00' for Type R, n/a for Type 13, 2.00' for combination)
  - (h) Number of units,  $N_o$
- 5. Determine inlet design coefficients, as applicable
  - (a) Clogging factor for a grate,  $C_{o-G}$  (0.5)
  - (b) Clogging factor for a curb opening,  $C_{o-C}$  (0.1)
  - (c) Clogging factor for a slotted inlet,  $C_o$  (0.5)
  - (d) Area opening ratio for a grate,  $A$  (0.6)
  - (e) Grate orifice coefficient,  $C_{d-G}$  (0.67)
  - (f) Grate weir coefficient,  $C_{w-G}$  (3.00)
  - (g) Curb opening orifice coefficient,  $C_{d-C}$  (0.67)
  - (h) Curb opening weir coefficient,  $C_{w-C}$  (2.30)
  - (i) Slotted inlet orifice coefficient,  $C_{d-S}$  (0.80)
  - (j) Slotted inlet weir coefficient,  $C_{w-S}$  (2.48)

Figure 901

### Inlet Design Example - Minor Storm



## Chapter 10 – Streets/Roads

### 10.1 Introduction

The criteria presented in this chapter will be used in the evaluation of the allowable drainage encroachment within streets/roads. The review of all submittals will be based on the criteria herein and the Manual, "Street, Inlets and Storm Drain" chapter. A number of Excel-based workbook tools are offered by UDFCD on their website ([www.UDFCD.org](http://www.UDFCD.org)).

### 10.2 Function of Streets/Roads in the Drainage System

Streets and roads, specifically the curb and gutter or the street/roadside ditches, are part of the Minor Drainage System. When the drainage in the street/road exceeds allowable limits, a storm sewer system (Chapter 9) or an open channel (Chapter 7) is required to convey the excess flows. The streets/roads are also part of the Major Drainage System when they carry floods in excess of the minor storm also subject to certain limitations. However, the primary function of streets/roads is for traffic movement and, therefore, the drainage function is subservient and must not interfere with the traffic function of the street/road.

Design criteria for the collection and moving of runoff water on streets/roads is based on a reasonable frequency and magnitude of traffic interference. That is, depending on the character of the street/road, certain traffic lanes can be fully inundated once during the minor design storm return period. However, during lesser intense storms, runoff will also inundate traffic lanes but to a lesser degree. The primary function of the streets/roads for the Minor Drainage System is therefore to convey the nuisance flows quickly and efficiently to the storm sewer or open channel drainage without interference with traffic movement. For the Major Drainage System, the function of the streets/roads is to provide an emergency passageway for the flood flows with minimal damage.

### 10.3 The Allowable Use of Streets/Roads as a Drainage System

The streets in the County are classified as arterial/parkway, collector and local, according to the average daily traffic (ADT) for which the street is designed. The larger the ADT, the more restrictive the allowable drainage encroachment into the driving lanes. The limits of storm runoff encroachment for each classification is shown in the following tables:

Table 1001

#### Allowable Use of Streets/Roads for Minor Storm Runoff

Street/Road Classification	Maximum Allowable Street/Road Encroachment
Major Collector/Arterial/Parkway	No curb overtopping. Flow spread must leave at least two 10-foot lanes free of water, 10 feet each side of the street/road crown/median.
Collector	No curb overtopping. Flow spread must leave at least one 10-foot lane free of water, 5 feet either side of the street/road crown.
Local	No curb overtopping for 6-inch vertical curb. Flow may spread to the back of sidewalk for a combination curb, gutter and sidewalk.

Table 1002

#### Allowable Use of Streets/Roads for Major Storm Runoff

Street/Road Classification	Maximum Allowable Street/Road Encroachment
Major Collector/Arterial/Parkway	Flow may spread to the back of sidewalk or to the top of curb if there is no sidewalk. To allow for emergency vehicles, the depth of water will not exceed 6 inches at the street crown or 12 inches at the gutter flowline whichever is more restrictive.
Local/Collector	Flow may spread to the back of sidewalk or to the top of curb if there is no sidewalk. The depth of water at the gutter flowline will not exceed maximum allowable depth or 12 inches.

Table 1003

#### Allowable Flow Depths for Standard Street Templates

The allowable flow depths presented in this table are based on the maximum allowable encroachment in Tables 1001 and 1002 and the standard templates. Allowable flow depths must be calculated for any modifications to the standard templates.

Street Classification	Allowable Minor Storm Flow Depth	Allowable Major Storm Flow Depth
Principal Arterial or Parkway (94' Flowline to Flowline with raised median)	6"	9.4"
Principal Arterial or Parkway (94' Flowline to Flowline without raised median)	6"	9.4"
Minor Arterial (70' Flowline to Flowline with raised median)	5.4"	9.4"
Minor Arterial (70' Flowline to Flowline without raised median)	6"	9.4"

Major Collector (49 feet flowline to flowline with raised median)	6"	9.4"
Major Collector (49' feet flowline to flowline without raised median)	6"	9.4"
Collector (with detached sidewalk)	4.7"	8.4"
Collector (with attached sidewalk)	4.7"	7.1"
Local (34' Flowline to Flowline, 6" vertical curb and detached sidewalk)	6"	8.4"
Local (34' Flowline to Flowline, combination curb, gutter, sidewalk)	5"	5"
Local (28' Flowline to Flowline, vertical curb and detached sidewalk)	6"	8.4"
Local (28' Flowline to Flowline, combination curb, gutter, sidewalk)	5"	5"

Table 1004

**Allowable Cross Street Flow**

Street/Road Classification	Minor Drainage System Maximum Depth	Major Drainage System Maximum Depth
Major Collector/Arterial/Parkway	None	None
Collector	None	12" depth at gutter flowline or edge of pavement if no gutter
Local	6" depth in *cross pan or gutter flowline	12" depth at gutter flowline or edge of pavement if no gutter

*\*Cross-pans are prohibited on arterial streets/roads. Cross-pans are allowed on collector and local streets/roads only at locations where traffic stops are intended at intersections and no storm sewer is present.*

Table 1005

**Allowable Culvert Overtopping**

Street/Road Classification	Minor Drainage System Maximum Depth	Major Drainage System Maximum Depth*
Major Collector/Arterial/Parkway	None	None. Minimum clearance between the low chord or culvert crown and the energy grade line is 6 inches for basins less than 2 square miles, 1 foot for basins up to 10 square miles and 2 feet for basins greater than 10 square miles.
Collector/Local/Driveway	None	12" depth at gutter flowline or edge of pavement if no gutter. The maximum headwater depth is 1.5 times the culvert height.
Local Mountains/ Driveway Mountains	None	Overtopping depth for the 100-year storm event is 12" unless approved by Planning and Zoning <del>and the Fire Protection District.</del>

*\*The regulations set forth in the ZR, also apply for culvert crossings that are within the Floodplain Overlay District.*

**10.4 Hydraulic Evaluation**

**10.4.1. Allowable Gutter Capacity**

The allowable gutter capacity is calculated using the modified Manning's formula. This equation is the basis of the UD-Inlet spreadsheet.

$$Q = R(0.56)(Z/n)S^{1/2} d^{8/3}$$

Where

Q = discharge in cfs

Z = 1/S<sub>x</sub>, where S<sub>x</sub> is the street transverse slope(ft/ft)

d = depth of water at face of curb (feet)

S<sub>o</sub> = street longitudinal slope(ft/ft)

n = Manning's roughness coefficient

R = reduction factor (*Manual*, Figure ST-2)

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A Manning's n-value of 0.016 will be used for the calculations at all street slopes. The allowable gutter capacity is computed by multiplying the theoretical street capacity by the appropriate reduction factor. The purpose of the reduction factor is for public safety.

The allowable gutter capacity will need to be reduced for non-symmetrical street sections. Street capacity calculations will be submitted to the County at critical locations of the non-symmetrical streets.

#### 10.4.2 Street/Road with Roadside Ditches

Some streets/roads are characterized by street/roadside ditches rather than curbs and gutters. The capacity is limited by the depth in the ditch and the maximum flow velocity. Refer to Section 7.6 for the design and capacity of street/roadside ditches.

## Chapter 11 – Culverts

### 11.1 Introduction

A culvert is defined as a conduit for the passage of surface water under a, street/road, driveway, railroad, canal or other embankment (except detention outlets). Culvert design involves both hydraulic and structural design considerations. This chapter sets forth only the hydraulic aspects of culvert design.

Culverts may be constructed with many shapes and materials. The most commonly used shape is circular. Other shapes include elliptical, arch and box. The most common culvert materials are concrete and steel. The material selected for a culvert is dependent upon factors such as durability, strength, roughness, bedding, water-tightness and abrasion and corrosion resistance.

### 11.2 Culvert Hydraulics

The procedures and basic data to be used for the hydraulic evaluation of culverts in the County will be in accordance with the *Manual*, "Culverts," except as modified herein. The reader is also referred to the many texts covering the subject for additional information.

### 11.3 Culvert Design Standards

#### 11.3.1 Construction Material and Pipe Size

Within the County ROW, culverts will be constructed from corrugated steel or concrete. Other materials for construction outside of County ROW will be subject to approval by Planning and Zoning.

The minimum pipe size for culverts within a public ROW will be 18 inches diameter round culvert or will have a minimum cross-sectional area of 1.6 ft<sup>2</sup> for arch shapes. Driveway culverts will be sized to pass the minor storm ditch flow capacity without overtopping the driveway. The minimum size culvert will be an 18" x 11" CSPA (15" equivalent round pipe) with flared end sections. Larger sizes may be required by Planning and Zoning as determined by the required culvert capacity calculations. Culverts crossing a drainageway will be sized to pass a 10-year storm without street overtopping. Using future developed conditions for the 100-year runoff, the allowable street overtopping will be determined based on Table 1005.

#### 11.3.2 Inlet and Outlet Configuration

Within the County, all culverts for drainageways are to be designed with headwalls or with flared-end sections at the inlet. Flared-end sections are only allowed on corrugated steel pipes with diameters of 42-inches (or equivalent) or less. No multiple barrel installations will be allowed unless warranted by special conditions as approved by Planning and Zoning.

Headwalls, wingwalls and flared-end sections should be designed and constructed to use the existing landforms of the site and blend with the natural landscape.

Additional protection in the form of riprap will also be required at the outlet due to the potential scouring velocities. Refer to Section 12.2.

#### 11.3.3 Hydraulic Data

When evaluating the capacity of a culvert, the following data will be used:

- a. Roughness Coefficient - Table 1101.
- b. Entrance Loss Coefficients - Table 1101.
- c. Capacity Curves - There are many charts, tables and curves in the literature for the computation of culvert hydraulic capacity. To assist in the review of the culvert design computations and to obtain uniformity of analysis, one of the following design aids will be used:

*Urban Storm Drainage Criteria Manual*, Denver, Colorado, latest revision

*HY8 Culvert Analysis Version 6.1*, U.S. Federal Highway Administration, Washington, D.C.

- d. Design Forms - Standard Form SF-3 is to be used for determining culvert capacities. A sample computation is discussed in Section 11.4 and shown on Table 1102.



#### 11.3.4 Velocity Considerations

In design of culverts, both the minimum and maximum velocities must be considered. A minimum velocity of flow is required to assure a self-cleansing condition of the culvert. A minimum velocity in the culvert of 3-fps at the outlet is recommended.

The maximum velocity is dictated by the channel conditions at the outlet. If the outlet velocities are less than 7-fps for grassed channels, then the minimum amount of protection is required due to the eddy currents generated by the flow transition. Higher outlet velocities will require substantially more protection. A maximum outlet velocity of 12-fps is recommended with erosion protection. If the culvert outlet velocity is greater than 12-fps, an energy dissipator will be required. Refer to Sections-12.2 for protection requirements at culvert outlet.

#### 11.3.6 Cross Culvert Location

The surface drainage in a street/roadside ditch will not be carried in excess of 500 feet before being discharged into a natural drainageway. Grade changes of greater than 2% will require a cross culvert. The final location of culverts will be determined by existing field conditions encountered during installation. Culverts will be installed at the slope of the natural terrain.

#### 11.3.7 Structural Design

As a minimum, all culverts will be designed to withstand an HS-25 loading (unless otherwise approved by Planning & Zoning) in accordance with the design procedures of AASHTO, "Standard Specifications for Highway Bridges," and with the pipe manufacturer's recommendation.

#### 11.3.8 Trashracks

Trashracks may be required at the entrance of culverts for some installations as loading (unless otherwise approved by Planning & Zoning), such as areas with potential for significant debris, or in areas where public access is likely. Installation of trashracks prevents debris from entering culverts.

The following criteria will be used for design of trashracks for storm drainage applications:

##### 1. Materials

All trashracks will be constructed with smooth steel pipe with a minimum 1.25 inches outside diameter. The trashrack ends and bracing should be constructed with steel angle sections. All trashrack components will have a corrosion protective finish.

##### 2. Trashrack Design

The trashracks will be constructed without cross-braces (if possible) in order to minimize debris clogging. The trashrack will be designed to withstand the full hydraulic load of a completely plugged trashrack based on the highest anticipated depth of ponding at the trashrack. The trashrack will also be hinged and removable for maintenance purposes. The clear opening at the bottom should be 9 to 12 inches to permit debris at low flow to go through.

##### 3. Bar Spacing

The steel pipe bars will be spaced with a clear opening of 4 ½ to 5 inches. In addition, the entire rack will have a minimum clear opening area (normal to the rack) at the design flow depth of four times the culvert opening area.

##### 4. Trashrack Slope

The trashrack will have a longitudinal slope of no steeper than 3 horizontal to 1 vertical for maintenance purposes.

##### 5. Hydraulics

Hydraulic losses through trashracks will be computed using the following equation:

---

$$H_T = 0.11 (TV/D)^2 (\sin A)$$

where:

- H<sub>T</sub> = Head Loss through Trashrack (feet)
- T = Thickness of Trashrack Bar (inches)
- V = Velocity Normal to Trashrack (fps)
- D = Center-to-Center Spacing of Bars (inches)
- A = Angle of Inclination of Rack with Horizontal

This equation will apply to all racks constructed normal to the approach flow direction. The velocity normal to the trashrack will be computed considering the rack to be 50 percent plugged.

This equation is a modification of the equation presented in *Design Standards No. 3 - Canals and Related Structures*, U.S. Department of the Interior, Bureau of Reclamation, Denver, Colorado. The modification consists of changing the computed head loss from inches to feet and eliminating the factor which accounts for approach flow directions other than normal to the trashrack.

Safety Grates will be required when it is not possible to “see daylight” from one end of the culvert to the other, the culvert is less than 42 inches in diameter, or conditions within the culvert (bends, obstructions, vertical drops) or at the outlet are likely to trap or injure a person.

11.4 Design Example

The procedure recommended to evaluate existing and proposed culverts is based on the procedures presented in HEC-5, *Hydraulic Charts for the Selection of Highway Culverts* HEC No. 5, USDOT, FHWA. The methodology consists of evaluating the culvert headwater requirements, assuming both inlet control and outlet control. The rating which results in the larger headwater requirements is the governing flow condition.

A sample calculation for rating an existing culvert is presented in Table 1102. The required data are as follows:

- Culvert size, length and type (48" CMP, L = 150', n = .024).
- Inlet, outlet elevation and slope (5540.0, 5535.5, so = 0.030).
- Inlet treatment (flared end-section).
- Low point elevation of embankment (EL = 5551.9).
- Tailwater rating curve (see Table 1102, Column 5).

From the above data, the entrance loss coefficient, K<sub>2</sub>, and the n-value are determined. The full flow Q and the velocity are calculated for comparison. The rating then proceeds in the following sequence:

- Step 1: Headwater values are selected and entered in column 3. The headwater to pipe diameter ratio (Hw/D) is calculated and entered in column 2. If the culvert is other than circular, the height of the culvert is used.
- Step 2: For the Hw/D ratios, the culvert capacity is read from the rating curves (Section-11.3.3) and entered into column 1. This completes the inlet condition rating.
- Step 3: For outlet condition, the Q values in column 1 are used to determine the head values (H) in column 4 from the appropriate outlet rating curves (Section-11.3.3).
- Step 4: The tailwater depths (Tw) are entered into column 5 for the corresponding Q values in column 1 according to the tailwater rating curve (i.e., downstream channel rating computations). If the tailwater depth (Tw) is less than the diameter of the culvert (D), column 6 and 7 are to be calculated (go to Step 5). If Tw is more than D, the tailwater values in column 5 are entered into column 8 for the ho values

and proceed to Step 6.

Step 5: The critical depth (dc) for the corresponding Q values in column 1 are entered into column 6. The average of the critical depth and the culvert diameter is calculated and entered into column 7 as the ho values.

Step 6: The headwater values (Hw) are calculated according to the equation:

---

$$H_w = H + h_o - LS_o$$

---

where H is from column 4, and ho is from column 8 (for Tw>D) or the larger value between column 5 and column 7 (for Tw<D). The values are entered into column 9.

Step 7: The final step is to compare the headwater requirements (columns 9 and 3) and to record the higher of the two values in column 10. The type of control is recorded in column 11, depending upon which case gives the higher headwater requirements. The headwater elevation is calculated by adding the controlling Hw (column 10) to the upstream invert elevation. A culvert rating curve can then be plotted from the values in columns 12 and 1.

To size a culvert crossing, the same form can be used with some variations in the basic procedures. First, a design capacity is selected and the maximum allowable headwater is determined. An inlet type (i.e., headwall) is selected, and the invert elevations and culvert slope are estimated based upon site constraints. A culvert type is then selected and first rated for inlet control and then for outlet control. If the controlling headwater exceeds the maximum allowable headwater, a different culvert configuration is selected and the procedure repeated until the desired results are achieved.

11.5 Culvert Sizing Criteria

11..5.1 Culverts within Drainageways

The sizing of a culvert is dependent upon two factors, the street classification and the allowable street overtopping. The allowable street overtopping for the various street classifications is set forth in Section 10.3. In addition to this policy, a criteria requiring that no street overtopping occur for a 10-year frequency storm has been established. Therefore, as a minimum design standard for street crossings, the following procedure will be used:

1.

Using the future developed conditions 100-year runoff, the allowable street overtopping will be determined from overflow rating curves developed from the street profile crossing the waterway.
2.

The culvert is then sized for the difference between the 100-year runoff and the allowable overtopping.
3.

If the resulting culvert is smaller than that required to pass the 10-year flood peak without overtopping, the culvert will be increased in size to pass the 10-year flow.

The CRITERIA is considered a minimum design standard and must be modified where other factors are considered more important. For instance, if the procedure still results in certain structures remaining in the 100-year floodplain, the design frequency may be increased to lower the floodplain elevation. Also, if only a small increase in culvert size is required to prevent overtopping, then the larger culvert is recommended.

11..5.2. Cross Culverts and Driveway Culverts within Street/Roadside Ditches

Minimum sizing of culverts is delineated in Section 11.6 of these CRITERIA. As a minimum, cross culverts and driveway culverts shall be designed to accommodate the ditch capacity.

11.6 Checklist

To aid the designer and reviewer, the following checklist has been prepared:

1.

Minimum culvert size within the public ROW, such as cross tubes, is 18-inch diameter round or equivalent for other shapes.

2. Minimum culvert size for street/roadside ditches at driveways is 15-inch diameter round or equivalent for other shapes.
3. Headwalls, wingwalls or flared end sections required for all culverts in accordance with these CRITERIA.
4. Check outlet velocity and provide adequate protection.
5. Check structural requirements.

Table 1101

### Hydraulic Data for Culverts

#### Pipe Roughness Coefficients

Manning's n-value	
Sewer Type	Capacity Calculation
RCP	0.015
CSP	0.026
HDPE/HP	0.012

#### (D) Culvert Entrance Losses

Type of Entrance	Entrance Coefficient, Ke
<b>Pipe</b>	
Headwall	
Grooved edge	0.20
Rounded Edge (0.15D radius)	0.15
Rounded edge (0.25D radius)	0.10
Square edge (cut concrete and CMP)	0.40
Headwall & 45° Wingwall	
Grooved edge	0.20
Square edge	0.35
Headwall with Parallel Wingwalls Spaced 1.25D apart	
Grooved edge	0.30
Square edge	0.40
Projecting entrance	
Grooved edge RCP	0.25
Square edge RCP	0.50
Sharp edge, thin wall CMP	0.90
Flared-end Section	0.50
<b>Box, Reinforced Concrete</b>	
Headwall Parallel to Embankment (no wingwalls)	
Square edge of 3 edges	0.50
Rounded on 3 edges to radius of 1/12 barrel dimension	0.20
Wingwalls at 30° to 75° to barrel	
Square edged at crown	0.40
Crown edge rounded to radius of 1/12 barrel dimension	0.20
Wingwalls at 10° to 30° to barrel	
Square edged at crown	0.50
Wingwalls parallel (extension of sides)	
Square edged at crown	0.70

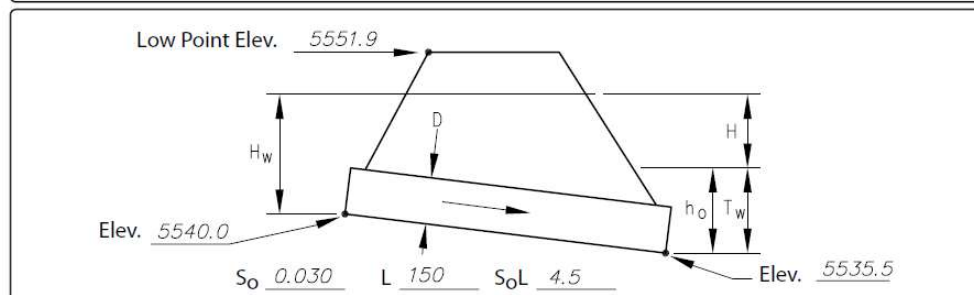
*Note: The entrance loss coefficients are used to evaluate the culvert or sewer capacity operating under outlet control.*

*Reference: Handbook of Steel Drainage and Highway Construction Products, AISI 1991*

Table 1102

**Standard Form SF-3 Culvert Rating**

Project: Design Example Location: Jefferson County Station: 2+00

**Culvert Data**Type: 48" CMP  $n$ : 0.024Inlet: Flared End Section  $Q_{Full}$ : 13.5 $K_e$ : 0.5  $K_{Full}$ : 10.7**Outlet Control Equations**

- $H_w = H + h_o - LS_o$
- For  $T_w < D$ ,  $h_o = \frac{D_c + D}{2}$  or  $T_w$  (whichever is greater)
- For box culvert:  $d = 0.315(Q/B)^{3/4} \leq D$   
(for any other shapes see HEC-5)

Q	Inlet Control		Outlet Control						Cont.	Control	Elev.
	$H_c$ $D$	$H_w$	H	$T_w$	$T_o < D$		$T_o > D$	$H_o$	$H_w$	$H_w$	
					$D_c$	$\frac{D_c + D}{2} = h_o$					
1	2	3	4	5	6	7	8	9	10	11	12
70	1.0	4	1.9	1.5	2.5	3.3		0.7	4	Inlet	5544.0
115	1.5	6	5.5	2.0	3.0	3.5		4.5	6	Inlet	5546.0
145	2.0(3)	8	8.9	2.5	3.4	3.7		8.1	8.1	Outlet	5548.8
170(1)	2.5(3)	10	12.5	3.0	3.7	3.9		11.9	11.9	Outlet	5551.9
195(2)	3.0(3)	12	16.0	3.5	4.0	4.0		15.5	15.5	Outlet	5555.5

Outlet Velocity,  $V = Q/A = 170 \text{ cfs}/12.8 \text{ ft}^2 = 13.5 \text{ fps}$ 

Notes:

- (1) Culvert capacity
- (2) Road overtopping
- (3) Example only

## Chapter 12 - Hydraulic Structures

### 12.1 Introduction

Hydraulic structures are used in storm drainage work to control the flow of the runoff. The energy associated with flowing water has the potential to create damage to the drainage works, especially in the form of erosion. Hydraulic structures, which include Conduit Outlet Structures, energy dissipators, check structures, bridges and irrigation ditch crossings, all control the energy and minimize the damage potential of storm runoff.

The criteria to be used in the design of hydraulic structures will be in accordance with the *Manual*. The specific criteria to be used with the modifications for the County are presented herein.

### 12.2 Conduit Outlet Structures

Outlet protection designed for the 100 year storm event is required for all storm-sewer and culvert locations. The design of Conduit Outlet Structures will be in accordance with the *Manual*.

### 12.3 Channel Grade Control Structures (Check and Drop Structures)

As discussed in chapter, "Open Channels," there is a maximum permissible velocity for major design storm runoff in grass lined channels. One of the more common methods of controlling the flow velocity is to reduce the channel invert slope, which requires a check drop to make up for the elevation difference occurring when the channel slope is reduced.

The design criteria for the check and drop structures will be in accordance with the *Manual*.

### 12.4 Bridges

The design of bridges within the County will be in accordance with the *Manual*. The design capacity of the bridge will be determined by the method presented in Section 11.5 of these *CRITERIA*.

### 12.5 Irrigation Ditch Crossings

Any proposed development in the vicinity of the ditches or canals that crosses or utilizes the canal for surface drainage or proposes to make any modifications to the existing topography which alters and/or affects water quality and drainage patterns to the ditch will have the plans approved by the ditch company prior to approval by the County.

## Chapter 13 - Stormwater Quality Management

### 13.1 Introduction

The intent of this Chapter is to present minimum criteria for the implementation and use of BMPs in order to achieve the goal of mitigated stormwater quality during construction and after construction. Compliance with these *CRITERIA* does not require water quality monitoring by the individual developer, or quantitative descriptions of pollutant load removal. Instead, a performance-based approach is required for erosion, sediment and pollutant transport control. Individual methods must be selected and implemented to best fit the conditions and requirements of each site.

The quality of stormwater runoff from developed lands and urbanized areas can be impacted by some or all of the sources and pollutants shown in Table 1301. Stormwater quality control methods and techniques have been developed for two distinct phases of urbanization: the initial construction period of land disturbing activities and the ongoing response of the urban system to rainfall and runoff events. Site planning and engineering for developing lands must provide controls for both phases of urbanization. The general objectives for each of these two phases of urbanization are discussed in this chapter.

Table 1301

#### Possible Sources of Pollutants in Stormwater

Source	Contaminant
Vehicles, Machinery and Industrial Activities	Metals, Lubricants, Solvents, Paints
Lawn Care, Gardening	Pesticides, Herbicides, Fertilizers, Sediments
Household Chemicals	Paints, Solvents, Detergents, Disinfectants, Cleaners, Chlorine
General Population	Litter, Trash, Debris
Pets and Animals	Fecal Matter, Organic Wastes
Parking Lots	Oil, Grease, Automotive Fluids, Sediments
Construction	Soil and Sediment Particles

### 13.2 Temporary Erosion Control for Construction Activities

Construction activities that disturb the natural soil and vegetation have the potential to increase soil erosion and sediment movement. The disturbed, loose soil is easily eroded by the forces of rainfall, concentrated runoff and wind.

Erosion and sediment control practices are required, to the maximum extent practicable, on all developing sites. These practices are required to prevent disturbed soils from leaving the site and to maintain stormwater quality at a level comparable to the historic runoff conditions that existed prior to the construction activities.

Site planning and design must meet all of the objectives for stormwater quality control. Design and performance information for a variety of erosion and sediment control measures that are currently in practice or recommended for use in the region is presented in detail in the *Manual*.

The Land Disturbance Section of the ZR describes the submittal requirements and specifications for grading and erosion control plans and the minimum performance standards for site grading and erosion and sediment control.

### 13.3 Permanent Controls for Stormwater Quality Management

#### 13.3.1 Objectives for Permanent Stormwater Quality Control

Jefferson County requires that land undergoing development activities incorporate BMPs to achieve the objectives of permanent stormwater quality control. The following principles and objectives of stormwater quality BMPs will be used by the County to determine if adequate controls have been proposed during the site design and development process:

Minimize, to the maximum extent practicable, impacts of stormwater on receiving waters. An effective level of urban pollutant removal should be accomplished by the selected BMPs.

The site's physical constraints need to be considered. Select and design BMPs to work within the conditions on the site.

Economic impacts of the selected BMPs must be considered. Controls must be evaluated for installation (construction) costs and for future operation and/or maintenance costs.

Multi-use benefits should be incorporated within stormwater quality features whenever possible. Land intensive BMPs, such as detention/retention ponds and vegetative strips should be designed to incorporate recreational and aesthetic features such as open space and landscape values whenever possible.

Opportunities for participation in master-planned regional facilities have been considered. The County will be contacted to determine if regional facilities for stormwater quality control may be available to the planned site.

#### 13.3.2 BMPs for Permanent Control

The Four-Step Process described in the *Manual*, is required for selecting structural BMPs in developing areas. Selection of a BMP must include consideration of long-term function and maintenance design expectations, an estimate of annual maintenance costs and maintenance schedule, the source of funding and anticipated life of the structural BMP.

##### Step 1. Employ Runoff Reduction Practices

To reduce runoff peaks and volumes from urbanizing areas, employ a practice generally termed "minimizing directly connected impervious areas" (MDCIA). The principal behind MDCIA is twofold – to reduce impervious areas and to route runoff from impervious surfaces over grassy areas to slow down runoff and promote infiltration. The benefits are less runoff, less stormwater pollution and less cost for drainage infrastructure.

###### a. Reduce "Actual" Impervious Area

- Replace regular pavement with permeable interlocking concrete pavement (PICP) and reinforced grass pavement.
- Replace storm sewer or hard surface swales with grass swales

###### b. Reduce "Effective" Impervious Area

- Direct runoff from impervious surfaces to grass buffers or grass swales
- Replace curb and gutter with grass swales
- Direct stormwater from parking lot(s) into an infiltration and/or water quality BMP prior to conveyance to the stormwater detention and water quality pond

##### Step 2. Provide Water Quality Capture Volume (WQCV)

A fundamental requirement for any site addressing stormwater quality is to provide WQCV. One or more of the many types of water quality basins, each draining slowly to provide for long-term settling of sediment particles, may be selected (*Manual*, Chapter 4, Treatment BMP's).

- Permeable Pavement Systems
- Bioretention (Rain Garden or Porous Landscape Detention)
- Extended Detention Basin
- Sand Filter Basin
- Constructed Wetland Basin
- Underground Practices
- Retention Pond

##### Step 3. Stabilize Drainageways

Drainageway erosion, natural and manmade, can be a major source of sediment and associated constituents, such as phosphorus. Natural drainageways are often subject to bed and bank erosion when urbanizing areas increase the frequency, rate and volume of runoff. It is important that drainageways adjacent to or traversing development sites be stabilized. One of three basic methods of stabilization



may be selected.

- Constructed Grass or Riprap
- Stabilized Natural Channel
- Constructed Wetland Channel

#### Step 4. Implement Industrial and Commercial BMPs

If the development includes industrial or commercial uses, the need for specialized BMPs must be considered.

- Covering Storage and Handling Areas
- Spill Containment and Control

#### Other BMPs

Manufactured devices such as water quality vaults and inlets, infiltration trenches and oil/grease separators, may be considered when stormwater quality is not required in accordance with Section 3.3.7 and site constraints do not allow for full implementation of Step 1 and Step 2 BMPs.

#### 13.3.3 Minimum Design Criteria

It is expected that the BMPs designed for each site will vary depending on land use, extent of development, redevelopment constraints and the physical characteristics of the site (soils, slope and runoff).

The County will evaluate the adequacy and appropriateness of the proposed BMPs based on their fulfillment of the previously stated objectives, as well as the satisfaction of the following minimum design criteria:

1. A site specific Stormwater Quality Control Plan and associated hydraulic calculations will be incorporated in the Phase III Drainage Report and plan describing: the type of BMPs selected and associated hydraulic calculations, a construction and implementation schedule and a description of long term maintenance requirements and responsibilities.
2. The design of sites will incorporate one or more BMPs from Step 1 and Step 2 designed to capture and treat the calculated EURV as defined in the *Manual*.

When incorporating Excess Urban Runoff Volume (EURV) into a stormwater quantity detention basin, the capacity will be based on the following:

Onstream WQCV and EURV facilities are not recommended unless they are designed as regional facilities. If a non-regional WQCV and EURV facility is placed onstream, it must be designed to serve the upstream watershed based on current development conditions.

3. The design of sites will incorporate one or more BMPs from Steps 3 and 4 depending on the planned use of the site and the proximity to drainageways.
4. Design criteria for manufactured devices are dependent on the specific device. The appropriateness of a device will be considered on a case-by-case basis.
5. Non-residential projects which include more than the required number of parking spaces will be required to employ one or more Step 1 BMPs to limit the effective impervious area which would result from the minimum required number of parking spaces as determined by the ZR.
6. Permanent erosion protection and stabilization measures will be provided for all disturbed areas.

#### 13.3.4 Control Measure Requirements

The control measures for applicable development sites shall meet one of the following base design standards listed below:

(A) WQCV Standard: The control measure(s) is designed to provide treatment and/or infiltration of the WQCV and:

- 1) 100% of the applicable development site is captured, except Jefferson County staff may exclude up to 20%, not to exceed 1 acre, of the applicable development site area when Jefferson County staff has determined that it is not practicable to capture runoff from portions of the site that will not drain towards control measures. In addition, the applicant must provide documentation that the implementation of a separate control measure for that portion of the site is not practicable (e.g., driveway access that drains directly to street).
- 2) Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the control measure implemented. Consideration of drain time shall include maintaining vegetation necessary for operation of the control measure (e.g., wetland vegetation).

(B) Pollutant Removal Standard: The control measure(s) is designed to treat at a minimum the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30 mg/L or less.

- 1) 100% of the applicable development site is captured, except Jefferson County staff may exclude up to 20% not to exceed 1 acre of the applicable development site area if Jefferson County staff has determined that it is not practicable to capture runoff from portions of the site that will not drain towards control measures. In addition, Jefferson County staff must also determine that the implementation of a separate control measure for that portion of the site is not practicable (e.g., driveway access that drains directly to street).

(C) Runoff Reduction Standard: The control measure(s) is designed to infiltrate into the ground where site geology permits, evaporate, or evapotranspire a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area for the applicable development site discharged without infiltration. This base design standard can be met through practices such as green infrastructure. "Green infrastructure" generally refers to control measures that use vegetation, soils, and natural processes or mimic natural processes to manage stormwater. Green infrastructure can be used in place of or in addition to low impact development principles.

(D) Applicable Development Site Draining to a Regional WQCV Control Measure: The regional WQCV control measure must be designed to accept the drainage from the applicable development site. Stormwater from the site must not discharge to a water of the state before being discharged to the regional WQCV control measure. The regional WQCV control measure must meet the requirements of the MS4 Permit.

(E) Applicable Development Site Draining to a Regional WQCV Facility: The regional WQCV facility is designed to accept drainage from the applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the applicable development site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. The control measure must be designed in accordance with a design manual identified by the permittee. In addition, the stream channel between the discharge point of the applicable development site and the regional WQCV facility must be stabilized.

The regional WQCV facility must meet the following requirements:

- 1) The regional WQCV facility must be implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.
- 2) The regional WQCV facility must be designed and maintained for 100% WQCV for its entire drainage area.
- 3) The regional WQCV facility must have capacity to accommodate the drainage from the applicable development site.
- 4) The regional WQCV facility be designed and built to comply with all assumptions for the development activities planned within its drainage area, including the imperviousness of its drainage area and the applicable development site.
- 5) Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the facility. Consideration of drain time shall include maintaining vegetation necessary for operation of the facility (e.g., wetland vegetation).

6) The regional WQCV facility shall meet the requirements in the MS4 Permit for the regional WQCV facility consistent with requirements and actions for control measures.

7) The regional WQCV facility must be subject to Jefferson County's authority consistent with requirements and actions for a Control Measure in accordance with the MS4 Permit.

8) Regional Facilities must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered Regional Facilities. Water bodies listed by name in surface water quality classifications and standards regulations (5 CCR 1002-32 through 5 CCR 1002-38) may not be considered regional facilities.

(F) Constrained Redevelopment Sites Standard:

1) Applicability: The constrained redevelopment sites standard applies to redevelopment sites meeting the following criteria:

(a) The applicable redevelopment site is for a site that has greater than 75% impervious area, and

(b) Jefferson County staff has determined that it is not practicable to meet any of the design standards in the MS4 Permit, or

(c) Jefferson County staff determination shall include an evaluation of the applicable redevelopment sites ability to install a control measure without reducing surface area covered with the structures.

2) Constrained Redevelopment Sites Design Standard: The control measure(s) is designed to meet **one** of the following:

(a) Provide treatment of the WQCV for the area captured. The captured area shall be 50% or more of the impervious area of the applicable redevelopment site. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the control measure implemented,

(b) The control measure(s) is designed to provide for treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30 mg/L or less. A minimum of 50% of the applicable development area including 50% or more of the impervious area of the applicable development area shall drain to the control measure(s). This standard does not require that 100% of the applicable redevelopment site area be directed to control measure(s) as long as the overall removal goal is met or exceeded (e.g., providing increased removal for a smaller area), or

(c) Infiltrate, evaporate, or evapotranspire, through practices such as green infrastructure, a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area for the applicable redevelopment site discharged without infiltration.

13.3.5 Site Plan Requirements

(A) Site Plan Requirements: Site plans that include control measures for the applicable development sites must include the following:

1) Design details for all structural control measures implemented to meet the requirements of the MS4 Permit.

2) A narrative reference for all non-structural control measures for the site, if applicable. "Non-structural control measures" are control measures that are not structural control measures, including control measures that prevent or reduce pollutants being introduced to water or that prevent or reduce the generation of runoff or illicit discharges.

3) Documentation of operation and maintenance procedures to ensure the long term observation, maintenance, and operation of the control measures. The documentation shall include frequencies for routine inspections and maintenance activities.

4) Documentation regarding easements or other legal means for access of the control measure sites for operation, maintenance, and inspection of control measures.

(B) Site Plan Review: The site plan review shall include the following minimum requirements designed to prevent inadequate control measures from being implemented or modified:

- 1) Jefferson County approval of the control measures shall include confirmation that control measures meet the requirements of the MS4 Permit.
- 2) Jefferson County approval of the that site plans meet the requirements of the MS4 Permit

## Chapter 14 – Detention

### 14.1 Introduction

The criteria presented in this chapter will be used in the design and evaluation of all facilities. The review of all planning submittals (refer to Chapter 2) will be based on the criteria presented in this section.

The main purpose of a detention facility is to store the excess storm runoff associated with an increased basin imperviousness and discharge this excess at a rate similar to the rate experienced from the basin without development. Any special design condition which cannot be defined by these *CRITERIA* will be reviewed by Planning and Zoning before proceeding with design.

Dams and water diversion/detention areas should be designed and constructed to appear as natural features, creating site amenities. Techniques to achieve this include creation of topographic changes that mimic natural conditions (including a variety of slope changes), using natural materials such as stone, blending with the textures and patterns of the surrounding landscape and using materials that match the local environment. When possible, preserve existing drainage patterns.

### 14.2 Detention Methods

The various detention methods are defined on the basis of where the facility is constructed, such as open space detention, parking lot or underground. Full spectrum detention is required for all new storm drainage facilities. Full spectrum detention is required for all modified facilities if additional pond volume is necessary due to an increase in the proposed development area and/or increased designed impervious area. Full Spectrum Detention will be designed as outlined in Chapter 13 and the *Manual*.

### 14.3 Design Criteria

#### 14.3.1 Volume and Release Rates

The maximum release rates, volumes and drain times are determined from 90% of pre-developed flow conditions *or the latest update from the Manual and design spreadsheets*.

When designing water quality and detention facilities reference the latest version of Urban Drainage UD-Detention software.

Drain times must be in conformance with CRS 37-92-602 (8).

#### 14.3.2 Design Frequency

All detention facilities are to be designed for the 100-year recurrence interval flood.

#### 14.3.3 Hydraulic Design

Hydraulic design data for sizing of detention facilities outlet works is as follows:

##### 1. Weir flow

The general form of the equation for horizontal crested weirs is:

---

$$Q = CLH^{3/2}$$

Where Q = discharge (cfs)

C = weir coefficient

(Table 1401)

L = horizontal length (feet)

H = total energy head (feet)

---

Another common weir is the v-notch; the equation is as follows:

---

$$Q = 2.5 \tan (\theta/2) H^{5/2}$$

Where  $\theta$  = angle of the notch at the apex (degrees)

---

When designing or evaluating weir flow, the effects of submergence must be considered. A single check on submergence can be made by comparing the tailwater to the headwater depth. The example calculation for a weir design on Figure 1403 illustrates the submergence check.

## 2. Orifice Flow

The equation governing the orifice opening and plate is the orifice flow equation:

---

$$Q = C_d A (2gh)^{1/2}$$

Where  $Q$  = Flow (cfs)

$C_d$  = Orifice coefficient

$A$  = Area (ft<sup>2</sup>)

$g$  = Gravitational constant = 32.2 ft/sec<sup>2</sup>

$h$  = Head on orifice measured from centerline of orifice (ft)

An orifice coefficient ( $C_d$ ) value of 0.65 will be used for sizing of square edged orifice openings and plates.

---

## 14.4 Design Standards for Open Space Detention

### 14.4.1 State Engineer's Office

Any dam constructed for the purpose of storing water, with a surface area, volume or dam height as specified in CRS 37-87-105 as amended, will require the approval of the plans by the State Engineer's Office. All detention storage areas will be designed and constructed in accordance with these *CRITERIA*. Those facilities subject to the state statutes will be designed and constructed in accordance with the criteria of the state.

### 14.4.2 Grading Requirements

Slopes on riprapped earthen embankments will not be steeper than 3 (horizontal) to 1 (vertical). For grassed detention facilities, the minimum bottom slope will be 2.0 percent measured perpendicular to the trickle channel. Slopes for detention ponds that are eligible for Urban Drainage maintenance assistance will not be steeper than 4 (horizontal) to 1 (vertical).

### 14.4.3 Retaining Walls

Retaining walls are permitted in detention ponds below the 100-year water surface elevation as long as all of the following requirements are met.

- The retaining wall must be made of large blocks (one-ton weight per block or heavier) or monolithic pour concrete.

- The retaining wall must not exceed 50% of the detention pond perimeter for residential or institutional use.
- Safety improvements are provided as required by Planning and Zoning. Examples include but are not limited to fencing and guardrails.

#### 14.4.4 Freeboard Requirements

The minimum required freeboard for open space detention facilities is 1.0 foot above the computed 100-year water surface elevation.

#### 14.4.5 Trickle Flow Control

All grassed bottom detention ponds, except porous landscape detention, will include a concrete lined trickle channel or equivalent performing materials and design. Trickle flow criteria is presented in Section 7.4.2.6(a).

#### 14.4.6 Outlet Configuration

See the *Manual's* Outlet Structure Fact Sheet in Chapter 4 of Volume 3 for details. Minimum pipe outlet size is 15 inches. Trash racks are required for all water quality and EURV openings and will be designed in accordance with the *Manual*.

The outlet will be designed to minimize unauthorized modifications, which affect proper function. A sign with a minimum area of 0.75 square feet will be attached to the outlet or posted nearby with the following message:

---

#### WARNING

Unauthorized modification of this outlet is a knowing violation of Section 309 of the Clean Water Act.  
Punishment: Fine and/or Imprisonment: 3-6 years

---

The 100-year discharge must pass over the weir and therefore the weir must be of adequate length. The effective weir length (L) occurs for three sides of the box. To ensure the 100-year control occurs at the throat of the outlet pipe, a 50 percent increase in the required weir length is required. In addition, the outlet pipe must have an adequate slope to ensure throat control in the pipe.

#### 14.4.7 Embankment Protection

Whenever a detention pond uses an embankment to contain water, the embankment will be protected from catastrophic failure due to overtopping. Overtopping can occur when the pond outlets become obstructed or when a larger than 100-year storm occurs. Failure protection for the embankment will be provided by a separate emergency spillway having a minimum capacity of twice the maximum release rate for the 100-year storm, or in the form of a buried heavy riprap layer on the entire downstream face of the embankment. Emergency spillways will be directed toward an open channel, natural drainageway, street/roadside ditch or a street (see Figure 1407). Structures will not be permitted in the path of the emergency spillway or overflow. The invert of the emergency spillway should be set equal to or above the 100-year water surface elevation.

#### 14.4.8 Vegetation Requirements

All open space detention ponds under 7000 feet in elevation will be revegetated by either irrigated sod or natural dry-land grasses in accordance with the *Manual*. Detention ponds above 7000 feet in elevation will be revegetated according to the recommendations of the JCD and/or the *Jefferson County Small Site Erosion Control Manual*.

### 14.5 Design Standards for MPLD

MPLD may be used only for single family residential developments within the mountains. See Figure 1408 for the design requirements for MPLD.

All non-lot specific designs of MPLD is required at the time of development process. Lot specific design of the MPLD may be delayed until the time of building permit at the discretion of the Planning and Zoning subject to the following requirements.

- The Phase III Drainage Report includes the MPLD volume calculations and soil type/classification and percolation test if in soil type C and/or D

- The Phase III Drainage Report discusses the general location of the MPLD's and the proposed septic system, if any
- The Phase III Drainage Report includes a typical design of an MPLD
- Drainage easements and performance guarantees for MPLD's are provided

**14.6 Design Standards for Parking Lot Detention**

The requirements for parking lot detention is as follows:

**14.6.1 Depth Limitation**

The maximum allowable design depth of the ponding for the 100-year flood is 12 inches.

**14.6.2 Freeboard Requirements**

The minimum required freeboard for parking lot detention facilities is .25 feet above the computed 100-year water surface elevation. There may need to be more than .25 feet of freeboard depending on overflow weir capacity calculations.

**14.6.3 Overflow Requirements**

All parking lot detention ponds will have a safe overflow that at a minimum has capacity for the 100-year allowable release rate.

**14.6.4 Outlet Configuration**

The minimum pipe size for the outlet is 15" diameter where a drop inlet is used to discharge to a storm sewer or drainageway. Where a weir and a small diameter outlet through a curb are used, the size and shape are dependent on the discharge/storage requirements. A minimum pipe size of 3" diameter is recommended.

**14.6.5 Performance**

To assure that the detention facility performs as designed, maintenance access will be provided in accordance with Section 3.3.9. The outlet will be designed to minimize unauthorized modifications which affect function. Any repaving of the parking lot will be evaluated for impact on volume and release rates and is subject to approval by Planning and Zoning

**14.6.6 Flood Hazard Warning**

All parking lot detention areas will have a minimum of two signs posted identifying the detention pond area. The signs will have a minimum area of 1.5 square feet and contain the following message:

WARNING

This area is a detention basin and is subject to periodic flooding to a depth of (provide design depth).

Any suitable materials and geometry of the sign are permissible, subject to approval by Planning and Zoning.

**14.6.7 EURV**

EURV in a parking lot must meet the standards for permeable interlocking concrete pavement (PICP) and reinforced grass pavement outlined in the *Manual*.

**14.7 Design Standards for Underground Detention**

The requirements for underground detention are as follows:

**14.7.1 Materials**



Underground detention will be constructed using ASP, HP, HDPE or RCP. The pipe thickness cover, bedding and backfill will be designed to withstand HS-20 loading or as required by Planning and Zoning.

14.7.2 Configuration

Pipe segments will be sufficient in number, diameter and length to provide the required minimum storage volume for the 100-year design. As an option, the design can be stored in the pipe segments and the difference for the 100-year stored above the pipe in an open space detention (Section 14.4) or in a parking lot detention (Section 14.5). The minimum diameter of the pipe segments will be 36 inches.

The pipe segments will be placed side by side and connected at both ends by elbow tee fittings and across the fitting at the outlet (see Figure 1405). The pipe segments will be continuously sloped at a minimum of 0.25% to the outlet. Manholes for maintenance access (see Section 14.6.5) will be placed in the tee fittings and in the straight segments of the pipe, when required.

Permanent buildings or structures will not be placed directly above the underground detention.

14.7.3 Overflow Requirements

All underground detention will have a safe overflow that at a minimum has capacity for the 100-year allowable release rate.

14.7.4 Inlet and Outlet Design

The outlet from the detention will consist of a short (maximum 25 ft.) length(s) of CSP, HP or RCP with a 15" minimum diameter. A two-pipe outlet may be required to control both design frequencies. The invert of the lowest outlet pipe will be set at the lowest point in the detention pipes. The outlet pipe(s) will discharge into a standard manhole (see CDOT M-604-20) or into a drainageway with erosion protection provided per Sections 11.3.2, 12.2 and 12.3. If an orifice plate is required to control the release rates, the plate(s) will be hinged to open into the detention pipes to facilitate back flushing of the outlet pipe(s).

Inlet to the detention pipes can be by way of surface inlets and/or by a local private storm sewer system.

14.7.5 EURV

EURV facilities must be designed in accordance with the *Manual* design criteria, unless it is demonstrated that the proposed method is as effective as the *Manual* design criteria.

14.7.6 Maintenance Access

Access easements to the detention site will be provided in accordance with Section 3.3.10. To facilitate cleaning of the pipe segments, 3-foot diameter maintenance access ports will be placed according to the following schedule:

Maintenance Access Requirements

Detention Pipe Size	Maximum Spacing	Minimum Frequency
36" to 54"	150'	Every pipe segment
60" to 66"	200'	Every other pipe segment
>66"	200'	One at each end of the battery of pipes

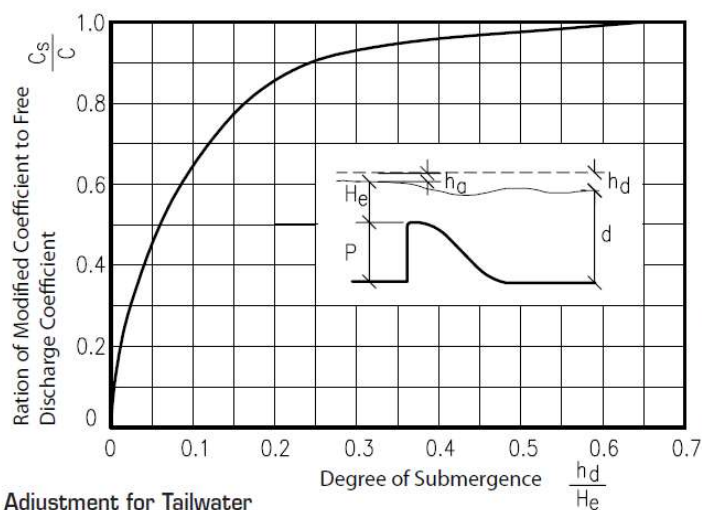
The manholes will be constructed in accordance with the detail on Figure 1405.

14.8 Design Standards for Combined Detention Ponds

Combined detention ponds, such as open space/parking lot detention, must meet the relevant set of design standards for design of each portion of the detention pond.

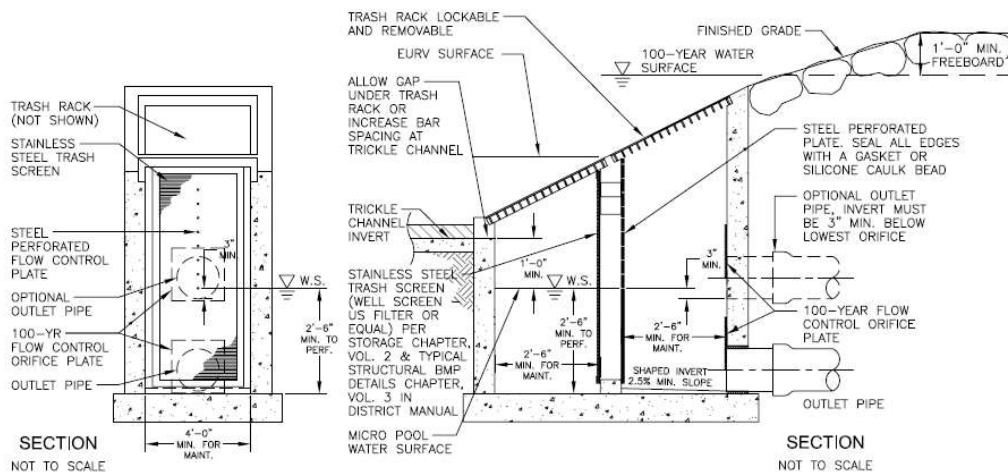
Table 1401  
Weir Flow Coefficients

Shape	Coefficient	Comments	Schematic
<b>Sharp Crested</b>	- (H in feet)		
Projection Ratio (H/P = 0.4)	3.4	H < 1.0	
Projection Ratio (H/P = 2.0)	4.0	H > 1.0	
<b>Broad Crested</b>			
W/Sharp U/S Corner	2.6	Minimum Value	
W/Rounded U/S Corner	3.1	Critical Depth	
<b>Triangular Section</b>			
<b>A) Vertical U/S Slope</b>			
1:1 D/S Slope	3.8	H > 0.7	
4:1 D/S Slope	3.2	H > 0.7	
10:1 D/S Slope	2.9	H > 0.7	
<b>B) 1:1 U/S Slope</b>			
1:1 D/S Slope	3.8	H > 0.5	
3:1 D/S Slope	3.5	H > 0.5	
<b>Trapezoidal Section</b>			
1:1 U/S Slope, 2:1 D/S Slope	3.4	H > 1.0	
2:1 U/S Slope, 2:1 D/S Slope	3.4	H > 1.0	
<b>Road Crossings</b>			
Gravel	3.0	H > 1.0	
Paved	3.1	H > 1.0	



Reference: King & Brater,  
Handbook of Hydraulics,  
McGraw Hill Book Company,  
1963 – Design of Small Dams,  
Bureau of Reclamation, 1977

Figure 1401  
**Detention Pond Outlet Configurations**  
 For small sites <5 acres



Adapted from the City and County of Denver Storm Drainage Criteria

Figure 1402  
**Detention Pond Details**

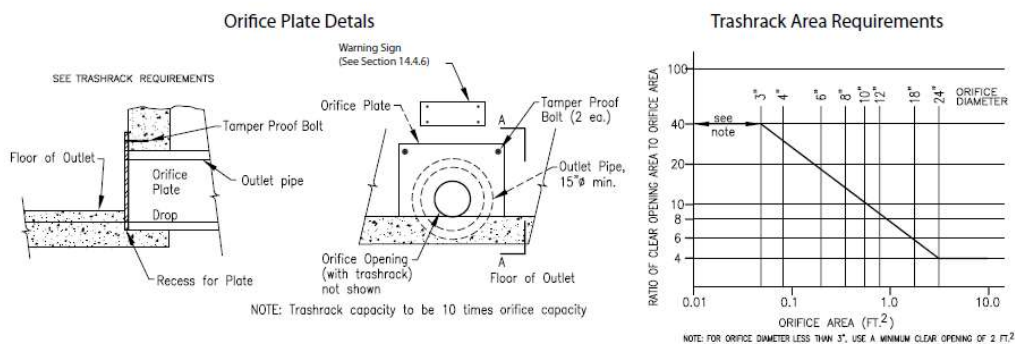
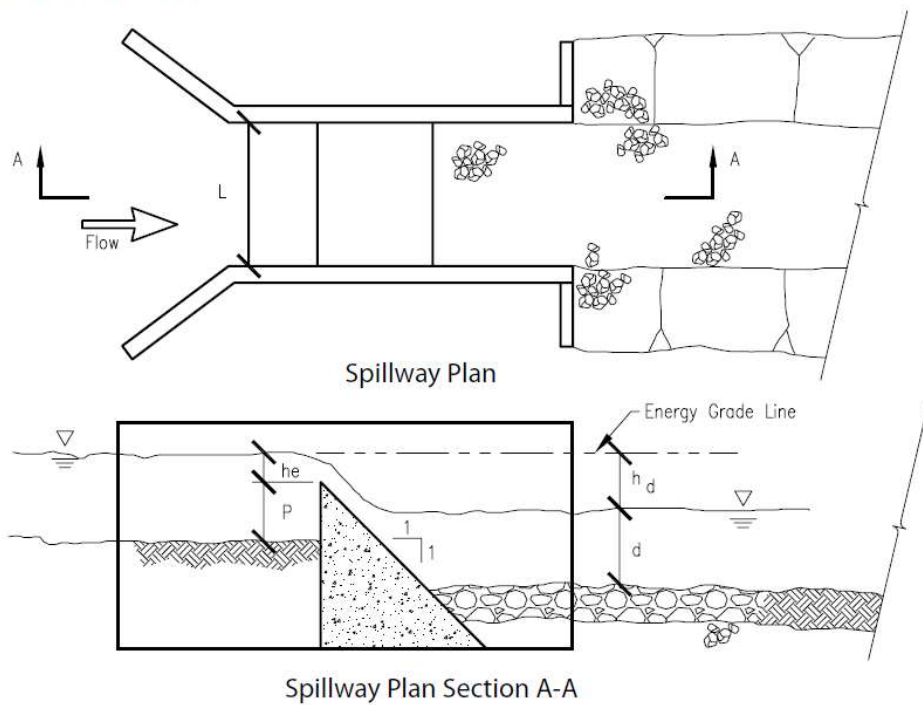


Figure 1403  
Weir Design Example



GIVEN:  $Q = 100$  CFS, Triangular weir with vertical face, and 1:1 downstream slope,  $p = 2'$ ,  $h_e = 2'$ , tailwater depth = 4.5',  $h_d = 1.5$

FIND:  $L$ , and check submergence

Solution:  $L_w = Q/CH^{3/2} = (100)/(3.8)/(2)^{3/2} = 9.3$  FT.

Submergence check

$\frac{h_d}{h_e} = \frac{1.5}{2.0} = 0.75$ , then from Table 1401,  $C_s/C = 1.0$ ,  
therefore no submergence adjustment is required.

**Section A-A**

100 year level

4'-0"

8"

EURV Surface Elev.

4.6"

C8x18.75 American Standard Structural Steel Channel. Trash Rack Attached By Welding

H Varies 1' Min.

3.75'

3 or 4

1

U.S. Filter\* Stainless Steel Well-Screen (or equal) Per Tables 6a-1, 6a-2

Micro Pool W.S.

C8x18.75 American Standard Structural Steel Channel Formed Into Concrete Bottom And Sides Of  $W_{conc}$ . Trash Rack Attached By Intermittent Welds.

Steel Perforated Flow Control Plate

H = .5'

3" Minimum

4"

100 Year Flow Control Orifice Plate 20" Diameter

100 year Outlet Pipe

15" Min.

Emergency spillway

1' min.

\*Design Engineer may use additional openings for 2 year or 10 year storms due to downstream capacity problems, 5 year and 10 year releases are always required.

**Section B-B - Plan View**

Steel Perforated Flow Control Plate

$W_{conc}$

Trash Rack Attached By Intermittent Welding All Around

6" Min.

Flow

**Section C-C**

Well-Screen Frame Attached To Channel By Intermittent Welds

Stainless Steel Support Bars

No. 93 Stainless Steel (U.S. Filter\* or Equal) Wires

0.139'

0.090"

Flow

Limits for this Standardized Design:

1. All outlet plate openings are circular.
2. Maximum diameter of opening = 2 inches.

1. All outlet plate openings are circular.
2. Maximum diameter of opening = 2 inches.

\*U.S. Filter, St. Paul, Minnesota, USA

\* Recommended only for Ponds with a large tributary area

Red indicates design example

Reference: Urban Drainage and Flood Control District Drainage Criteria

$$R \text{ Value} = (\text{net open area})/(\text{gross rack area}) = 0.60$$

Figure 1405  
**Underground Detention**

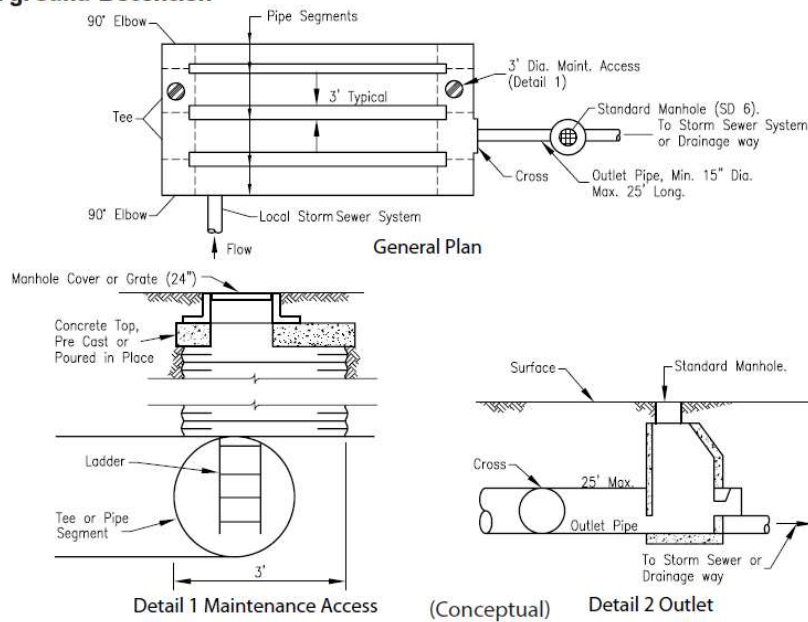


Figure 1406  
**Pond Forebay With Dissipator**

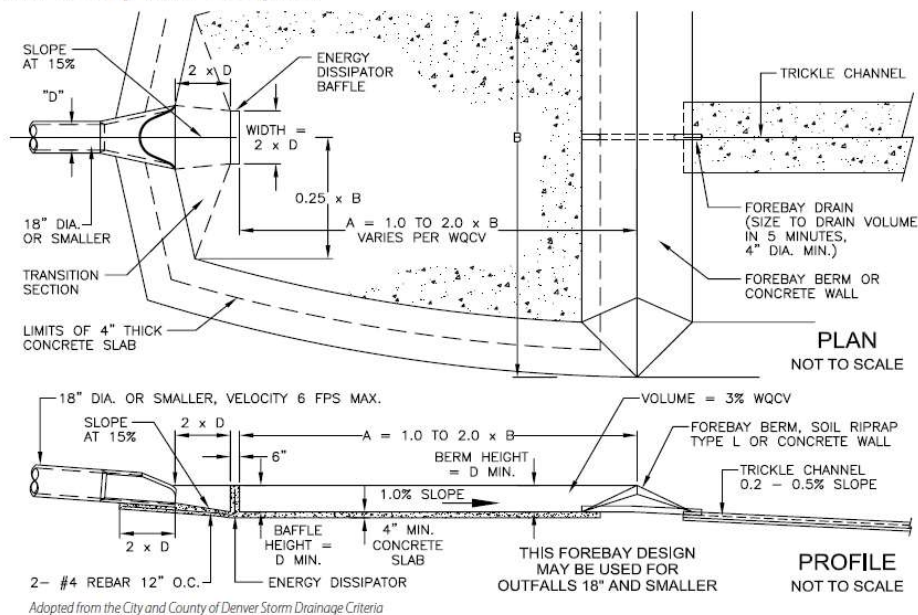
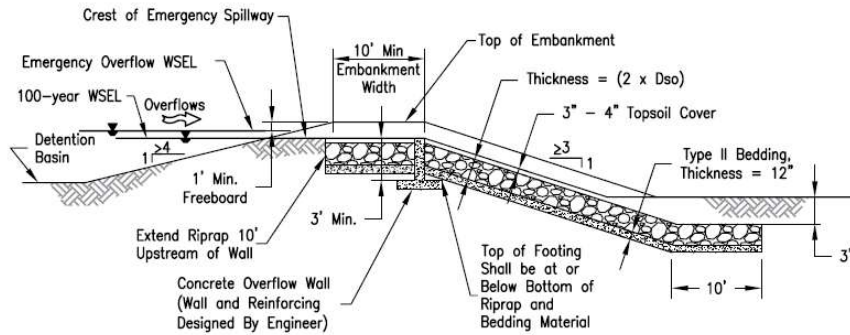


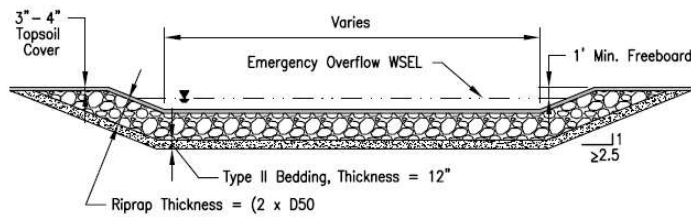


Figure 1407

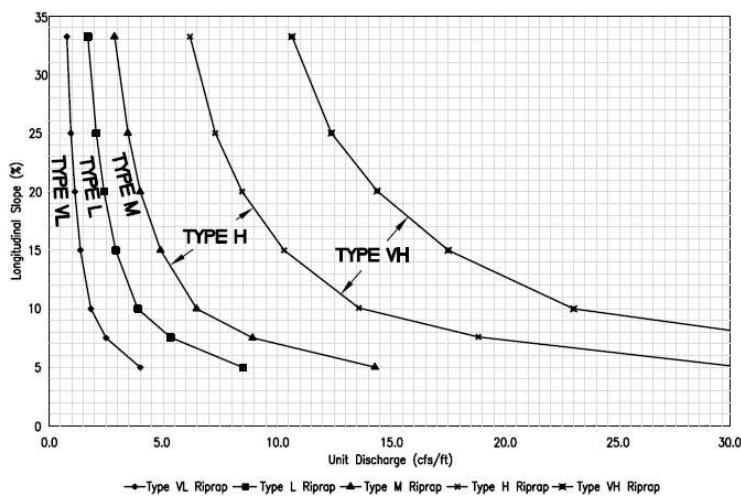
# **Embankment Protection Details And Rock Sizing Chart**



## **Emergency Spillway Profile**



## **Spillway Channel at Crest and Downstream Side of Embankment**

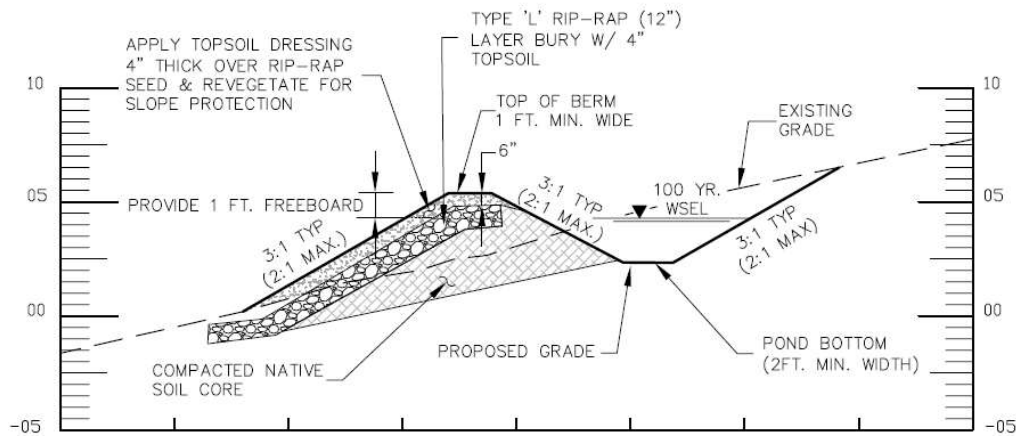


Reference: Douglas County Drainage Criteria

Figure 1408  
**Mountain Porous Landscape Design**

**NOTES:**

1. Volume of Mountain Porous Landscape Design pond (MPLD): 100 year plus full water quality volume.
2. NRCS Hydrologic Soil Group:
  - a.) Type A and B - No percolation test required.
  - b.) Type C and D - Provide percolation test data for each proposed MPLD. Perform percolation test at bottom elevation of proposed MPLD. Provide soil classification analysis.
3. Provide verification that there are at least 4-feet of suitable material below the bottom of the proposed MPLD to allow for sufficient infiltration. Maximum drain time is 72 hours.
4. Maximum depth of MPLD: 5-feet including 1-foot of freeboard.
5. Maximum internal and external slopes: 2: 1 (H: V). Provide up-slope/in-flow erosion control measures. Rolled erosion control products are required for slopes exceeding 3: 1.
6. Minimum pond bottom width: 2-feet.
7. Minimum top of berm width: 1-foot.
8. Elevation of top of berm shall be within 0.10 of a foot.
9. Overflow slope rip-rap: Type L minimum 12-inch minus. Verify with rip-rap calculations.
10. If the existing slope exceeds 30%, provide detail for key-in into native material. Based on site conditions, a slope stability analysis may be required.
11. The design engineer shall perform an open-hole inspection at time of excavation to verify soil conditions. The design engineer shall certify the volume of the MPLD with as-built drawings.
12. The MPLD shall be maintained by the property owner.





## Appendix

### Detention Facility Construction Drawing Checklist

#### General

- ☐ Overall plan view of Detention Basin
- ☐ Pond profile(s)
- ☐ Enlarged plan view of forebay(s) and construction details
- ☐ Enlarged plan view of micropool(s) and construction details
- ☐ Outlet structure construction details
- ☐ Construction details of other features and components

#### Overall Detention Plan View Details

- ☐ Prepare at a maximum scale of 1" =50'
- ☐ Proposed contours with contour labels and slope labels
- ☐ Existing contours with contour labels
- ☐ Show location and label forebay(s)
- ☐ Show location and label micropool
- ☐ Show location and label outlet structure
- ☐ Show location and label emergency overflow spillway
- ☐ Show location and label inflow pipe(s)
- ☐ Show location of stormwater management facility sign(s)
- ☐ Show location and label concrete trickle/low flow channel(s)
- ☐ Show location of riprap outlet protection
- ☐ Show location and label access/maintenance road(s) or ramps
- ☐ Show EURV water surface limits
- ☐ Show 100-year water surface elevation
- ☐ Existing and proposed utilities within or adjacent to Detention Basin
- ☐ Property/Tract boundaries
- ☐ Existing and proposed easements
- ☐ Label all proposed walls and provide spot elevations at top and bottom of wall

#### Detention Basin Profile(s)

- ☐ Low flow/trickle channel profile from inlet(s) to outlet structure

- ☐ Invert elevations, longitudinal grades along flow path
- ☐ Profile through outlet structure and outlet pipe (provide pipe sizes, length, slope and hydraulic grade line)
- ☐ Invert elevations and longitudinal slopes of outlet structure features
- ☐ Invert elevations and longitudinal slopes of outfall pipe
- ☐ EURV water surface elevation
- ☐ 100-year water surface elevation
- ☐ Micropool depths and elevations
- ☐ Emergency overflow spillway elevation (with top of bank elevations)
- ☐ Energy dissipation/rip rap protection at pond outlet
- ☐ Energy dissipation/rip rap protection at emergency overflow spillway

Enlarged plan view of forebay(s) and construction details (See Figure 1406)

- ☐ Prepare at a maximum scale of 1" = 20'
- ☐ Enlarged plan view with dimensions and spot elevations, slope of bottom
- ☐ Cross section of concrete lined forebay with concrete slopes or 6" curb sides
- ☐ Structural/reinforcing details
- ☐ Energy dissipation structure details
- ☐ Drain pipe or weir detail
- ☐ Overflow protection, rip rap size, depth, dimension and location
- ☐ Maintenance access to forebay

Enlarged plan view of micropool and construction details

- ☐ Prepare at a maximum scale of 1" = 20'
- ☐ Enlarged plan view with dimensions, depths and spot elevations
- ☐ Cross section of concrete lined or grouted boulder micropool
- ☐ Permanent pool water surface elevation
- ☐ Floor elevation
- ☐ Details of low flow/trickle channel connection to micropool
- ☐ Details of connection to or interface with outlet structure
- ☐ Details for safety ramp/improvements

Outlet structure construction details

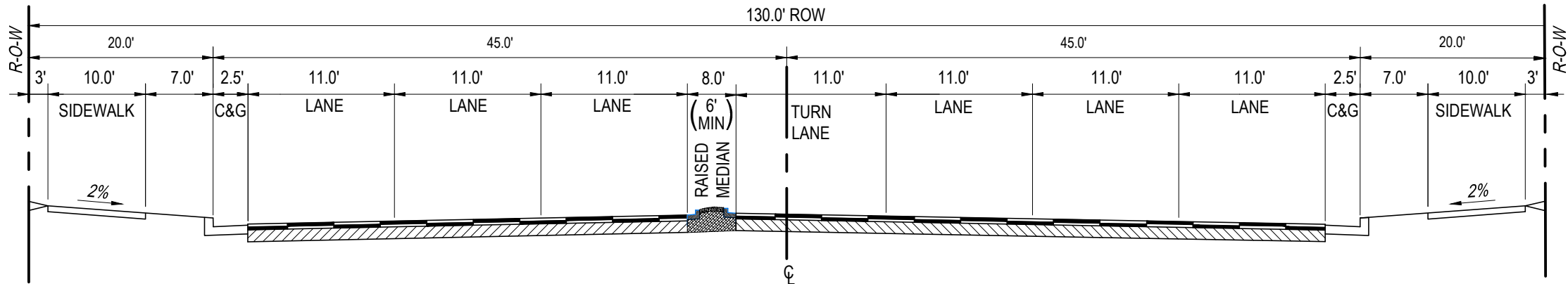
- ☐ Enlarged view with dimensions, depths and spot elevations

- ☐ Enlarged plan view to show proposed detailed grading/spot elevations around structure
- ☐ Cross sections, as required, to show depths, concrete thicknesses, EURV, 100-year and other appropriate water surface elevations, etc.
- ☐ Water quality outlet plate details and material specifications (plate dimensions, perforation size, number of row and a number of columns)
- ☐ Water quality outlet plate anchoring detail
- ☐ Overflow grate dimensions, material, type, opening size, anchoring detail
- ☐ Well screen/trash rack dimensions, material, type, opening size, anchoring detail
- ☐ Wingwall layout and structural reinforcing details

Construction details of other features and components

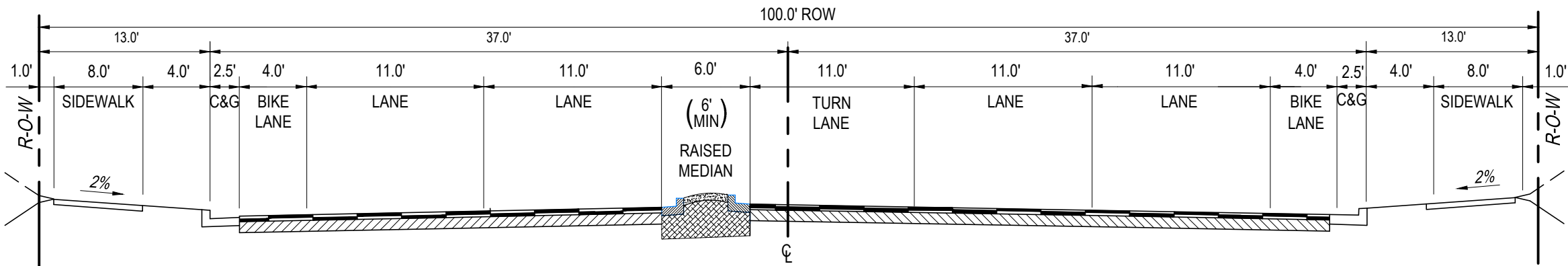
- ☐ Cross section of access/maintenance road(s) or ramps with all-weather surface treatment (specify material type, thickness, slope and width)
- ☐ Emergency overflow spillway profile and cross section (weir elevation, weir length, riprap size, depth, dimensions, bedding material)
- ☐ Construction details for stormwater management facility signs
- ☐ Low flow/trickle channel construction details (cross section, material specification, slope)

# **TRANSPORTATION DESIGN AND CONSTRUCTION MANUAL – TEMPLATES**



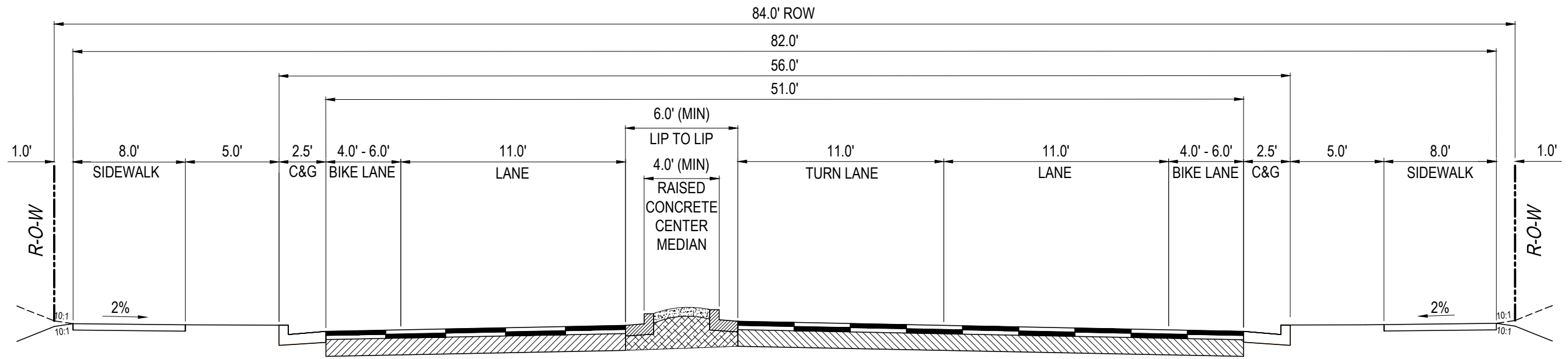
NOTES

- 1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 25,000.
- 2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING.
- 3. ACCELERATION/DECELERATION LANES AND/OR TURN LANES MAY BE REQUIRED AND MAY NECESSITATE ADDITIONAL RIGHT-OF-WAY. SEE SECTION 3.7.3.
- 4. MEDIANS MAY BE RAISED, DEPRESSED, OR PAINTED AS APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING. SEE STANDARD NO. 9 FOR TYPICAL MEDIAN DESIGNS.
- 5. LANE WIDTHS MAY BE REDUCED TO 10FT IN CERTAIN CONDITIONS IF APPROVED BY PLANNING & ZONING DIVISION.



NOTES

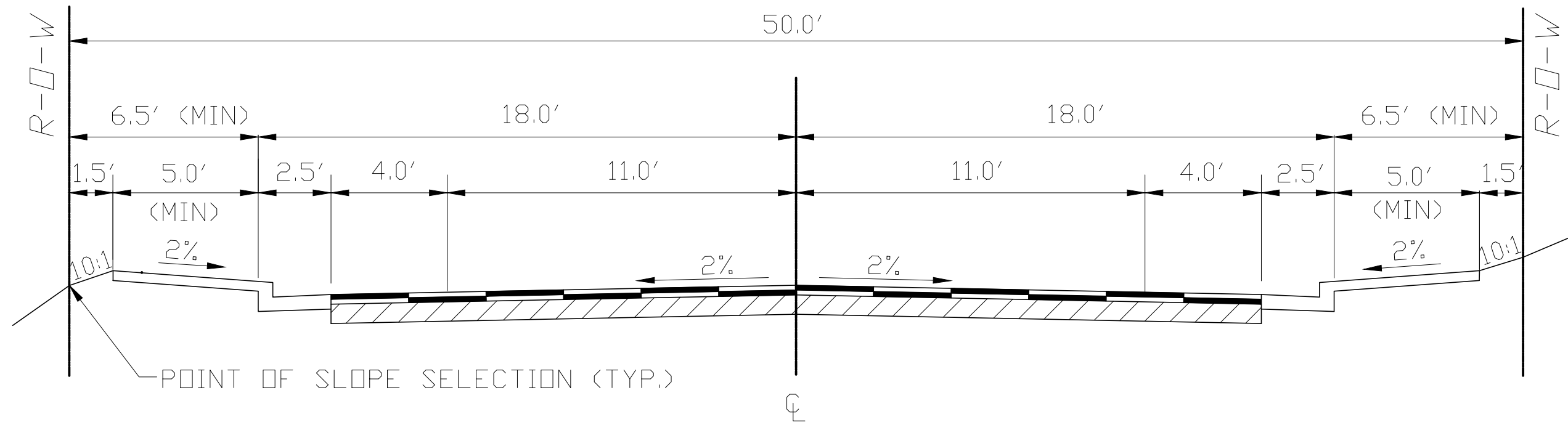
- 1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 15,000 BUT LESS THAN 25,000.
- 2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY DEPARTMENT OF PLANNING & ZONING.
- 3. ACCELERATION/DECELERATION LANES AND/OR TURN LANES MAY BE REQUIRED AND MAY NECESSITATE ADDITIONAL RIGHT-OF-WAY. SEE SECTION 3.7.3.
- 4. MEDIANS MAY BE RAISED, DEPRESSED, OR PAINTED AS APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING. SEE STANDARD NO. 9 FOR TYPICAL MEDIAN DESIGNS.
- 5. BICYCLES LANES ARE REQUIRED FOR STREETS IDENTIFIED WITH THE DESIGNATION 'PROPOSED BIKE LANES' IN THE JEFFERSON COUNTY BICYCLE PLAN OR ANY SUBSEQUENT PLAN THAT HAS BEEN APPROVED BY THE BOARD OF COUNTY COMMISSIONERS.
- 6. SIDEWALKS MAY BE ATTACHED AS APPROVED BY JEFFERSON COUNTY PLANNING AND ZONING.
- 7. IF BICYCLE LANES ARE NOT REQUIRED, SIDEWALK WIDTHS SHALL BE 10 FEET.
- 8. IF BICYCLE LANE WIDTHS EXCEED 5 FEET, A 1.5 TO 3 FEET WIDE BUFFER SHALL BE INCLUDED
- 9. LANE WIDTHS MAY BE REDUCED TO 10 FEET IN CERTAIN CONDITIONS IF APPROVED BY PLANNING & ZONING DIVISION.



MAJOR COLLECTOR STREET

NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 8,000 BUT LESS THAN 15,000.
2. ACCESS POINTS SHALL BE APPROVED BY JEFFERSON COUNTY PLANNING & ZONING.
3. MEDIANS MAY BE RAISED, DEPRESSED, OR PAINTED AND WIDTH MAY VARY AS APPROVED BY JEFFERSON COUNTY PLANNING & ZONING. SEE STANDARD NO. 9 FOR TYPICAL MEDIAN DESIGNS.
4. VERTICAL CURB REQUIRED.
5. BICYCLES LANES ARE REQUIRED FOR STREETS IDENTIFIED WITH THE DESIGNATION 'PROPOSED BIKE LANES' IN THE JEFFERSON COUNTY BICYCLE PLAN OR ANY SUBSEQUENT PLAN THAT HAS BEEN APPROVED BY THE BOARD OF COUNTY COMMISSIONERS.
6. SIDEWALKS MAY BE ATTACHED AS APPROVED BY JEFFERSON COUNTY PLANNING & ZONING.
7. IF BICYCLE LANES ARE NOT REQUIRED, SIDEWALK WIDTHS SHALL BE 10 FEET.
8. IF BICYCLE LANE WIDTHS EXCEED 5 FEET, A 1.5 - 3 FOOT WIDE BUFFER SHALL BE INCLUDED.
9. LANE WIDTHS MAY BE REDUCED TO 10 FEET IN CERTAIN CONDITIONS IF APPROVED BY PLANNING & ZONING DIVISION.



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 1,000 BUT LESS THAN 8,000.
2. ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED TO ACCOMMODATE ADDITIONAL PARKING, TURN LANES, CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. BICYCLE LANES ARE REQUIRED FOR STREETS IDENTIFIED WITH THE DESIGNATION 'PROPOSED BIKE LANES' IN THE JEFFERSON COUNTY BICYCLE PLAN OR ANY SUBSEQUENT PLAN THAT HAS BEEN APPROVED BY THE BOARD OF COUNTY COMMISSIONERS.
5. IF BICYCLE LANE WIDTHS EXCEED 5 FEET, A 1.5-3 FOOT WIDE BUFFER SHALL BE INCLUDED.
6. LANE WIDTHS MAY BE REDUCED TO 10 FEET IN CERTAIN CONDITIONS IF APPROVED BY PLANNING & ZONING DIVISION.

Revisions:

Designed By: STAFF

Scale: (As Shown)

Drawn By: SAK

Date Created:

Checked By: Staff

Plot Date: 1/14/25

F.I.R. Date:

File: temp-4.dwg

F.O.R. Date:

For Const. Date:

File Location: G:\\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)

**JEFFERSON**  
COUNTY COLORADO

DIVISION OF  
**Transportation and Engineering**  
100 JEFFERSON COUNTY PARKWAY, SUITE 3500  
GOLDEN, COLORADO 80419  
(303) 271-8495

TEMPLATE 4

COLLECTOR STREET (36' FROM  $\ell$  TO  $\ell$ ) WITH ATTACHED SIDEWALKS

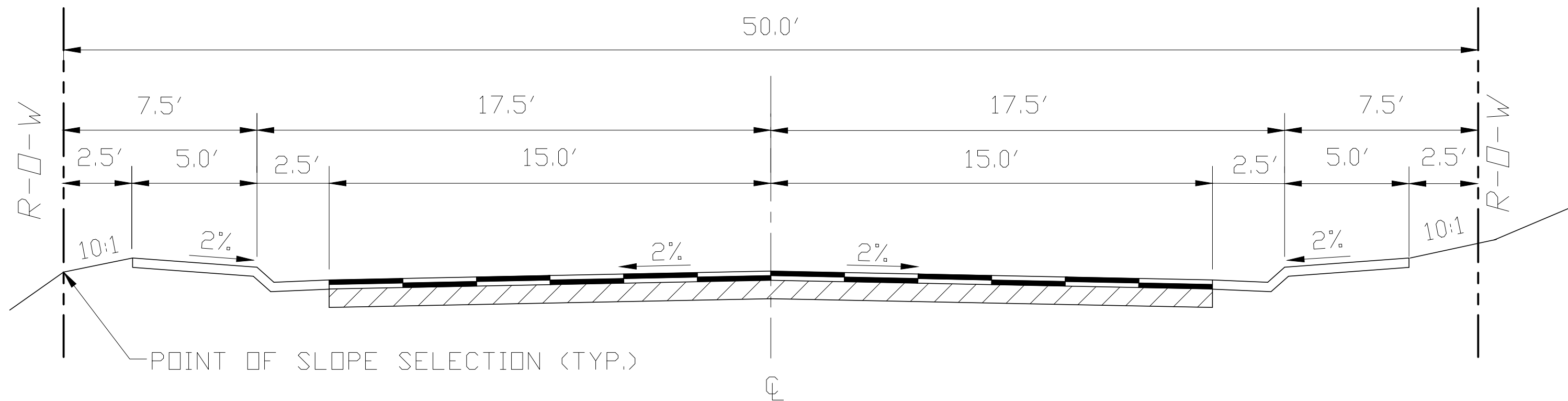
Project No.: ###

Sheet **1**

Of **1**



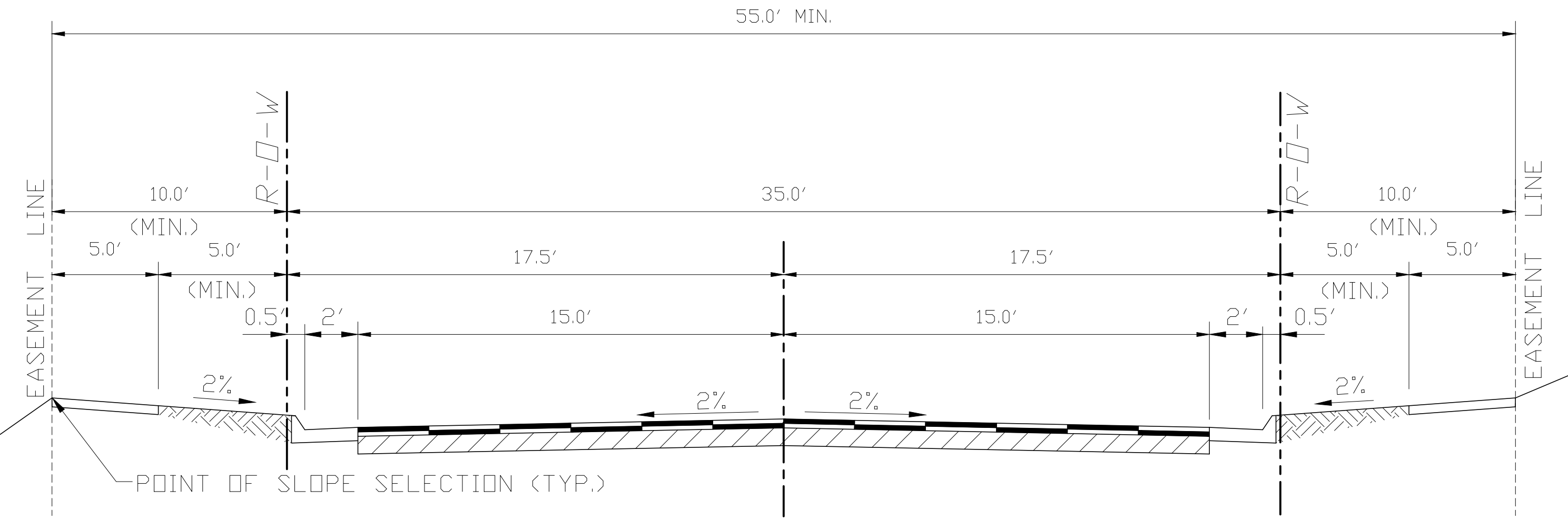




## NOTES

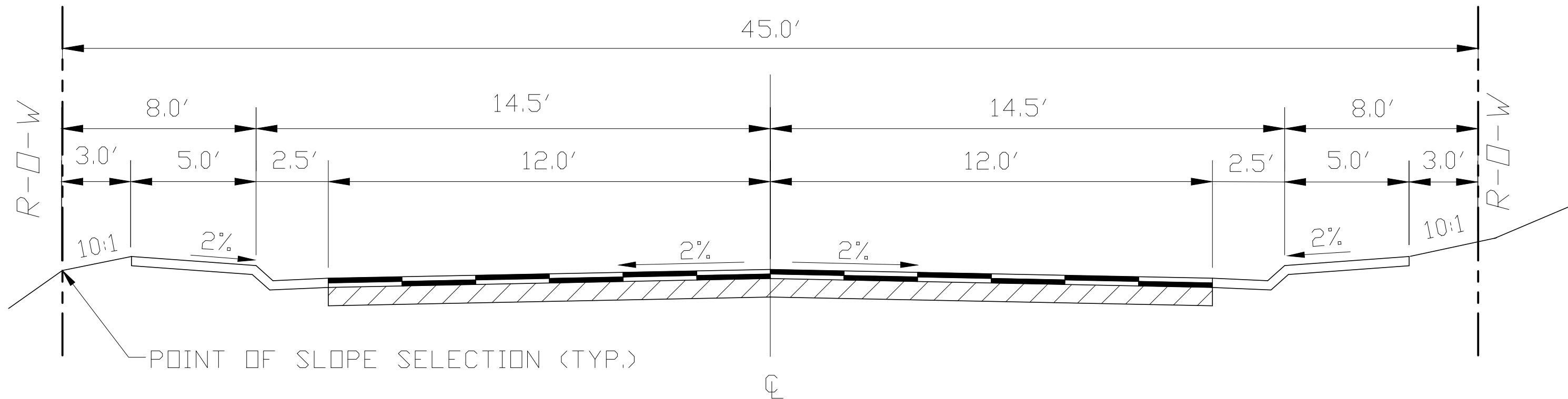
1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS LESS THAN 1,000.
2. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. MOUNTABLE CURB ALLOWED.

Revisions:	Designed By: STAFF	Scale: (As Shown)	<div><div>JEFFERSON COUNTY COLORADO</div><div>DIVISION OF Transportation and Engineering</div><div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div></div>	TEMPLATE 6		
	Drawn By: SAK	Date Created:		LOCAL STREET (34' FROM $\pi$ TO $\pi$ ) WITH ATTACHED SIDEWALKS		
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:		Project No.: ###	Sheet 1	Of 1
	File: temp-6.dwg	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)					



**NOTES**

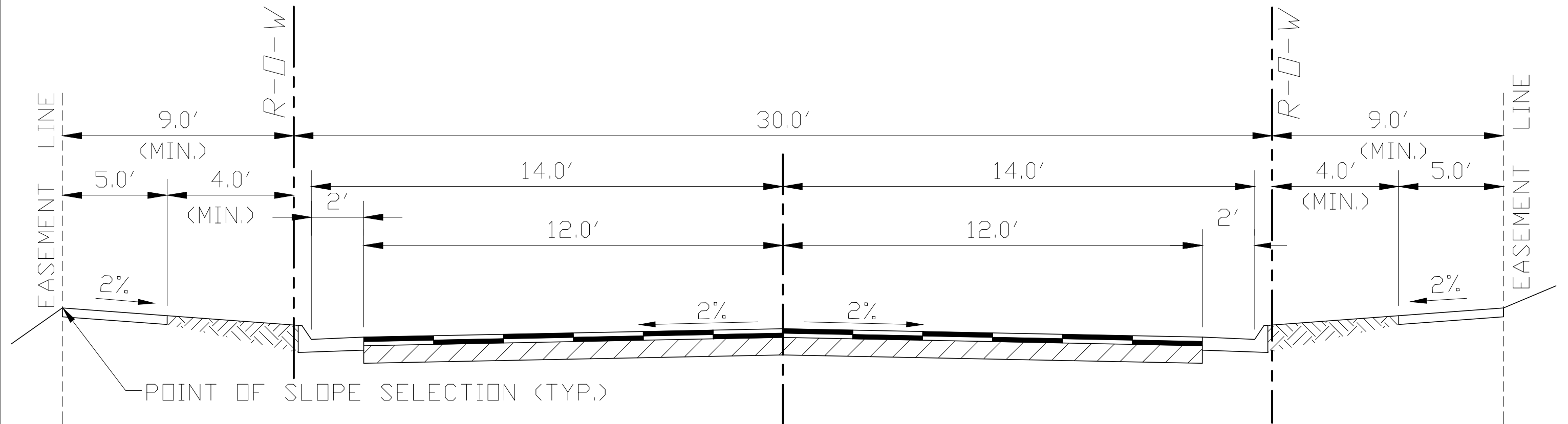
- 1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS LESS THAN 1,000.
- 2. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
- 3. MOUNTABLE CURB ALLOWED.



# NOTES

1. THIS TEMPLATE MAY BE USED WHERE THE DESIGN ADT IS LESS THAN 350 SUBJECT TO APPROVAL BY PLANNING AND ZONING BASED ON SAFETY AND TRAFFIC OPERATIONS AND SPECIFIC SITE CONDITIONS.
2. A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. ON STREET PARKING IS NOT PERMITTED.
5. MOUNTABLE CURB ALLOWED.

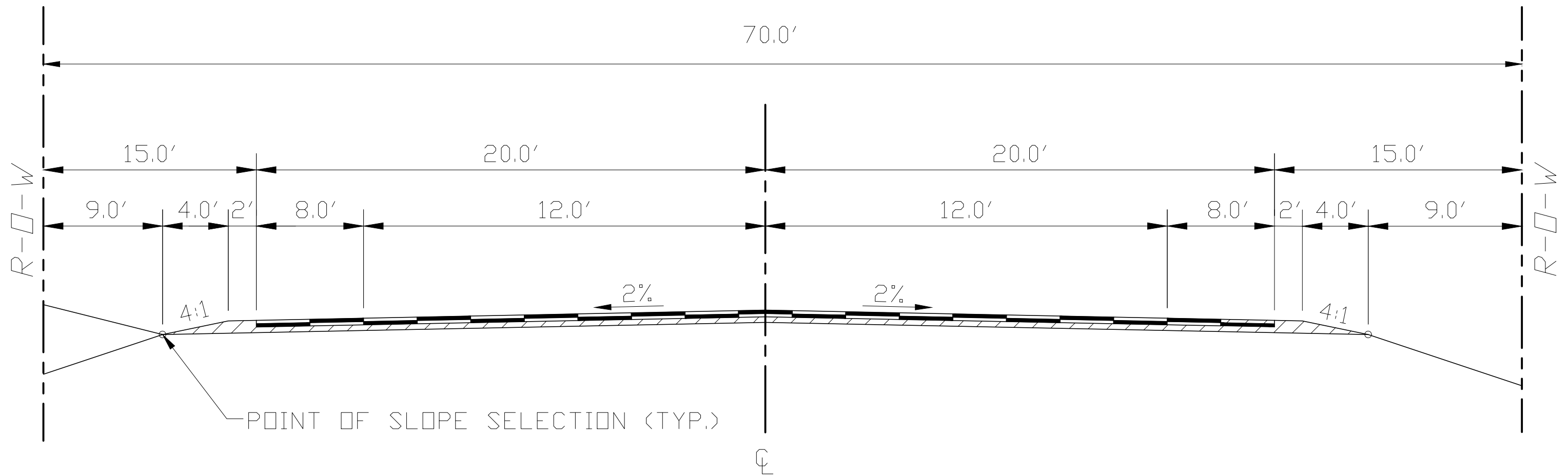
Revisions:	Designed By:	STAFF	Scale:	(As Shown)	<div><div>JEFFERSON</div><div>COUNTY COLORADO</div></div> <div>DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	TEMPLATE 8				
	Drawn By:	SAK	Date Created:			LOCAL STREET (28' FROM $\ell$ TO $\ell$ ) WITH ATTACHED SIDEWALKS				
	Checked By:	Staff	Plot Date:	1/14/25		F.I.R. Date:				
	File:	temp-8.dwg	F.O.R. Date:			For Const. Date:				
	File Location:	G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)				Project No.:	####	Sheet	1	Of



## NOTES

1. THIS TEMPLATE MAY BE USED WHERE THE DESIGN ADT IS LESS THAN 350 SUBJECT TO APPROVAL BY PLANNING AND ZONING BASED ON SAFETY AND TRAFFIC OPERATIONS AND SPECIFIC SITE CONDITIONS.
2. A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. ON STREET PARKING IS NOT PERMITTED.
5. VERTICAL CURB REQUIRED.

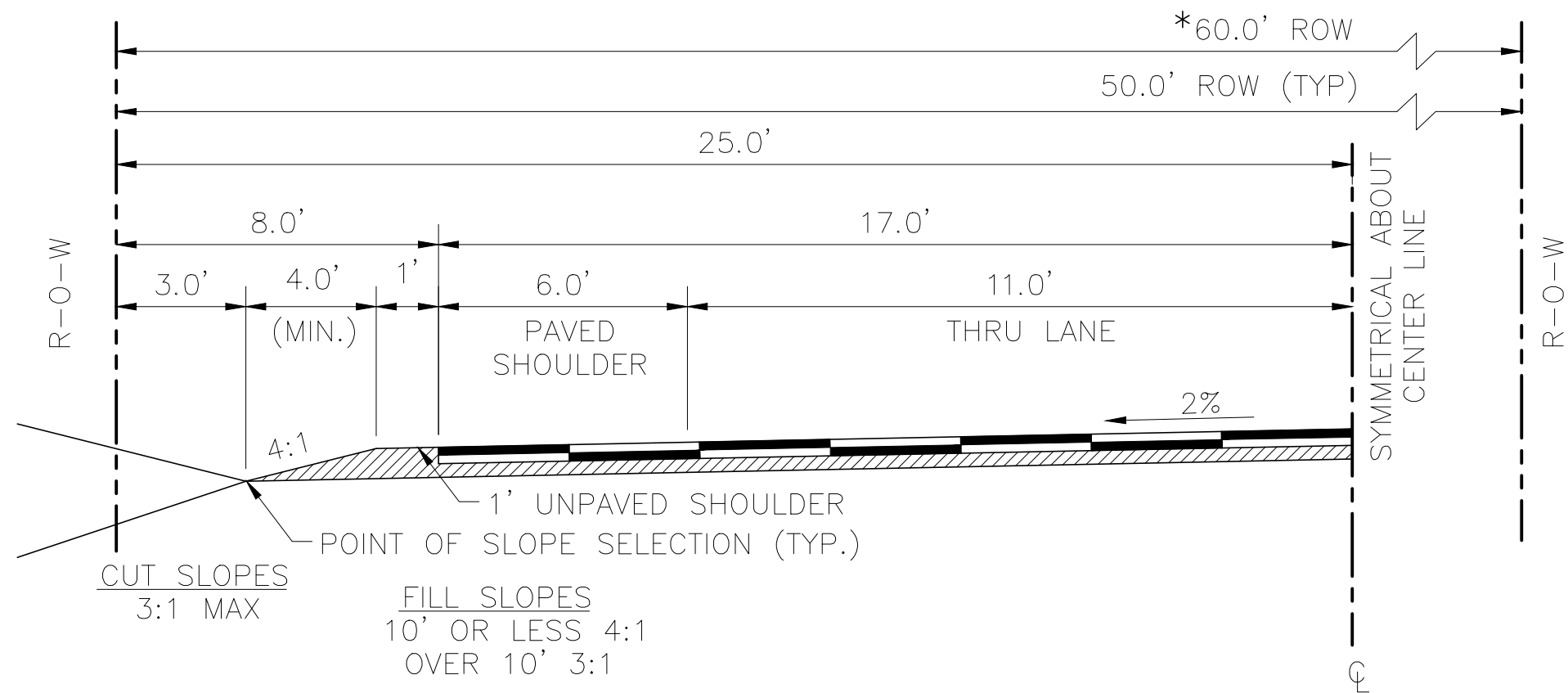
Revisions:	Designed By: STAFF	Scale: (As Shown)	<div><div>JEFFERSON</div><div>COUNTY COLORADO</div></div>	<div>DIVISION OF Transportation and Engineering</div> <div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	TEMPLATE 9		
	Drawn By: SAK	Date Created:			LOCAL STREET (28' FROM E TO E) WITH DETACHED SIDEWALKS		
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:					
	File: temp-9.dwg	F.O.R. Date: For Const. Date:					
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)						
Project No.: ###			Sheet 1		Of 1		



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 8,000.
2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY JEFFERSON COUNTY PLANNING & ZONING. ACCELERATION/DECELERATION, LEFT TURN AND/OR CLIMBING LANES MAY BE REQUIRED AND WILL NECESSITATE ADDITIONAL RIGHT-OF-WAY.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.

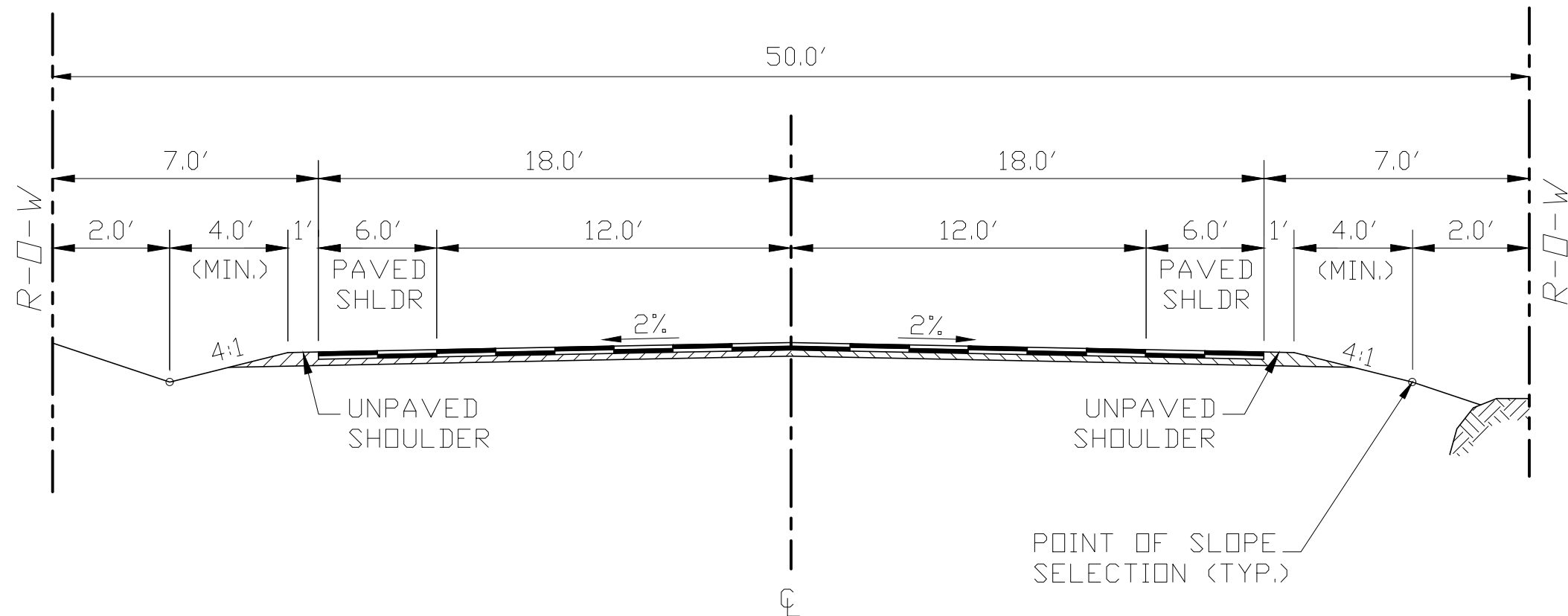
Revisions:	Designed By: STAFF	Scale: (As Shown)	<div>JEFFERSON COUNTY COLORADO</div>	<div>DIVISION OF Transportation and Engineering</div> <div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	TEMPLATE 10		
	Drawn By: SAK	Date Created:			MINOR ARTERIAL ROAD		
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:					
	File: temp-10.dwg	F.O.R. Date: For Const. Date:					
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)						
					Project No.: —	Sheet 1	Of 1



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 2,000 BUT LESS THAN 8,000.
- \*2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY JEFFERSON COUNTY PLANNING & ZONING. ACCELERATION/DECELERATION, LEFT TURN AND/OR CLIMBING LANES MAY BE REQUIRED AND WILL NECESSITATE ADDITIONAL RIGHT-OF-WAY.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.
5. PAVED SHOULDER MAY BE REDUCED TO 4 FT. DUE TO THE EXISTENCE OF LIMITING FACTORS.

Revisions:	Designed By: STAFF	Scale: (As Shown)	<div><div>JEFFERSON COUNTY COLORADO</div><div><div>DIVISION OF</div><div>Transportation and Engineering</div><div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div></div></div>	TEMPLATE 11			
	Drawn By: SAK	Date Created:		MAJOR COLLECTOR ROAD			
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:					
	File: temp-11.dwg	F.O.R. Date: For Const. Date:					
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)						
			Project No.: —			Sheet 1	Of 1



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 1,000 BUT LESS THAN 2,000.
2. ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.
5. PAVED SHOULDER MAY BE REDUCED TO 4 FT. DUE TO THE EXISTENCE OF LIMITING FACTORS.

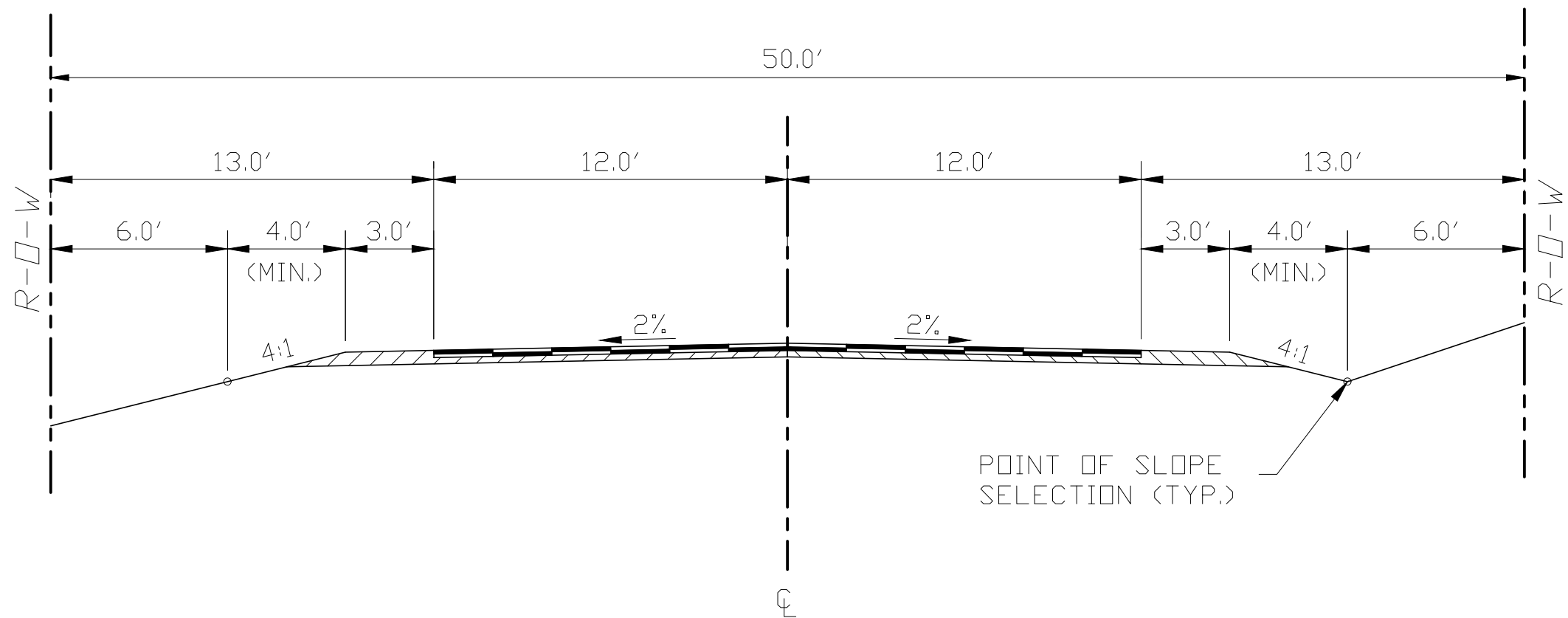
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	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)	

**JEFFERSON**  
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(303) 271-8495

**TEMPLATE 12**  
**COLLECTOR ROAD**

Project No.: - Sheet **1** Of **1**



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS LESS THAN 1,000.
2. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.

Revisions:	Designed By: STAFF	Scale: (As Shown)
	Drawn By: SAK	Date Created:
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:
	File: temp-13.dwg	F.O.R. Date: For Const. Date:
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)	



DIVISION OF  
Transportation and Engineering  
100 JEFFERSON COUNTY PARKWAY, SUITE 3500  
GOLDEN, COLORADO 80419  
(303) 271-8495

TEMPLATE 13  
LOCAL ROAD

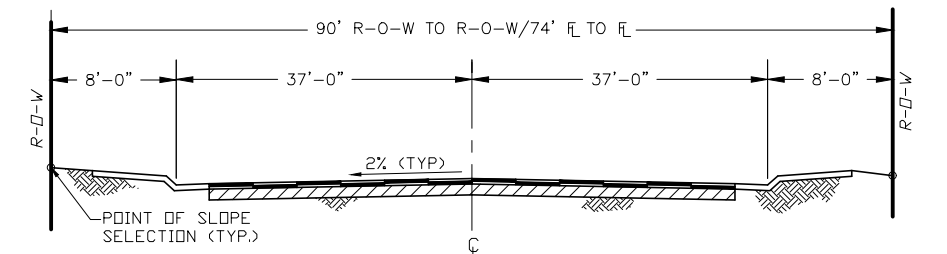
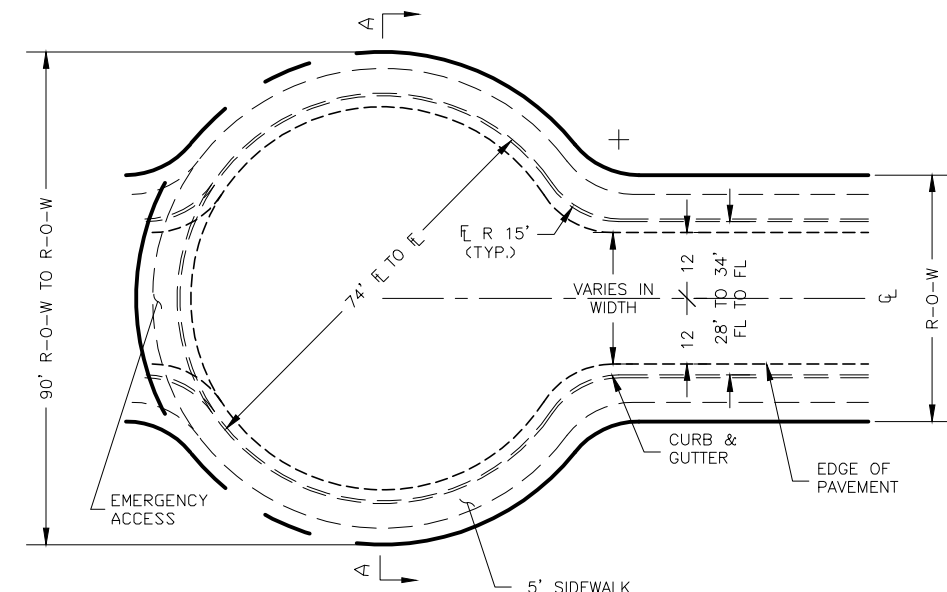
Project No.: - Sheet **1** Of **1**



OPTION 1

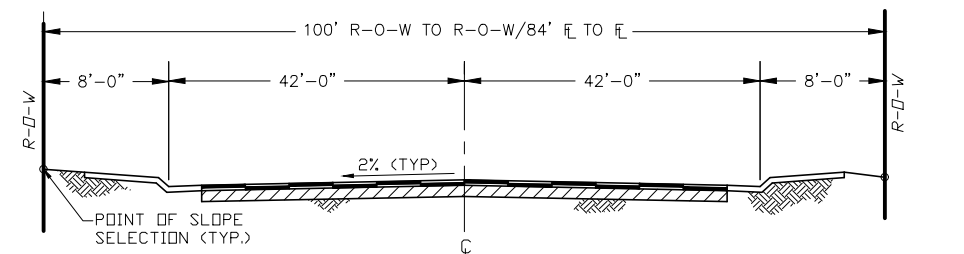
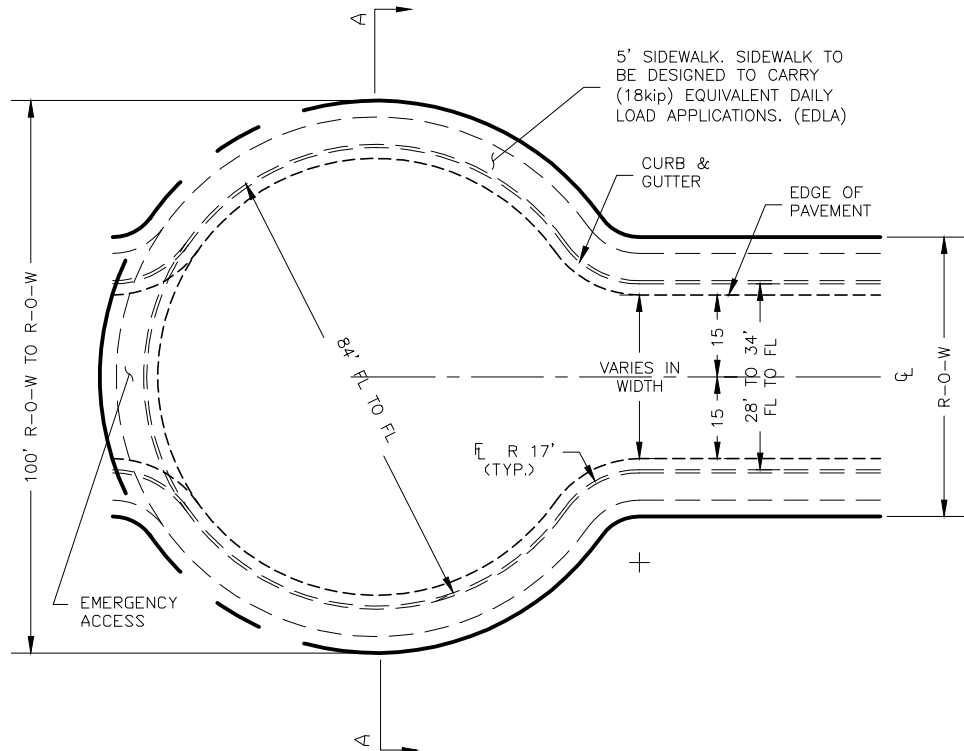
OPTION 2

OPTION 3



SECTION A - A  
74' FL to FL

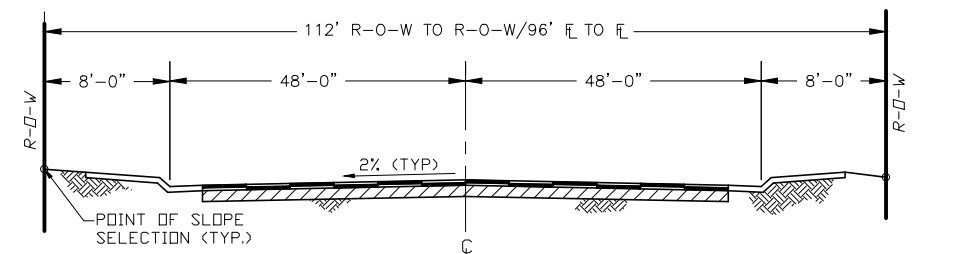
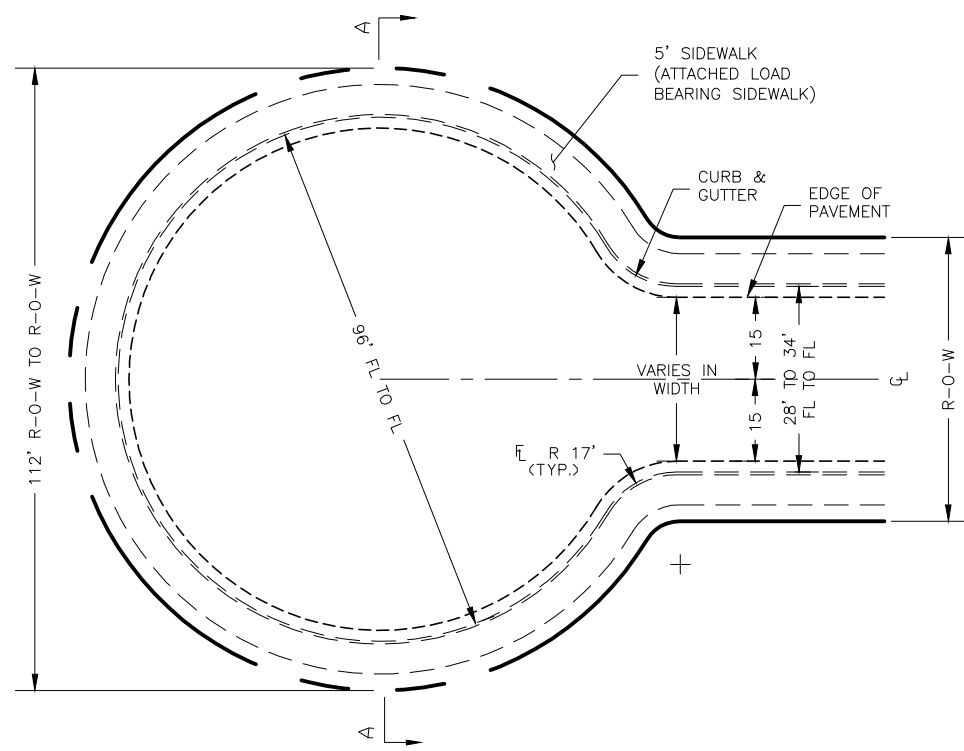
- NOTE:
- 1. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9
  - 2. THE FLOWLINE TO FLOWLINE DISTANCE OF 74' AND ON-STREET PARKING IS ALLOWED IF THERE IS EMERGENCY ACCESS CONNECTED TO THE CUL-DE-SAC THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.



SECTION A - A  
84' FL to FL

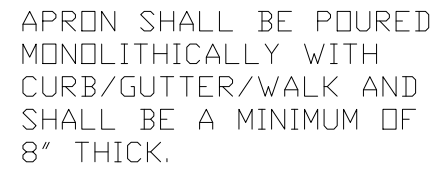
- NOTE:
- 1. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9
  - 2. THE FLOWLINE TO FLOWLINE DISTANCE OF 84' AND ON-STREET PARKING IS ALLOWED IF THERE IS EMERGENCY ACCESS CONNECTED TO THE CUL-DE-SAC THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.
  - 3. IF EMERGENCY ACCESS CONNECTION IS NOT PROVIDED, A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ON STREET PARKING IS NOT PERMITTED. ATTACHED SIDEWALK IS REQUIRED.

NOTE: Other than option 1 shown hereon, alternate standards for cul-de-sacs shall be approved by the appropriate fire protection district.



SECTION A - A  
96' FL to FL

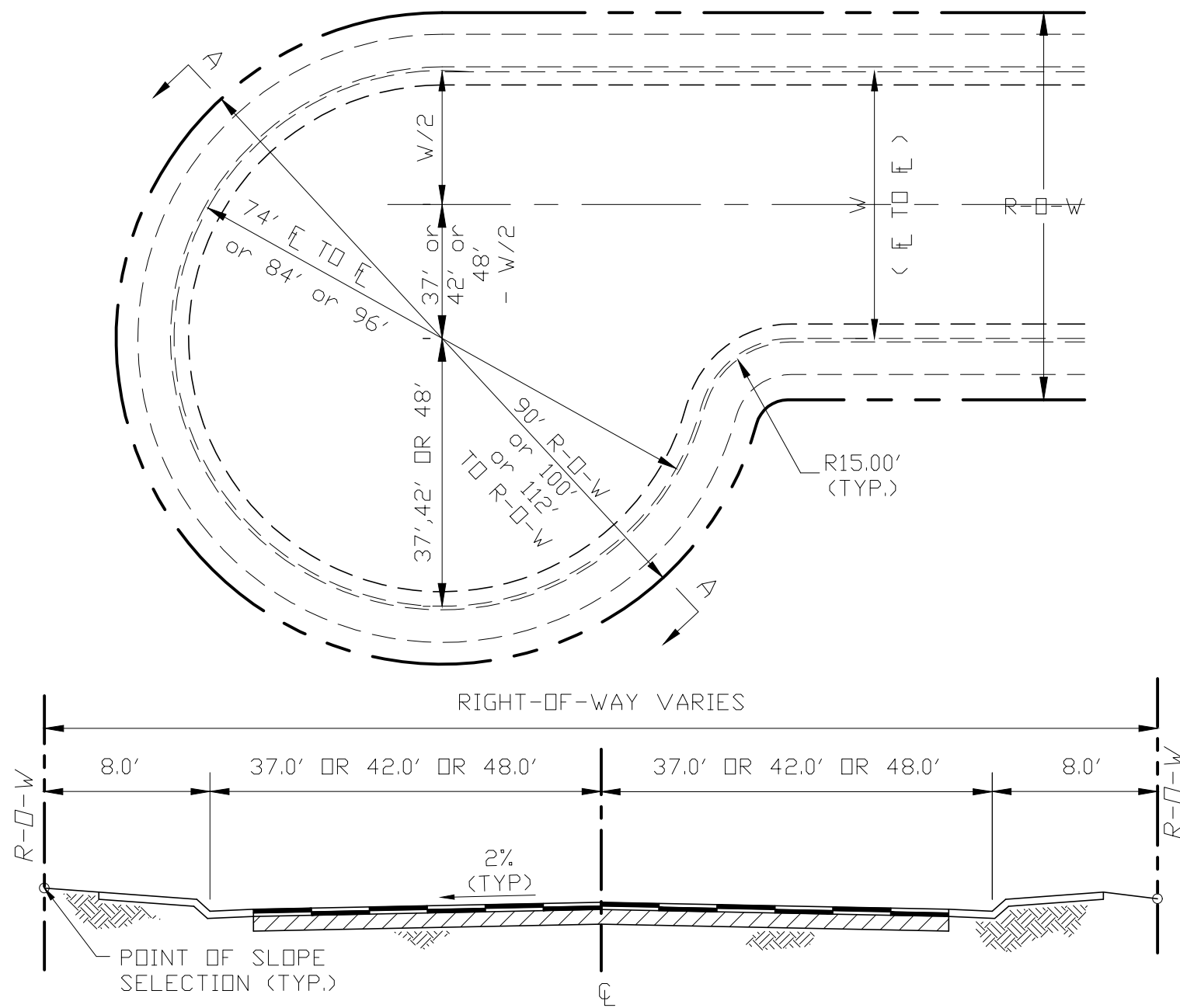
- NOTE:
- 1. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9
  - 2. A MINIMUM OF FOUR OFF-SITE STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ON-STREET PARKING IS NOT PERMITTED.



NOTE:

1. IF SUFFICIENT FALL IS AVAILABLE AROUND THE FLOWLINE OF THE PARTIAL CUL-DE-SAC (> 1%), THE CUL-DE-SAC MAY SLOPE AWAY FROM THE CROSSSPAN. SHOW SPOT ELEVATIONS AND FLOW ARROWS ON THE CONSTRUCTION PLANS.
2. SEE STANDARD NO.10 FOR CONCRETE JOINT DETAILS.
3. SEE STANDARD NO.5 FOR CROSSSPAN DETAIL.
4. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9

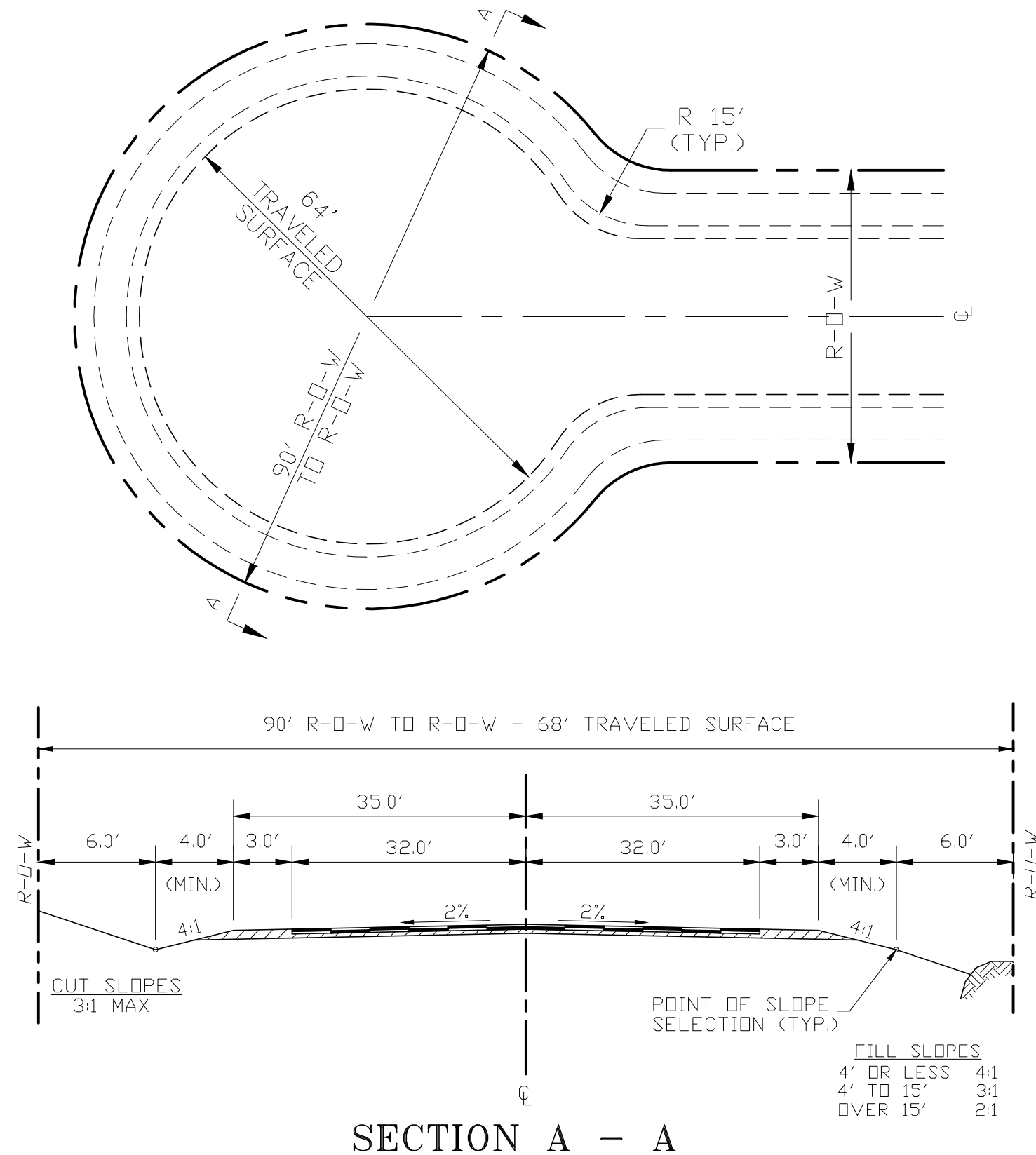
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	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:
	File: temp-15.dwg	F.O.R. Date: For Const. Date:
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)	



SECTION A - A

NOTES:

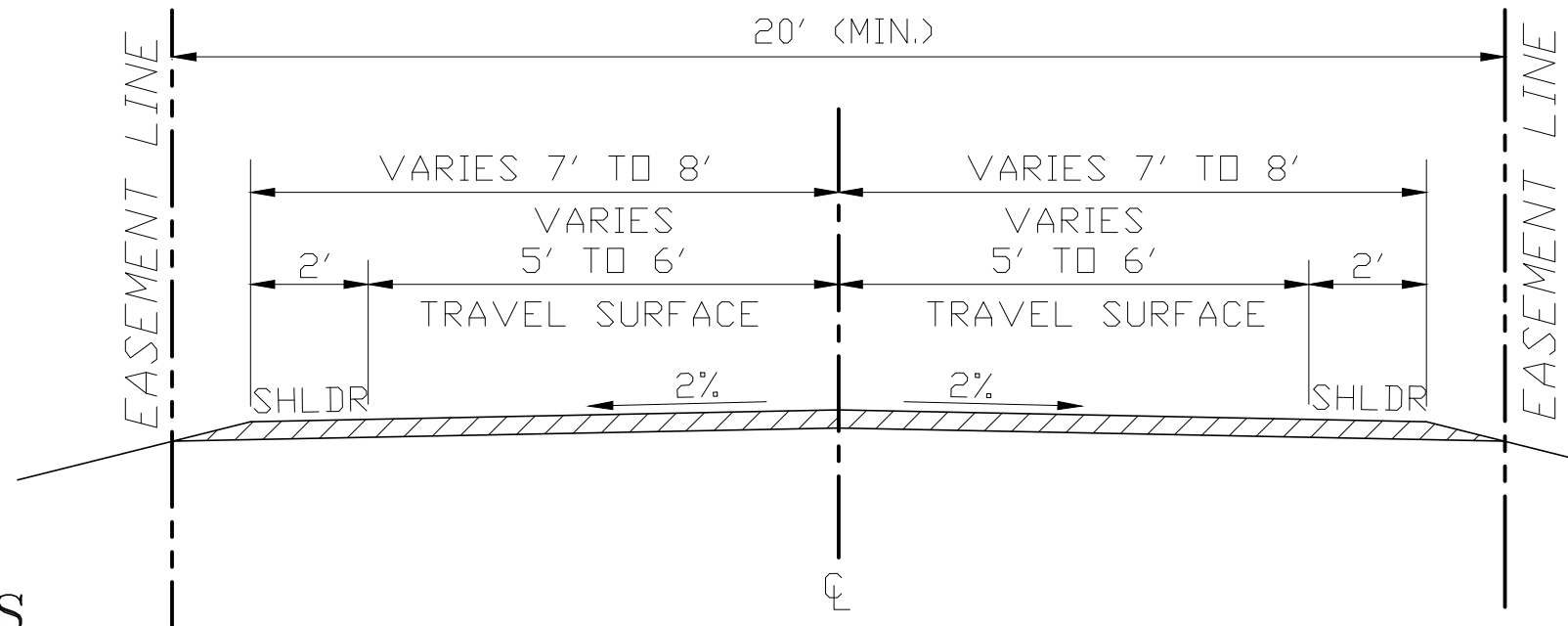
- 1. OFFSET CUL-DE-SAC FOR LOCAL ROADS SHALL BE BUILT ACCORDING TO THE SECTIONS SHOWN ON TEMPLATE NUMBER 16.
- 2. ALL DIMENSIONS SHALL BE SHOWN ON THE PLANS.
- 3. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9.
- 4. IF THE FLOWLINE TO FLOWLINE DISTANCE IS LESS THAN 96', A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ONSTREET PARKING IS NOT PERMITTED.
- 5. THE FLOWLINE TO FLOWLINE DISTANCE OF 84' IS ALLOWED PROVIDED THE ATTACHED SIDEWALK HAS A LOAD BEARING CAPACITY THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.
- 6. THE FLOWLINE TO FLOWLINE DISTANCE OF 74' AND ON-STREET PARKING IS ALLOWED IF THERE IS EMERGENCY ACCESS CONNECTED TO THE CUL-DE-SAC THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.



## NOTE:

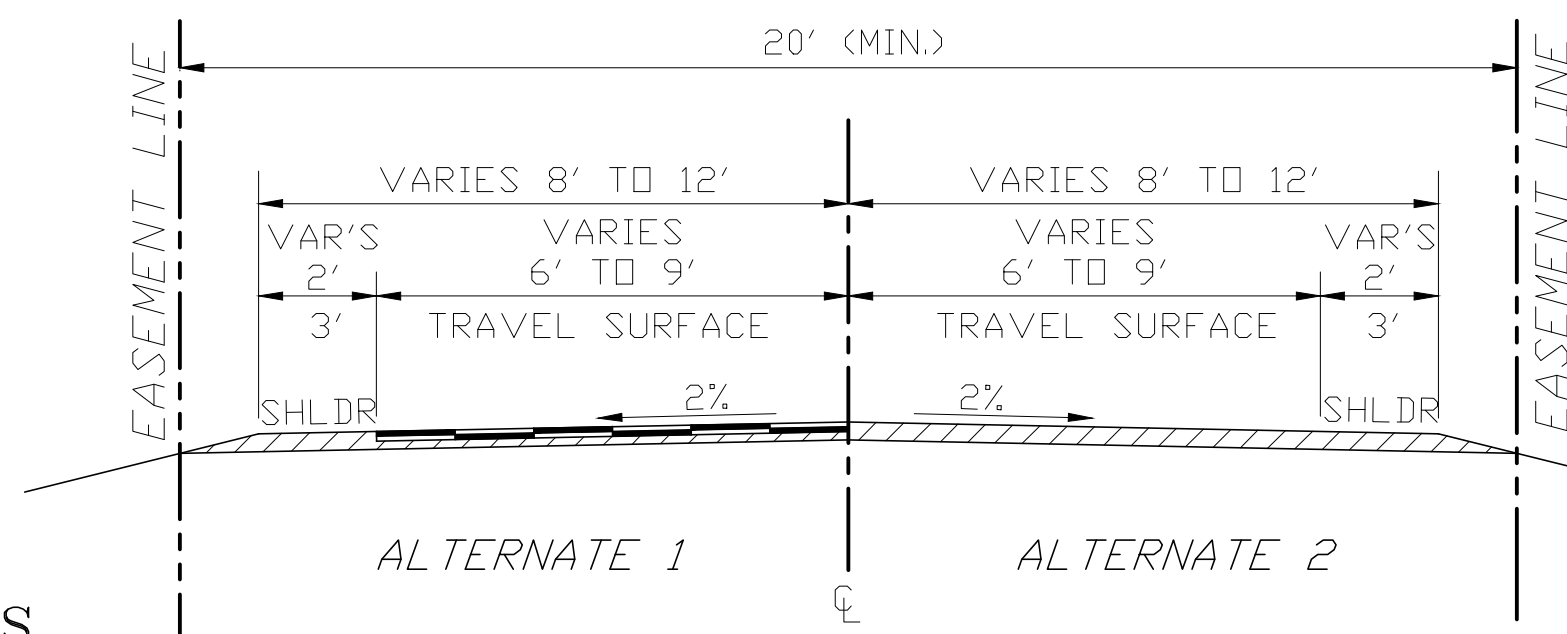
1. A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ON ROAD PARKING IS NOT PERMITTED.

Revisions:	Designed By: STAFF	Scale: (As Shown)	<div>JEFFERSON COUNTY COLORADO</div> <div>DIVISION OF Transportation and Engineering</div> <div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	TEMPLATE 17	
	Drawn By: SAK	Date Created:		CUL-DE-SAC FOR LOCAL ROADS	
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:		Project No.: -	Sheet 1 Of 1
	File: TEMP-17 [CUL-DE-SAC FOR LOCAL STREETS]	For Const. Date:			
	File Location: G:\_CAD\Standards\2025 Road Standards & Templates\Templates (2025)\Drawings				



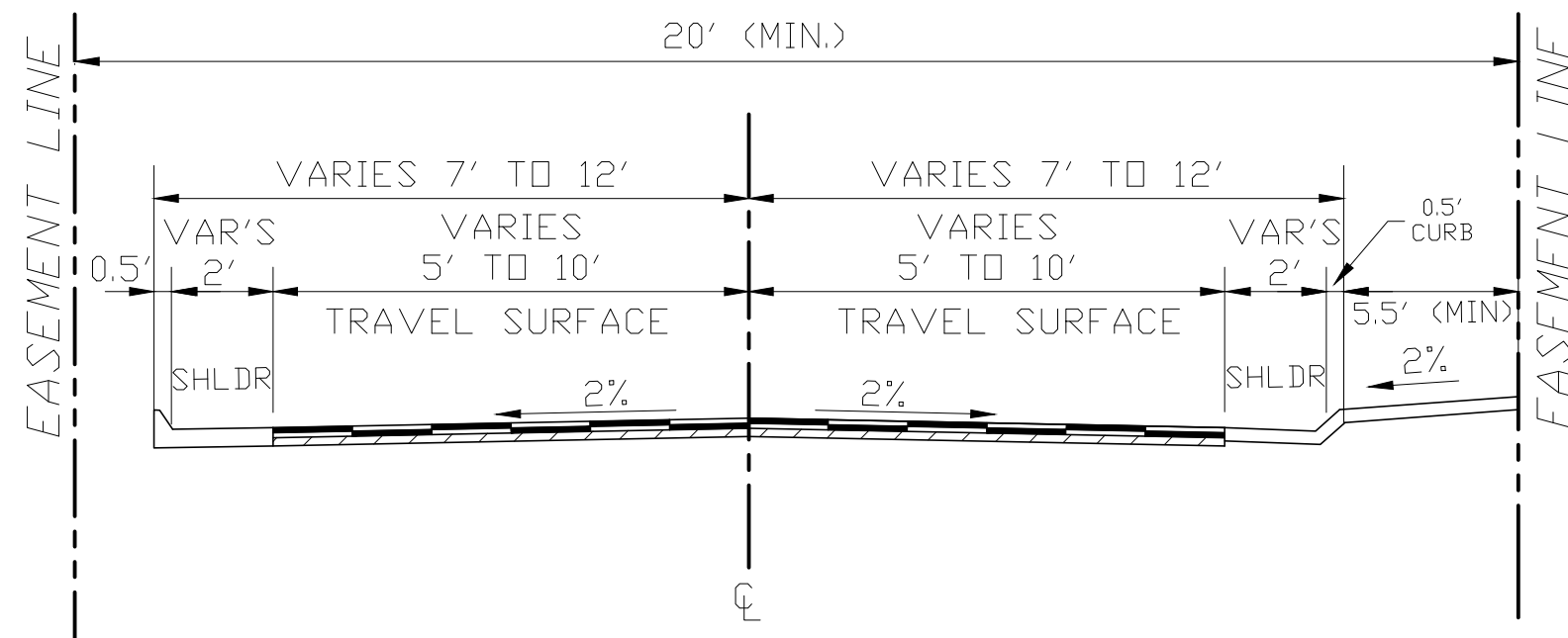
**NOTES**

1. ALL WEATHER SURFACE IS PERMITTED FOR DRIVEWAYS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS. AN ALL WEATHER TRAVEL SURFACE IS DEFINED AS AN IMPROVED SURFACE THAT IS DESIGNED TO WITHSTAND ALL WEATHER CONDITIONS FOR TYPICAL ROAD USE AND ABLE TO SUPPORT EMERGENCY VEHICLES. THE SURFACE IS REQUIRED TO BE CONSTRUCTED OF CONCRETE, ASPHALT, RECYCLED ASPHALT OR A MINIMUM OF 6-INCHES OF CLASS 6 ROAD BASE.
2. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. SEE SECTION 3.7.8 FOR ADDITIONAL DESIGN CRITERIA.
4. DRIVEWAYS LONGER THAN 150 FEET ARE REQUIRED TO HAVE 12 FOOT WIDE TRAVEL SURFACE WITH 2 FOOT WIDE SHOULDERS ON BOTH SIDES.
5. SUPER-ELEVATION ON DRIVEWAYS MAY BE ALLOWED FOR DRAINAGE PURPOSES AS APPROVED BY PLANNING AND ZONING.



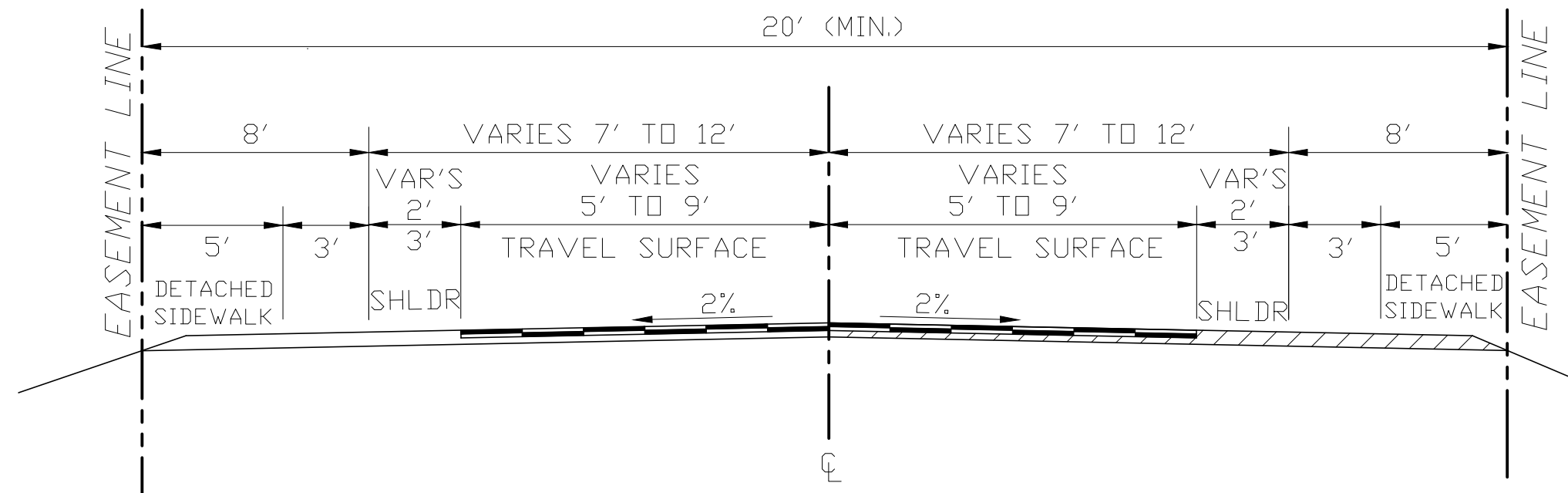
## NOTES

1. ALTERNATE 1 (PAVED SURFACE) IS REQUIRED FOR PRIVATE ROADS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS.
2. ALTERNATE 2 (ALL WEATHER SURFACE) IS PERMITTED FOR PRIVATE ROADS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS. AN ALL WEATHER TRAVEL SURFACE IS DEFINED AS AN IMPROVED SURFACE THAT IS DESIGNED TO WITHSTAND ALL WEATHER CONDITIONS FOR TYPICAL ROAD USE AND ABLE TO SUPPORT EMERGENCY VEHICLES. THE SURFACE IS REQUIRED TO BE CONSTRUCTED OF CONCRETE, ASPHALT, RECYCLED ASPHALT OR A MINIMUM OF 6-INCHES OF CLASS 6 ROAD BASE.
3. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. DITCHES ARE REQUIRED FOR PRIVATE ROADS SUBJECT TO THE LAND DEVELOPMENT REGULATION, AND THE TRANSPORTATION DESIGN AND CONSTRUCTION MANUAL.
5. SEE SECTION 3.7.8 FOR ADDITIONAL DESIGN CRITERIA.
6. ON ROAD PARKING IS NOT PERMITTED.
7. SUPER-ELEVATION ON PRIVATE ROADS MAY BE ALLOWED FOR DRAINAGE PURPOSES AS APPROVED BY PLANNING AND ZONING.



**NOTES**

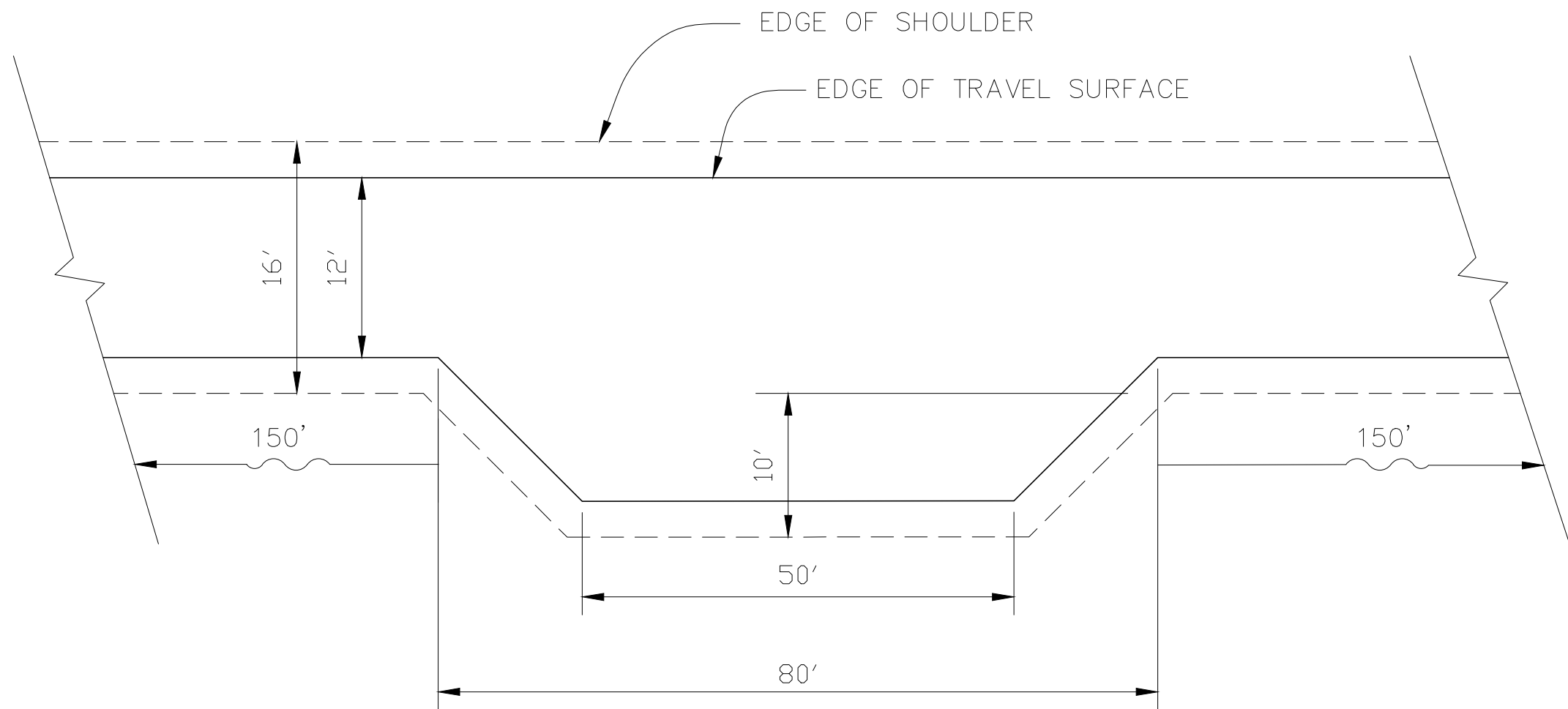
1. PAVED SURFACE IS REQUIRED FOR PRIVATE STREETS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS.
2. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. CURB AND GUTTER AND SIDEWALKS ARE REQUIRED FOR PRIVATE STREETS SUBJECT TO THE LAND DEVELOPMENT REGULATION AND THE TRANSPORTATION DESIGN AND CONSTRUCTION MANUAL.
4. SEE SECTION 3.7.8 FOR ADDITIONAL DESIGN CRITERIA.
5. ON-STREET PARKING IS NOT PERMITTED. IF ON-STREET PARKING IS DESIRED, THE TEMPLATE MAY BE WIDENED AS APPROVED BY PLANNING AND ZONING AND THE APPROPRIATE FIRE PROTECTION DISTRICT.
6. SUPER-ELEVATION ON PRIVATE STREETS MAY BE ALLOWED FOR DRAINAGE PURPOSES AS APPROVED BY PLANNING AND ZONING.

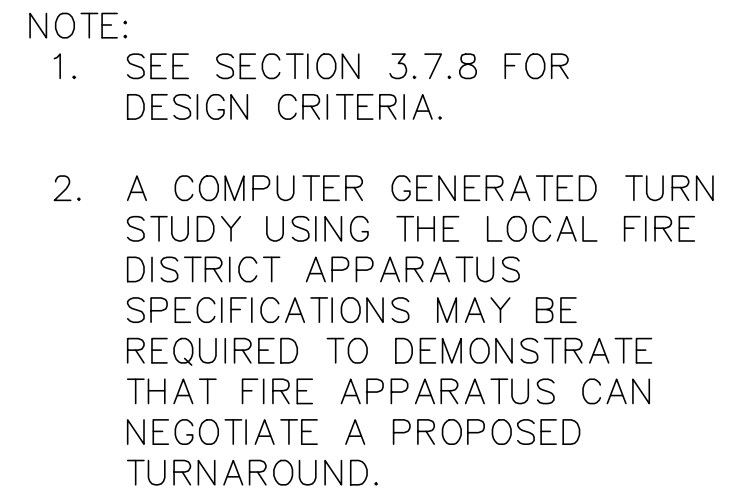


NOTES

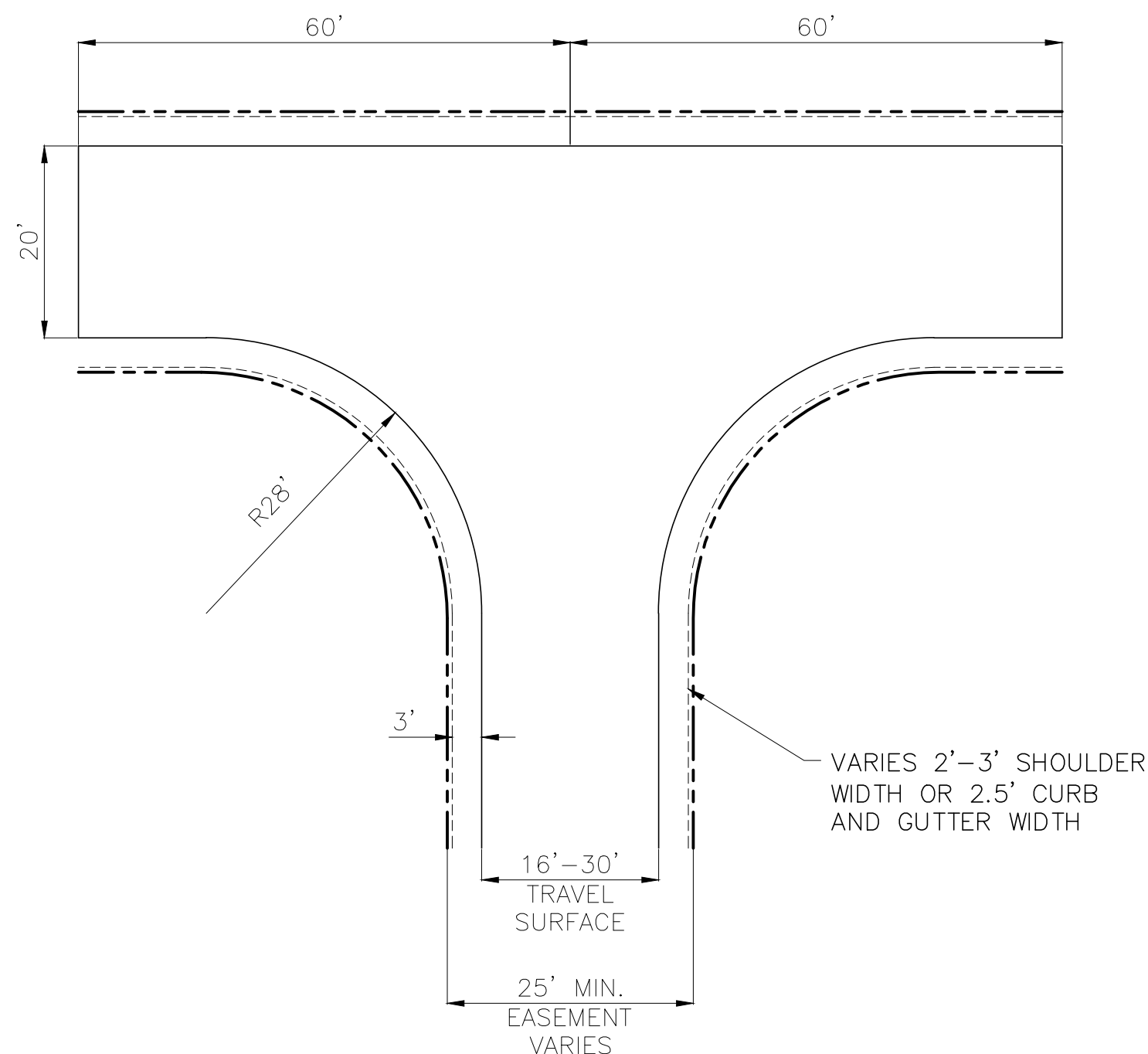
- 1. PAVED SURFACE IS REQUIRED FOR PRIVATE STREETS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS.
- 2. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
- 3. DITCHES MAY BE PROVIDED FOR PRIVATE STREETS IN ACCORDANCE WITH THE LAND DEVELOPMENT REGULATION.
- 4. SEE SECTION 3.7.8 FOR ADDITIONAL DESIGN CRITERIA.
- 5. ON-STREET PARKING IS NOT PERMITTED. IF ON-STREET PARKING IS DESIRED, THE TEMPLATE MAY BE WIDENED AS APPROVED BY PLANNING AND ZONING AND THE APPROPRIATE FIRE PROTECTION DISTRICT.
- 6. SUPER-ELEVATION ON STREETS MAY BE ALLOWED FOR DRAINAGE PURPOSES AS APPROVED BY PLANNING AND ZONING.
- 7. SIDEWALKS ARE REQUIRED FOR PRIVATE STREETS SUBJECT TO THE LAND DEVELOPMENT REGULATION AND THE TRANSPORTATION DESIGN AND CONSTRUCTION MANUAL.







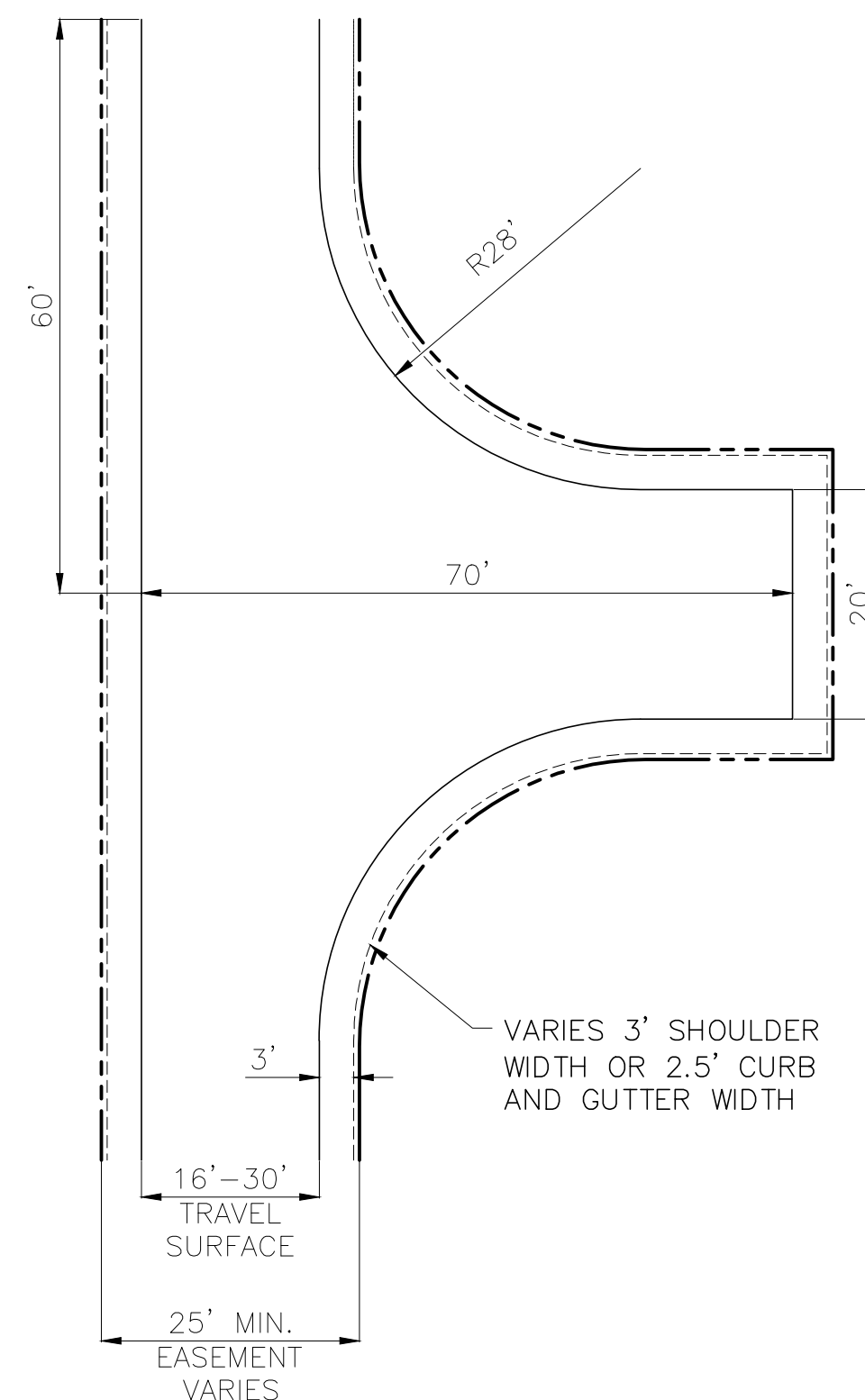
Revisions:	Designed By: STAFF	Scale: (As Shown)	<div><div>JEFFERSON COUNTY COLORADO</div><div><div>DIVISION OF</div><div>Transportation and Engineering</div><div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500</div><div>GOLDEN, COLORADO 80419</div><div>(303) 271-8495</div></div></div>	TEMPLATE 20		
	Drawn By: SAK	Date Created:		<div>Project No.: -</div> <div>Sheet -</div> <div>Of -</div>		
	Checked By: Staff	Plot Date: 1/14/25 F.I.R. Date:				
	File: temp-20.dwg	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Templates (2023)					



**120 FOOT HAMMERHEAD**

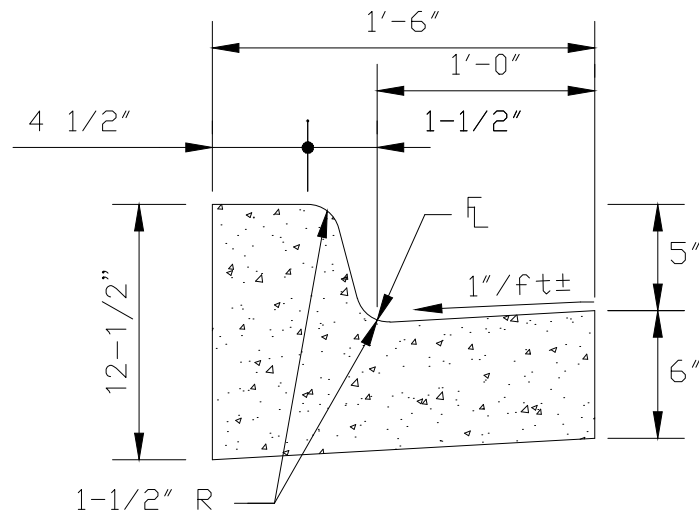
NOTE:

1. A COMPUTER GENERATED TURN STUDY USING THE LOCAL FIRE DISTRICT APPARATUS SPECIFICATIONS MAY BE REQUIRED TO DEMONSTRATE THAT FIRE APPARATUS CAN NEGOTIATE A PROPOSED TURNAROUND.



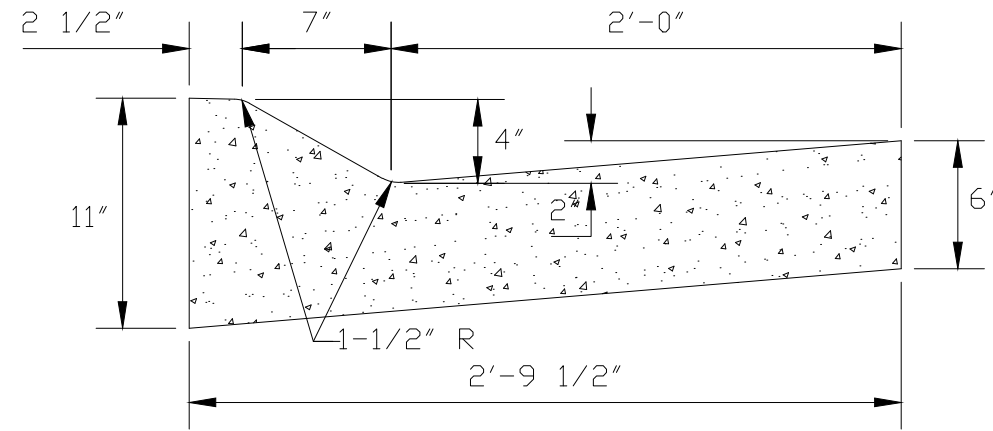
**ACCEPTABLE ALTERNATIVE  
TO 120-FOOT HAMMERHEAD**

# **TRANSPORTATION DESIGN AND CONSTRUCTION MANUAL – STANDARDS**



\* 6" VERTICAL CURB WITH 1' GUTTER IS REQUIRED FOR ALL RAISED MEDIANS.

### 6" VERTICAL CURB WITH 1' GUTTER

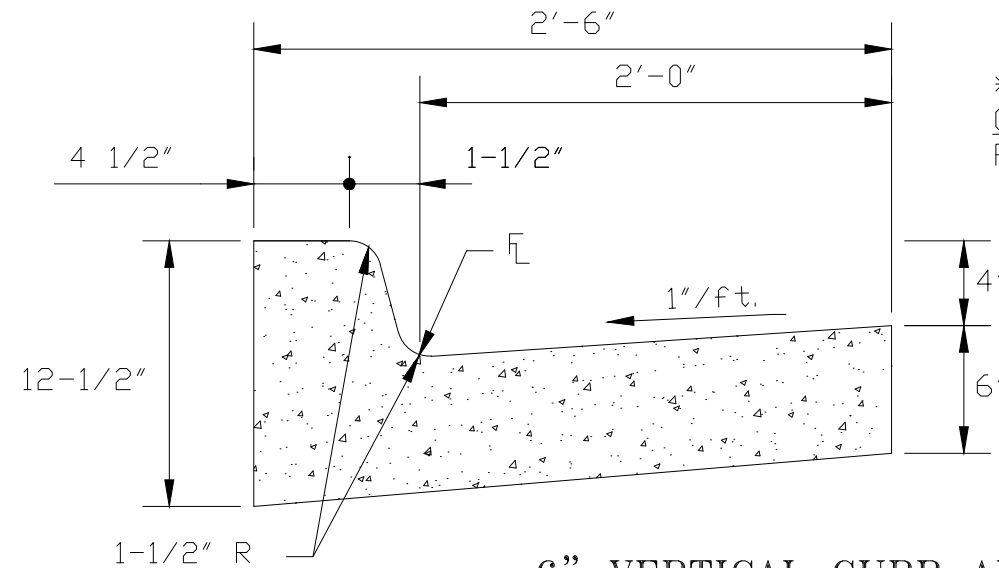


\* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS

\* ANY CURB TRANSITION FROM COMBINATION CURB, GUTTER AND SIDEWALK TO 6" VERTICAL CURB AND GUTTER SHALL TAKE PLACE IN A MINIMUM OF 12 FEET.

\* COMBINATION CURB, GUTTER, AND SIDEWALK IS REQUIRED FOR LOCAL STREETS.

### MOUNTABLE CURB & GUTTER



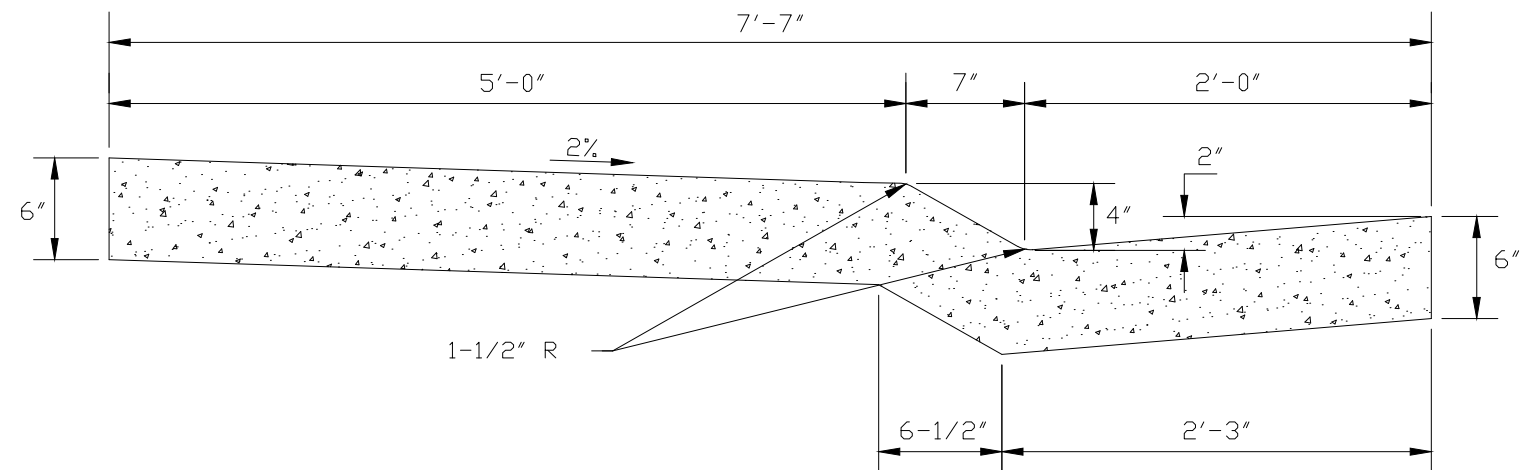
\* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS FOR ALL CURB AND GUTTER.

### 6" VERTICAL CURB AND GUTTER

FOR 1' SPILL CURB : REFERENCE CDOT "M-609-1 CURB, GUTTERS, AND SIDEWALKS". USE CURB AND GUTTER TYPE 2 (SECTION IB)

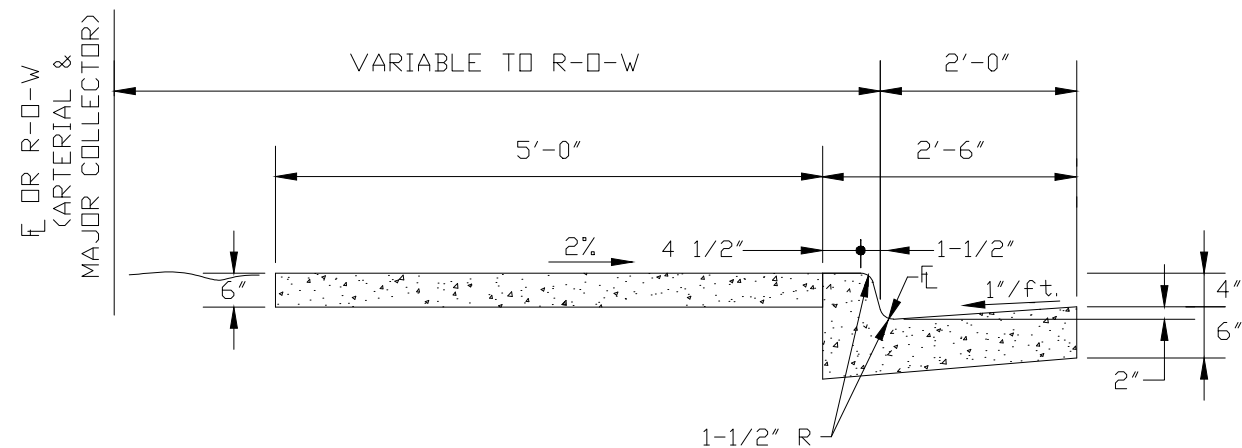
Revisions:	Designed By: SAK	Scale: (As Shown)	<div>JEFFERSON COUNTY COLORADO</div> <div>DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	STANDARD 1		
	Drawn By: SAK	Date Created:		CURB & GUTTER		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-1.DWG	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards					
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STANDARD 2 COMBINATION CURB, GUTTER AND SIDEWALK



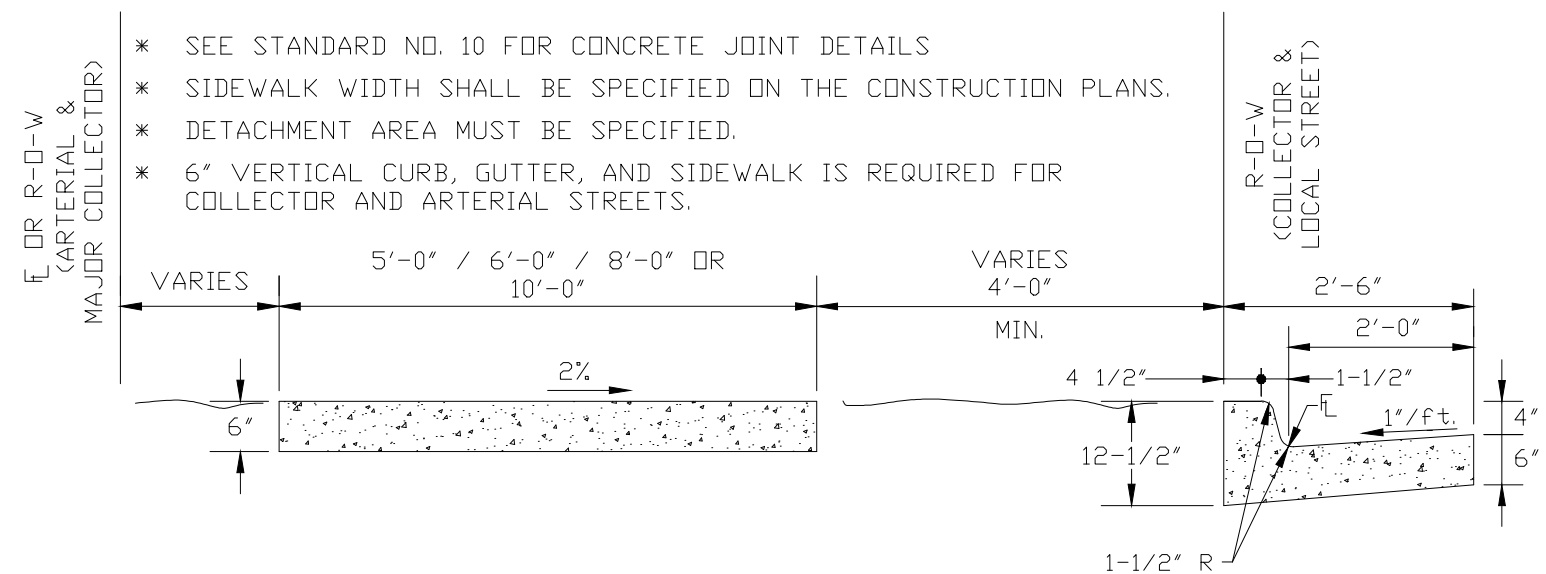
- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS
- \* ANY CURB TRANSITION FROM COMBINATION CURB, GUTTER AND SIDEWALK TO 6" VERTICAL CURB AND GUTTER SHALL TAKE PLACE IN A MINIMUM OF 12 FEET.

STANDARD 3 6" VERTICAL CURB, GUTTER AND ATTACHED SIDEWALK



- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS
- \* SIDEWALK WIDTH SHALL BE SPECIFIED ON THE CONSTRUCTION PLANS AS APPROVED BY PLANNING & ZONING
- \* 6" VERTICAL CURB, GUTTER, AND SIDEWALK IS REQUIRED FOR COLLECTOR AND ARTERIAL STREETS.

STANDARD 4 6" VERTICAL CURB, GUTTER AND DETACHED SIDEWALK



- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS
- \* SIDEWALK WIDTH SHALL BE SPECIFIED ON THE CONSTRUCTION PLANS.
- \* DETACHMENT AREA MUST BE SPECIFIED.
- \* 6" VERTICAL CURB, GUTTER, AND SIDEWALK IS REQUIRED FOR COLLECTOR AND ARTERIAL STREETS.

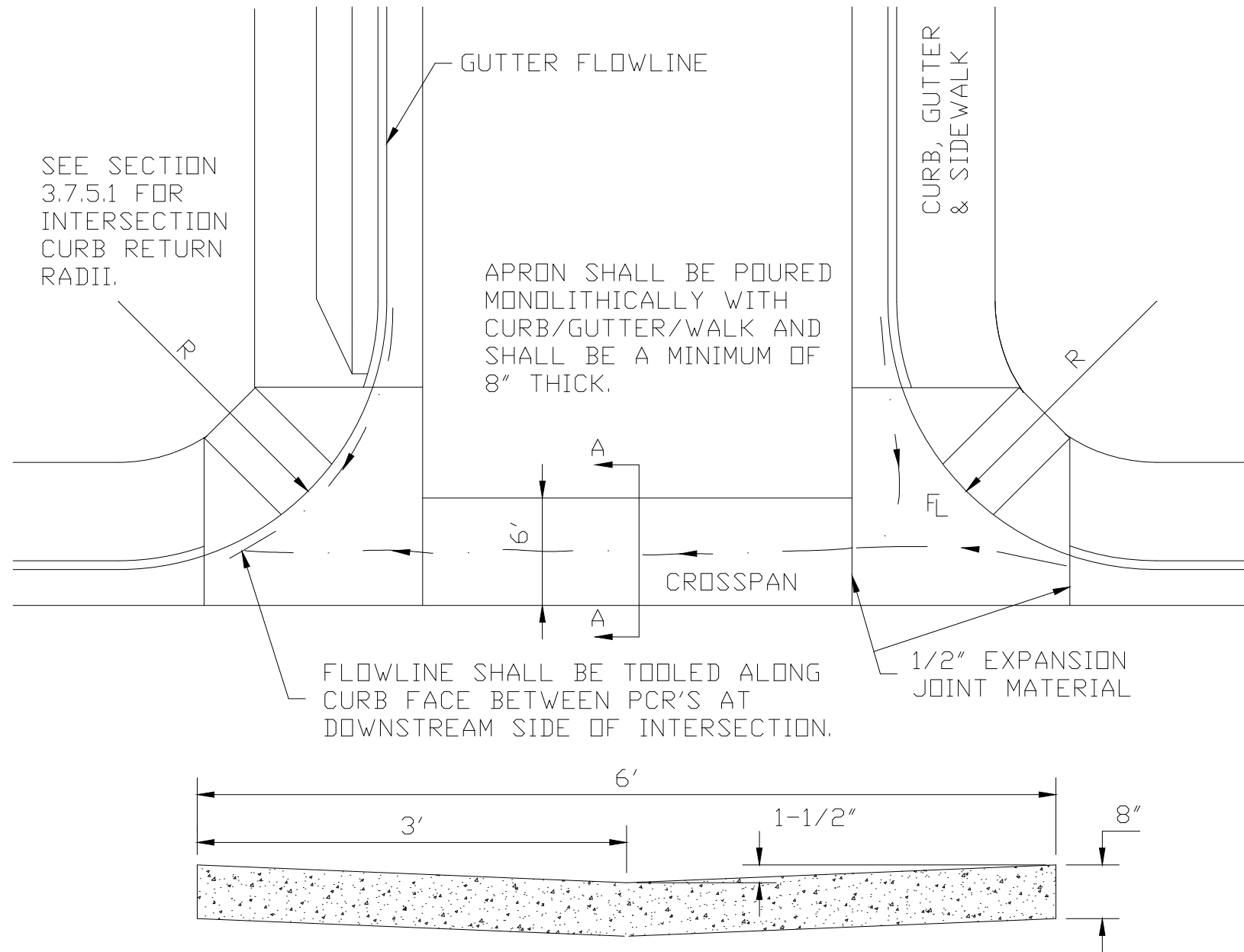
Revisions:	Designed By: SAK	Scale: (As Shown)
	Drawn By: SAK	Date Created:
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:
	File: STND-2-4.DWG	F.O.R. Date: For Const. Date:
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards	



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STANDARD 2, 3 & 4  
CURB, GUTTER & SIDEWALKS

Project No.: - Sheet - Of -

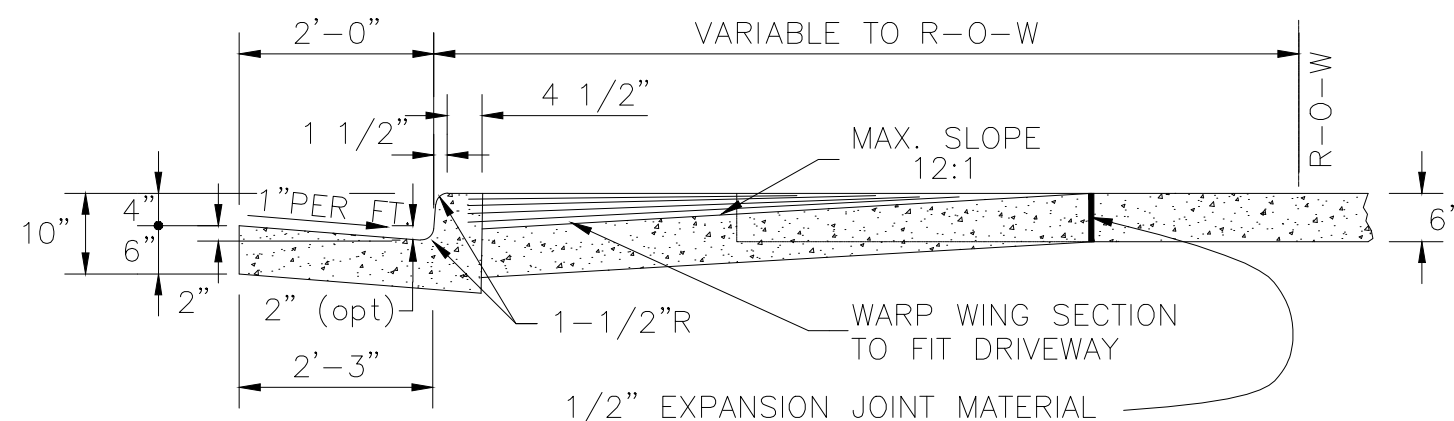
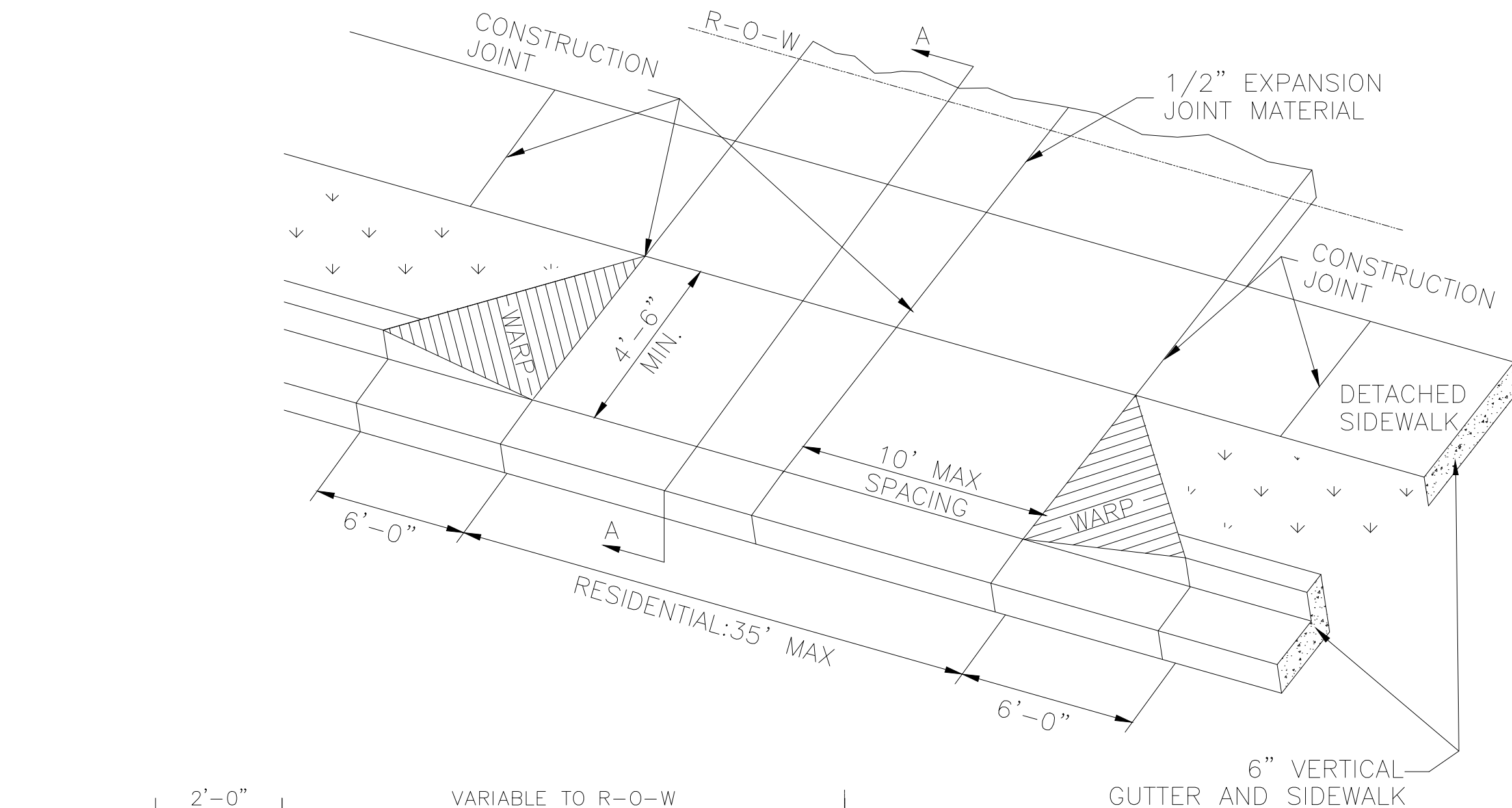


# SECTION A - A 6 FOOT CROSSSPAN

## NOTE:

- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS.
- \* EXPANSION JOINTS ARE REQUIRED AT P.C.R.'S.
- \* CROSSPANS ARE NOT PERMITTED ACROSS ARTERIAL/COLLECTOR STREETS.

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	Drawn By: SAK	Date Created:		TYPICAL INTERSECTION CROSSPAN			
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:					
	File: STND-5.DWG	F.O.R. Date: For Const. Date:					
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards						
			Project No.: -			Sheet -	Of -



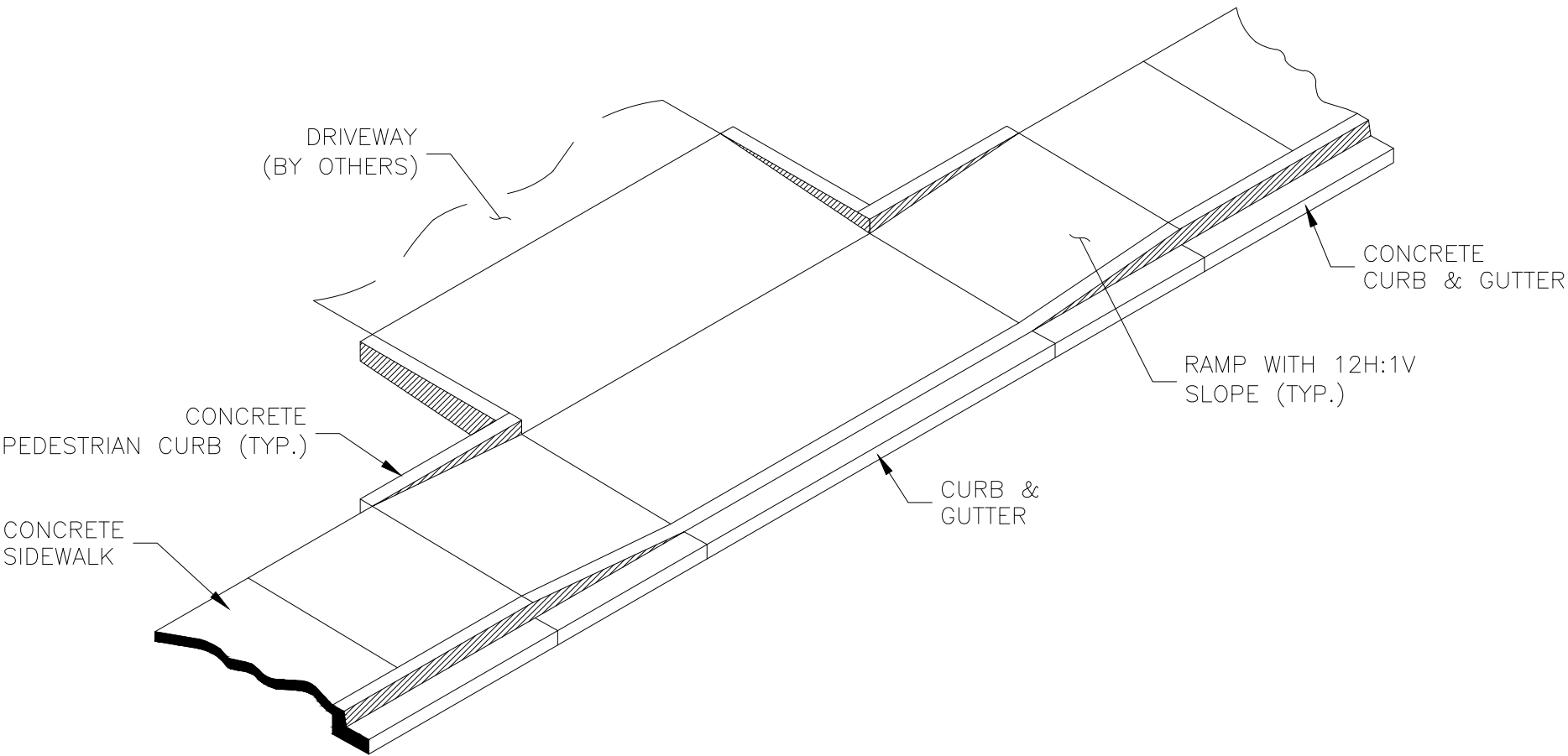
SECTION A - A

NOTE:

- \* THIS STANDARD IS NOT ALLOWED ON ARTERIAL STREETS.
- \* REFER TO DRIVEWAY INTERSECTION SPACING REQUIREMENTS IN THIS MANUAL.
- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS.
- \* SIDEWALK CROSS-SLOPE SHALL NOT EXCEED 2%.

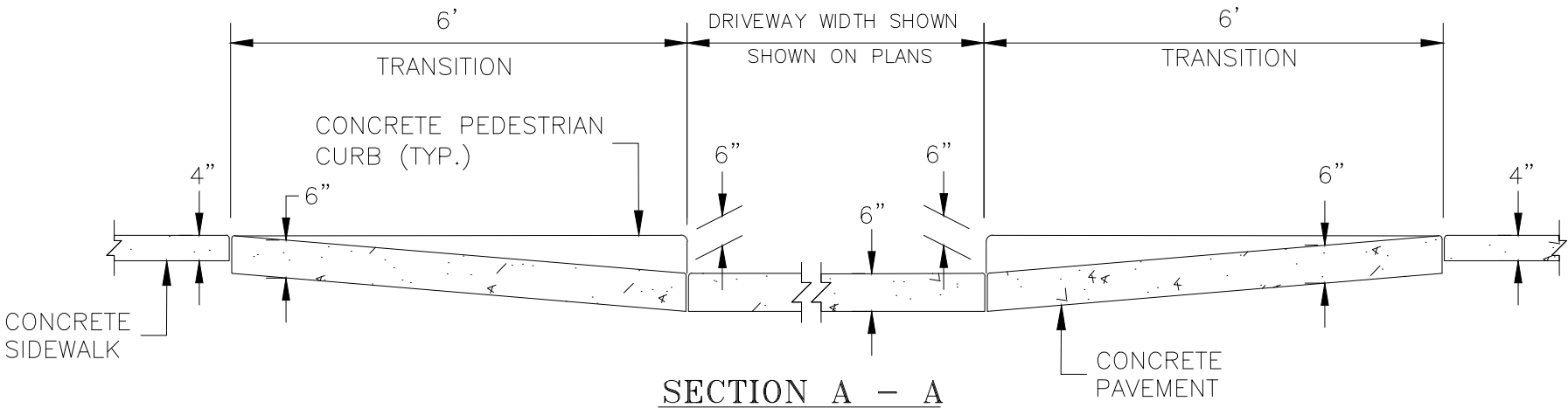
Revisions:	Designed By: SAK	Scale: (As Shown)	<div>JEFFERSON COUNTY COLORADO</div> <div>DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	STANDARD 6				
	Drawn By: SAK	Date Created:		DRIVEWAY SECTION FOR 6" VERTICAL CURB & GUTTER				
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:						
	File: STND-6.dwg	F.O.R. Date: For Const. Date:						
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards							
				Project No.: -	Sheet -	Of -		



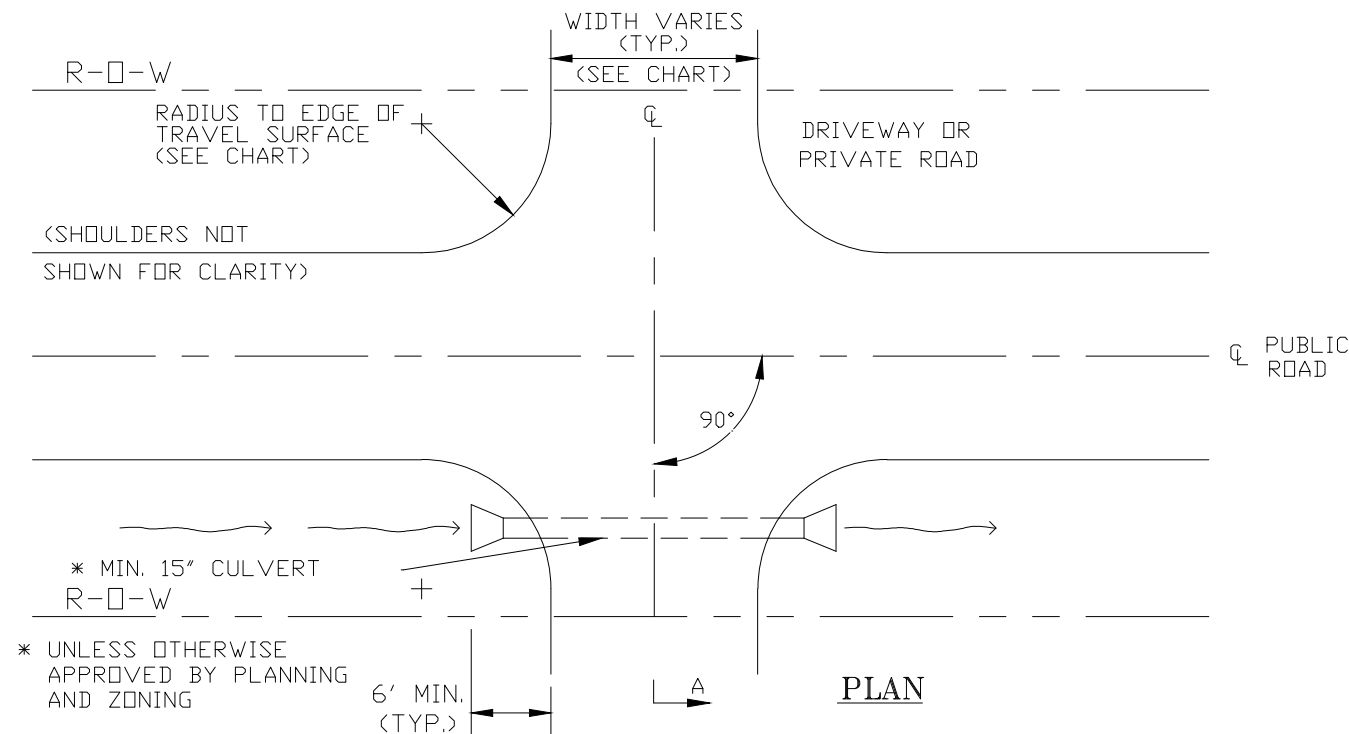


NOTE:

- 1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.
- 2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.
- 3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.
- 4. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE PAVEMENT.







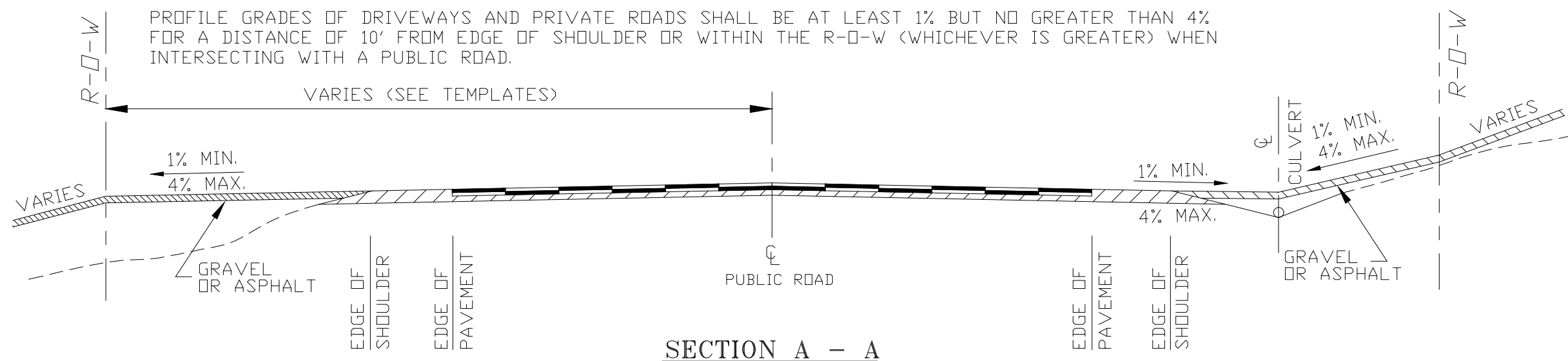
\* UNLESS OTHERWISE APPROVED BY PLANNING AND ZONING

DRIVEWAYS AND PRIVATE ROADS SHALL INTERSECT WITH PUBLIC ROADS AT RIGHT (90°) ANGLES OR AS NEARLY AT RIGHT ANGLES AS POSSIBLE FOR A DISTANCE OF:

- 25' FROM THE TRAVEL SURFACE OR WITHIN THE R-O-W (WHICHEVER IS GREATER) WHEN INTERSECTING WITH A MAJOR COLLECTOR OR ARTERIAL ROAD, OR
- 15' FROM THE TRAVEL SURFACE OR WITHIN THE R-O-W (WHICHEVER IS GREATER) WHEN INTERSECTING WITH A COLLECTOR OR LOCAL ROAD.

	TRAVEL SURFACE	
	WIDTH (FEET)	RADIUS (FEET)
DRIVEWAY	10	10
PRIVATE ROAD	16-18	15

\* AN ACCESS PERMIT FROM THE JEFFERSON COUNTY PLANNING & ZONING IS REQUIRED FOR A NEW OR MODIFICATION TO AN EXISTING DRIVEWAY OR PRIVATE ROAD ACCESSING A COUNTY ROAD.



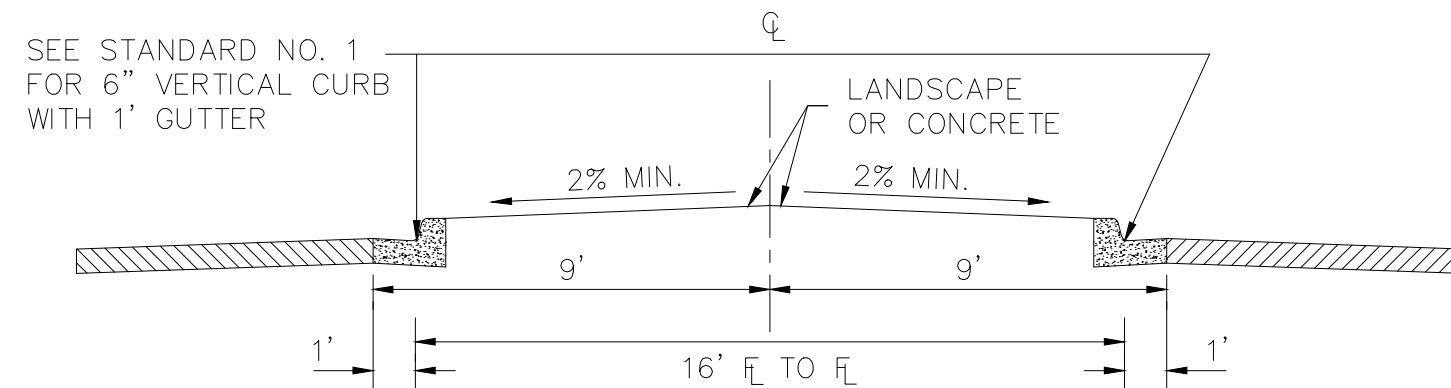
Revisions:	Designed By: SAK	Scale: (As Shown)
	Drawn By: SAK	Date Created:
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:
	File: STND-8.dwg	F.O.R. Date: For Const. Date:
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards	



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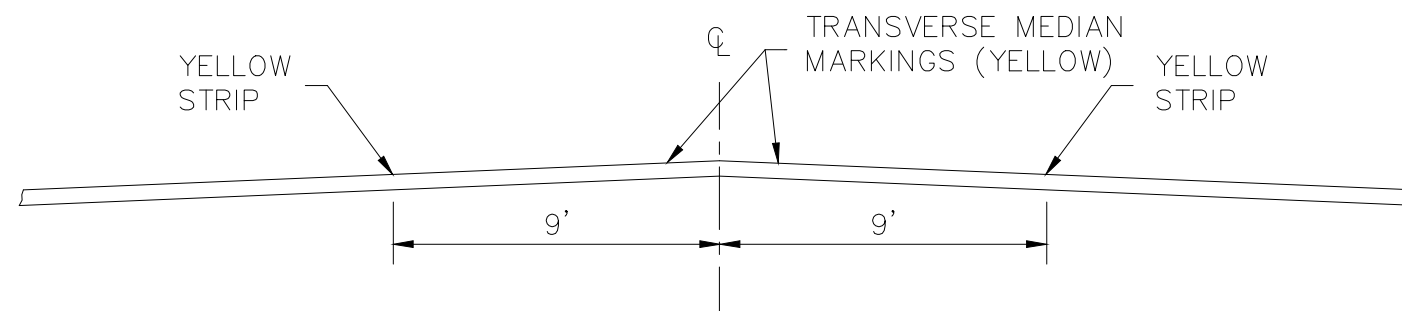
STANDARD 8  
DRIVEWAY/PRIVATE ROAD APPROACHES

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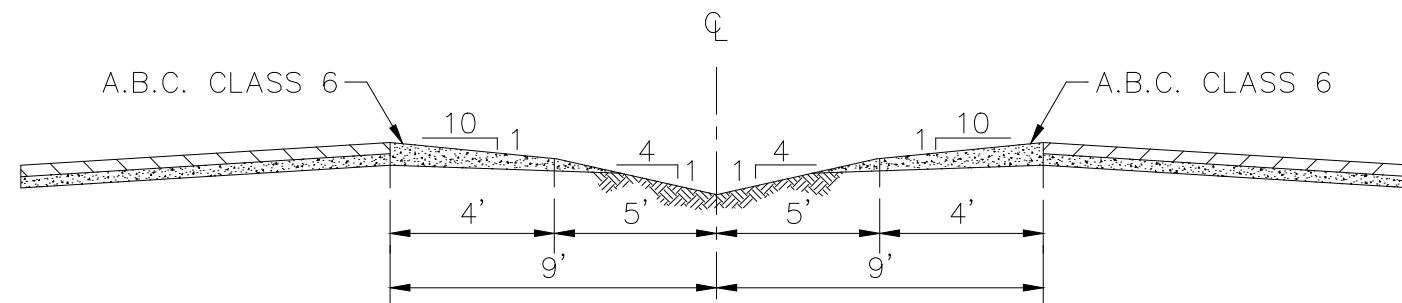
### RAISED MEDIAN

- \* MEDIAN TREATMENT SHALL BE APPROVED BY PLANNING AND ZONING.
- \* SOIL SHALL BE STERILIZED BENEATH RAISED MEDIANS WITH CONCRETE TREATMENTS.
- \* CURB INLETS AND STORM SEWER SHALL BE PROVIDED TO DRAIN ALL RAISED MEDIANS.



### PAVED, FLUSH MEDIAN

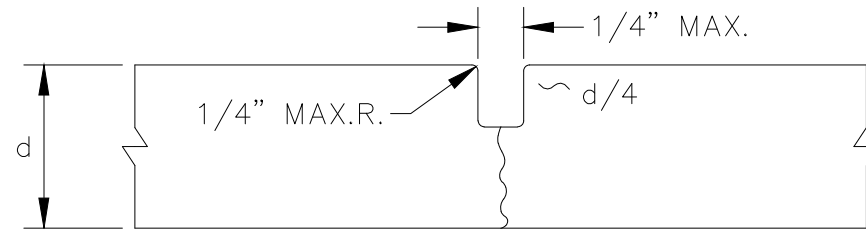
- \* REFER TO CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR ADDITIONAL STRIPING INFORMATION.



### DEPRESSED MEDIAN

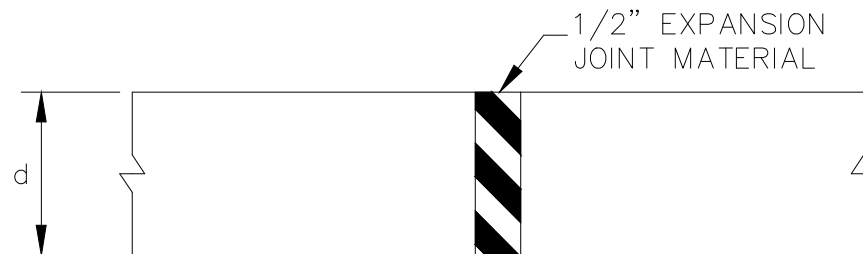
- \* MEDIAN TREATMENT SHALL BE APPROVED BY PLANNING AND ZONING.
- \* DRAINAGE SYSTEMS SHALL BE PROVIDED FOR IRRIGATED MEDIANS.

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	Drawn By: SAK	Date Created:		TYPICAL MEDIAN DESIGNS		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-9.dwg	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards					
				Project No.: -	Sheet -	Of -



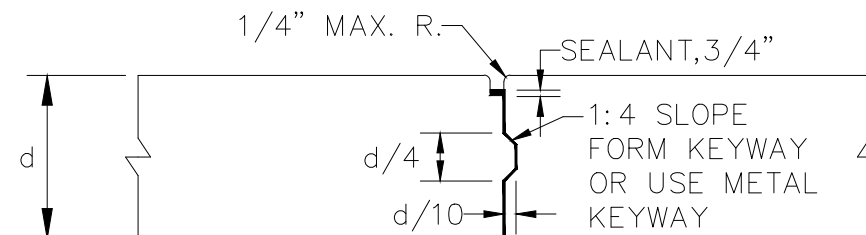
### CONTRACTION JOINT

- \* MAXIMUM CONTRACTION JOINT SPACING FOR CURB,GUTTER AND SIDEWALKS IS 10 FEET.
- \* SAWCUT JOINTS (IF USED) SHALL BE AFTER CONCRETE HAS SUFFICIENTLY HARDENED, BUT BEFORE UNCONTROLLED CRACKING OCCURS.



### EXPANSION JOINT

- \* 1/2" EXPANSION JOINT MATERIAL SHALL BE PLACED AS REQUIRED AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE
- \* EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR A FIXED STRUCTURE.

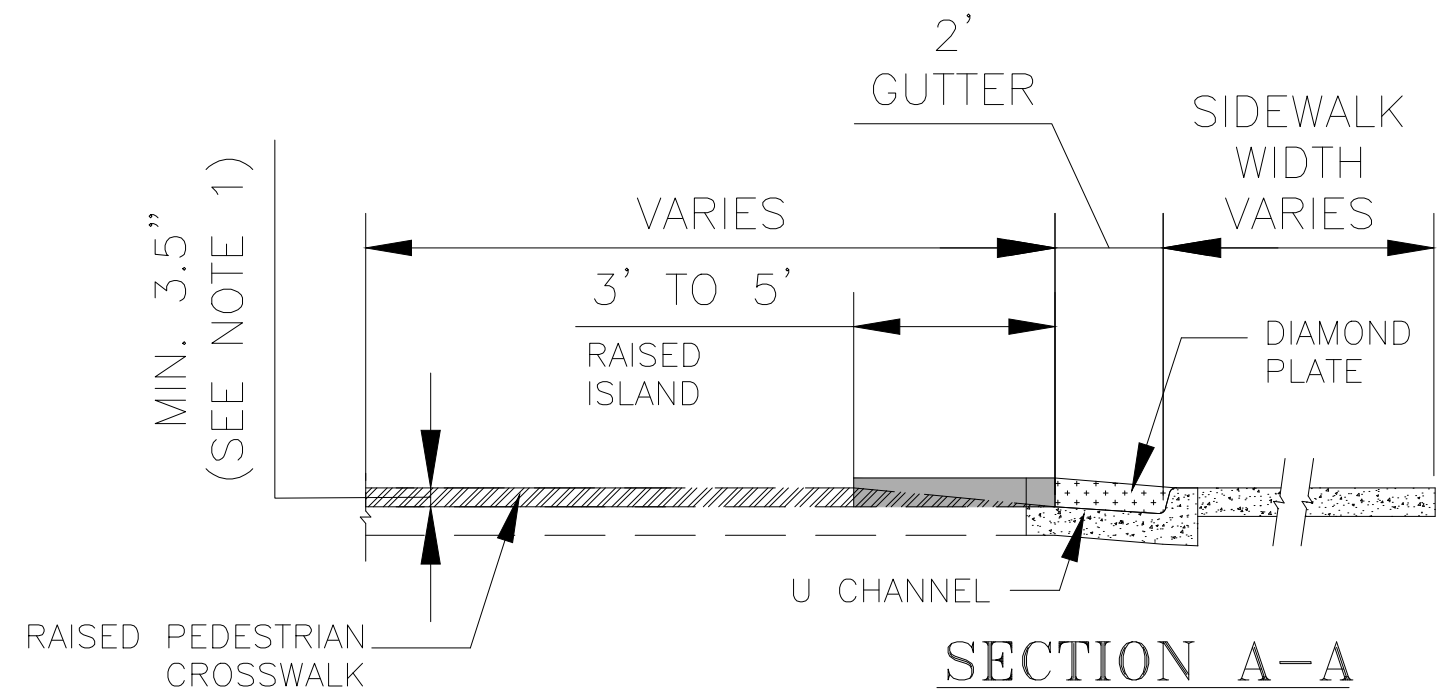


### LONGITUDINAL OR TRANSVERSE CONSTRUCTION JOINT

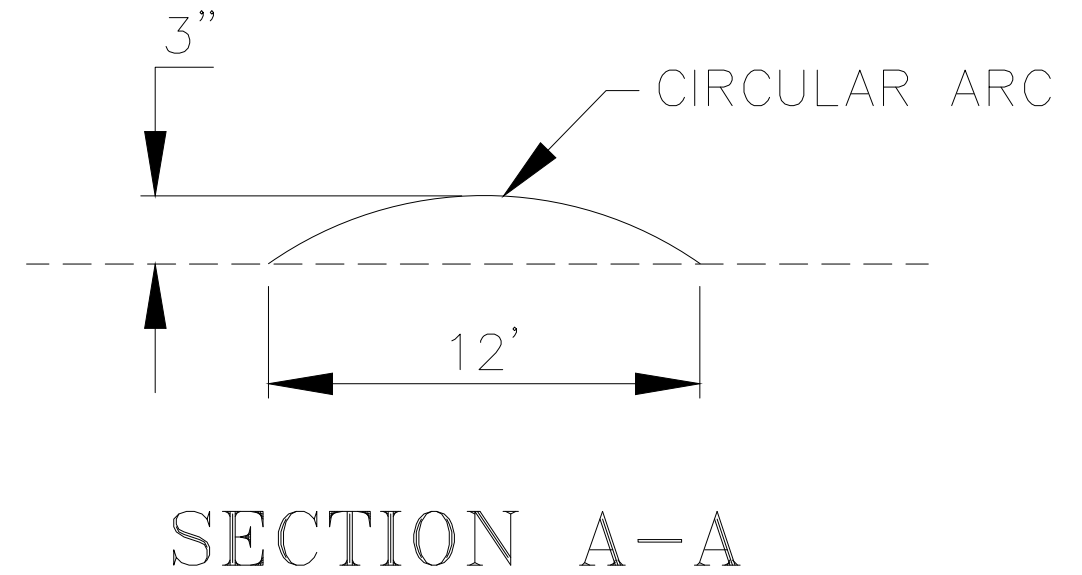
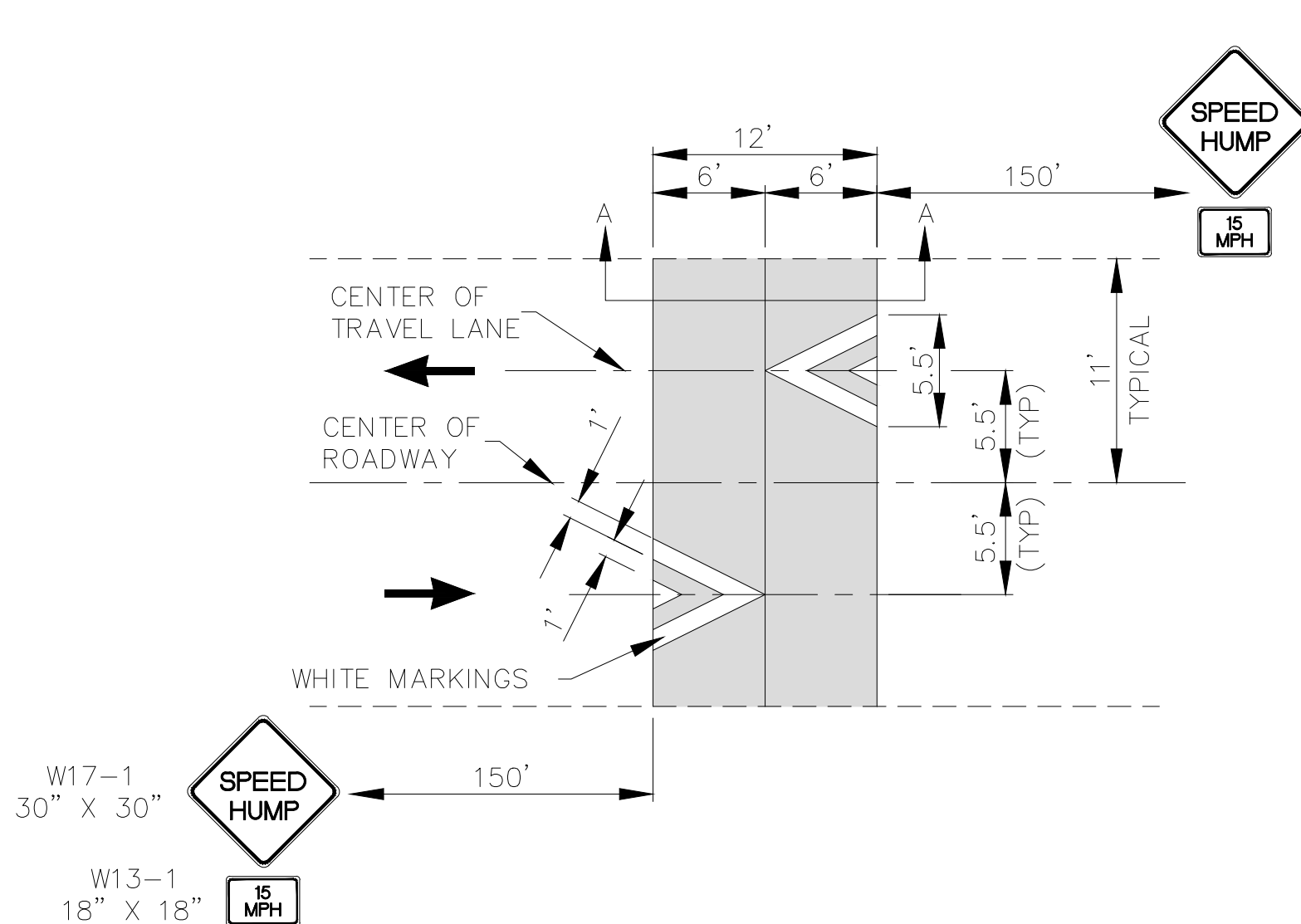
- \* TRANSVERSE CONSTRUCTION JOINTS REQUIRED AT THE END OF EACH DAY'S POUR AND WHEN THE POUR HAS BEEN SUSPENDED FOR 30 MINUTES OR MORE.

NOTE: JOINT LAYOUT AND JOINT DETAILS FOR CONCRETE STREETS SHALL BE SUBMITTED TO TRANSPORTATION AND ENGINEERING FOR APPROVAL.

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	Drawn By: SAK	Date Created:			
	Checked By: Staff	Plot Date: 1/13/2025	F.I.R. Date:		
	File: STND-10.DWG	F.O.R. Date:	For Const. Date:		
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards			Project No.: -	Sheet - Of -



1. CROSSWALK HEIGHT SHALL MATCH CURB HEIGHT. MINIMUM CROSSWALK HEIGHT OF 3.5 INCHES MAY BE PERMITTED DUE TO EXISTING CONSTRAINTS.
2. IF BIKE LANES ARE PRESENT, CURB EXTENSION AND DIAMOND PLATE SHALL BE MODIFIED AS DIRECTED BY JEFFERSON COUNTY SO THAT BICYCLE TRAVEL IS NOT OBSTRUCTED.
3. RAISED CROSSING SHALL BE CONSTRUCTED OF CONCRETE UNLESS DIRECTED OTHERWISE BY JEFFERSON COUNTY.



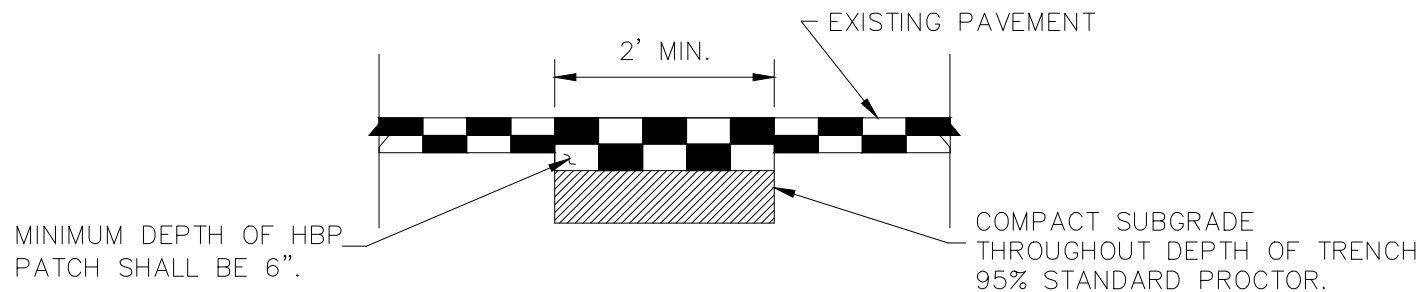
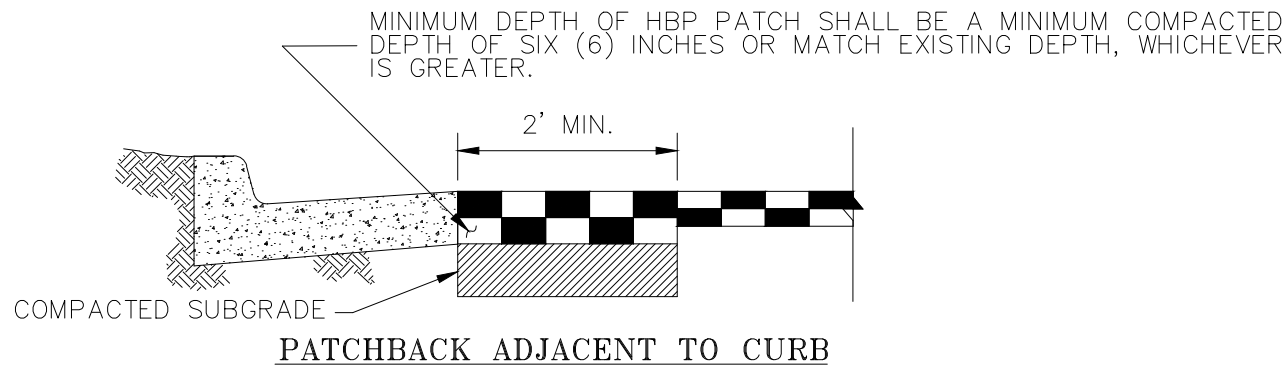
## NOTES:

PAVEMENT MARKINGS SHALL BE PERMANENT MARKINGS (THERMOPLASTIC, STAMARK, ETC.)

ADVISORY SPEED LIMIT MAY BE LOWER DUE TO STREET GEOMETRICS.

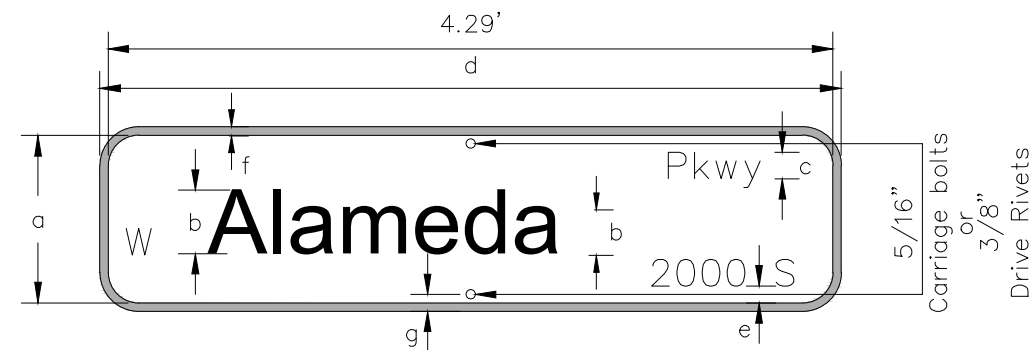
THE EXACT LOCATION OF SPEED HUMP, MARKINGS AND SIGNS WILL BE DETERMINED IN THE FIELD BY THE ENGINEER. (JEFFERSON COUNTY STAFF)

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	Drawn By: SAK	Date Created:		SPEED HUMP INSTALLATION		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-12.dwg	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards					
				Project No.: -	Sheet -	Of -



**NOTE:** PATCHBACK FOR UTILITY AND SERVICE TRENCHES

- \* STRAIGHT SAWCUT OR BLADECUT THE EXISTING ASPHALT PAVEMENT WHEN JOINING WITH NEW ASPHALT PAVEMENT.
- \* PATCH SHALL BE PLACED AND COMPACTED IN LIFTS A MAXIMUM OF 3" IN DEPTH.
- \* APPLY SS-I TACK COAT TO EXISTING ASPHALT AND/OR CONCRETE SURFACES.
- \* TRENCHES LESS THAN 2' IN WIDTH MUST RECEIVE PRIOR APPROVAL FROM THE TRANSPORTATION & ENGINEERING DIVISION.



**NOTE:**

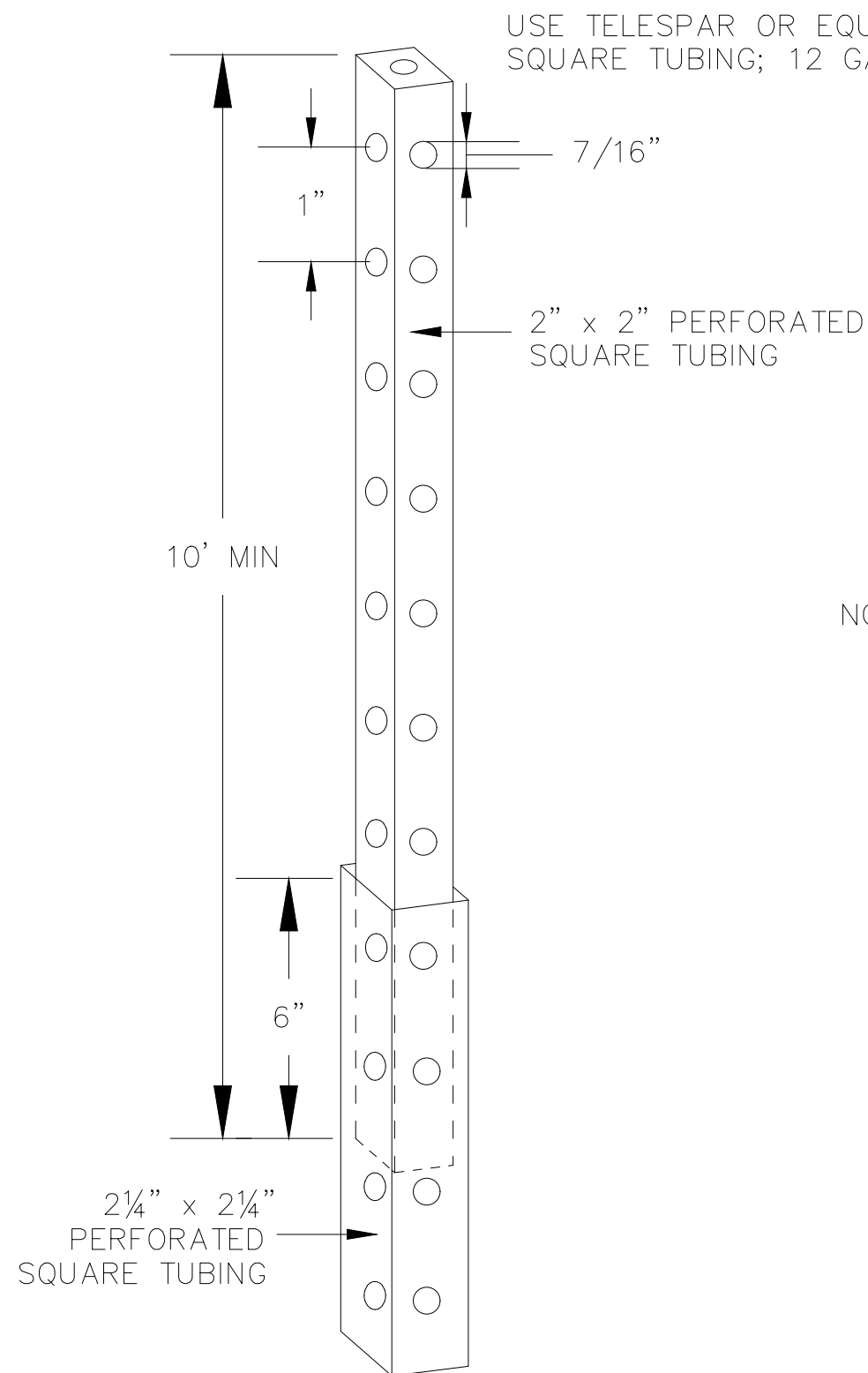
- \* SIGN BLANKS SHALL BE 6061 OR 5052-H38 ALUMINUM ALLOY .100"
- \* FACING SHALL BE 3M GREEN ELECTRO CUT FILM OR EQUIVALENT. \* LETTERS AND NUMBERS SHALL BE 3M HIGH INTENSITY GRADE PRISMATIC WHITE OR EQUIVALENT.
- \* ROAD TYPE (AVE, PKWY, ETC.) TO BE CENTERED IF POSSIBLE OVER GAP BETWEEN BLOCK # AND DIRECTION.
- \* FONT TYPE SHALL BE HIGHWAY GOTHIC B FED KERN REV, HELVETICA MED COMP ACCT AK REV, OR EQUIVALENT.
- \*\* POST MOUNTED OVER 40mph: 8" UPPER AND 6" LOWER.
- \*\* POST MOUNTED 40mph & UNDER: 6" UPPER AND 4.5" LOWER.

No.	Description	Dimensions (inches)		
		Overhead	Post-mounted, multi-lane, more than 40 mph	Post-mounted, other (multi-lane, 40 mph or less OR two-lane, all speeds)
a	sign height	18	9	9
b	initial capital letter height for street name	12	8	6
	lower case letter height for street name	9	6	4.5
c	initial capital letter height for street type indicator	5	3	3
	lower case letter height for street type indicator	4.5	2.25	2.25
d	length of sign	varies	varies	varies
e	edge of street type and block number to inside edge of border	0.5	0.5	0.5
f	border thickness	1	0.5	0.5
g	bolt hole center to edge of sign	n/a	1	1

**ROAD AND STREET NAME SIGNS**

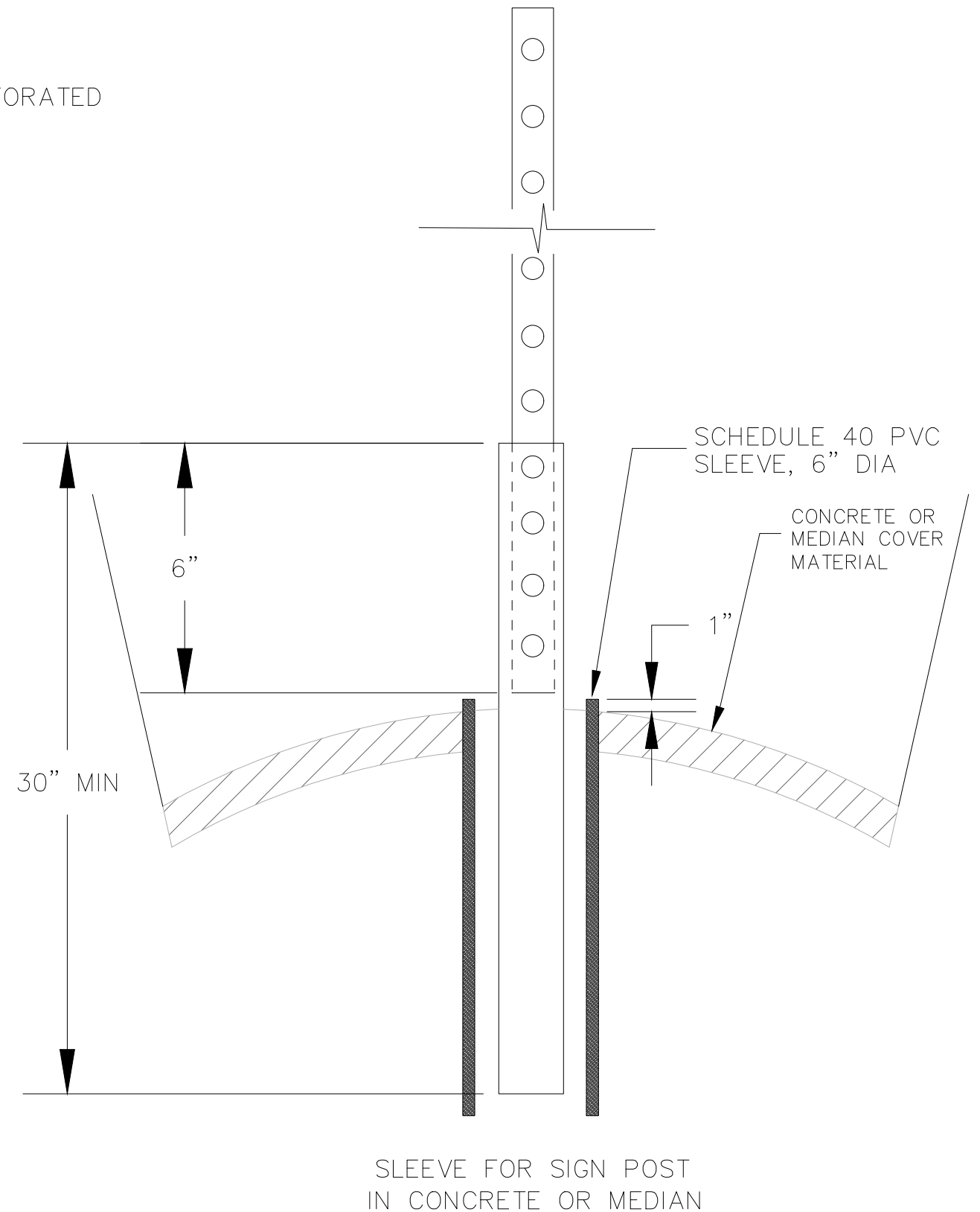
Revisions:	Designed By: SAK	Scale: (As Shown)	<div>JEFFERSONCOUNTY COLORADO</div> <div>DIVISION OF Transportation and Engineering</div> <div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	STANDARD 13 & 14		
	Drawn By: SAK	Date Created:		ASPHALT STREET/ROAD PATCHBACK & ROAD AND STREET NAME SIGNS		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-13-14.dwg	F.O.R. Date: For Const. Date:				
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NOTE: INSTALLATIONS TO USE  
3' LONG X 2.25" X 2.25"  
GALVANIZED TUBE BASE.

— 6" PVC SLEEVE TO BE  
USED FOR ALL SIGN POST  
BASES IN CONCRETE



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	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:
	File: STND-15.dwg	F.O.R. Date: For Const. Date:
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards	

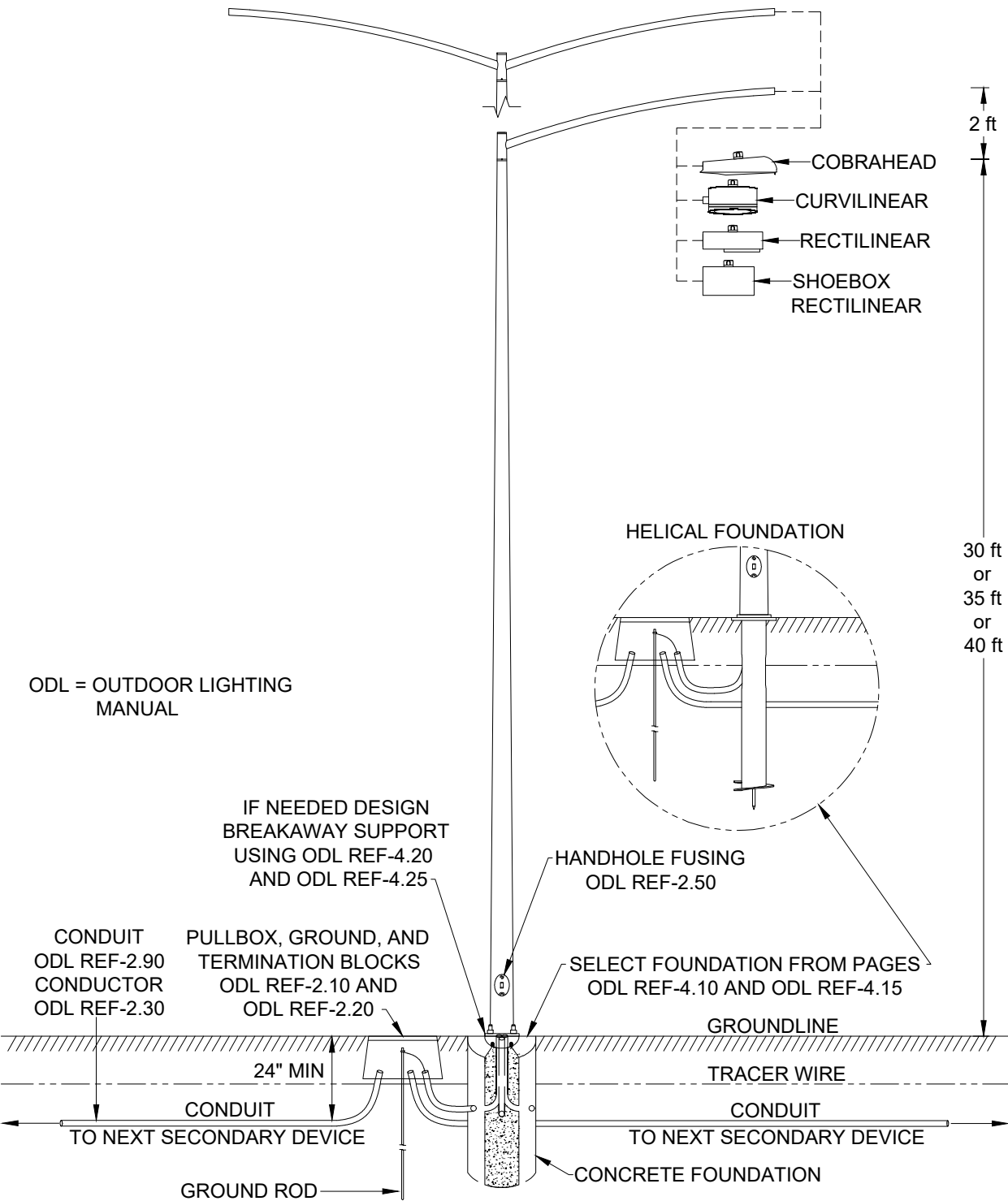
**JEFFERSON**  
COUNTY COLORADO

DIVISION OF  
Transportation and Engineering  
100 JEFFERSON COUNTY PARKWAY, SUITE 3500  
GOLDEN, COLORADO 80419  
(303) 271-8495

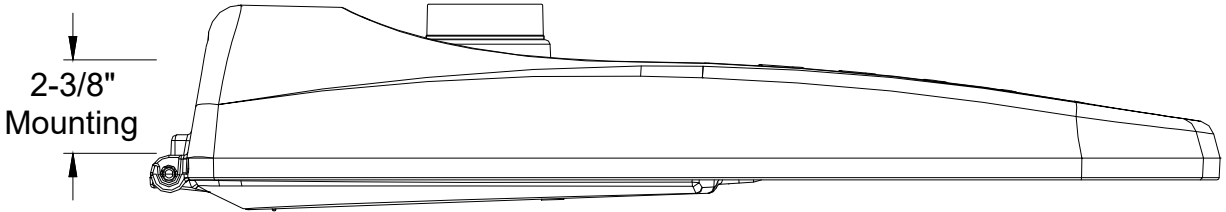
STANDARD 15  
SIGN POST AND BASE

Project No.: - Sheet - Of -

STEEL POLE - TENON TOP  
SIDE MOUNT LUMINAIRES



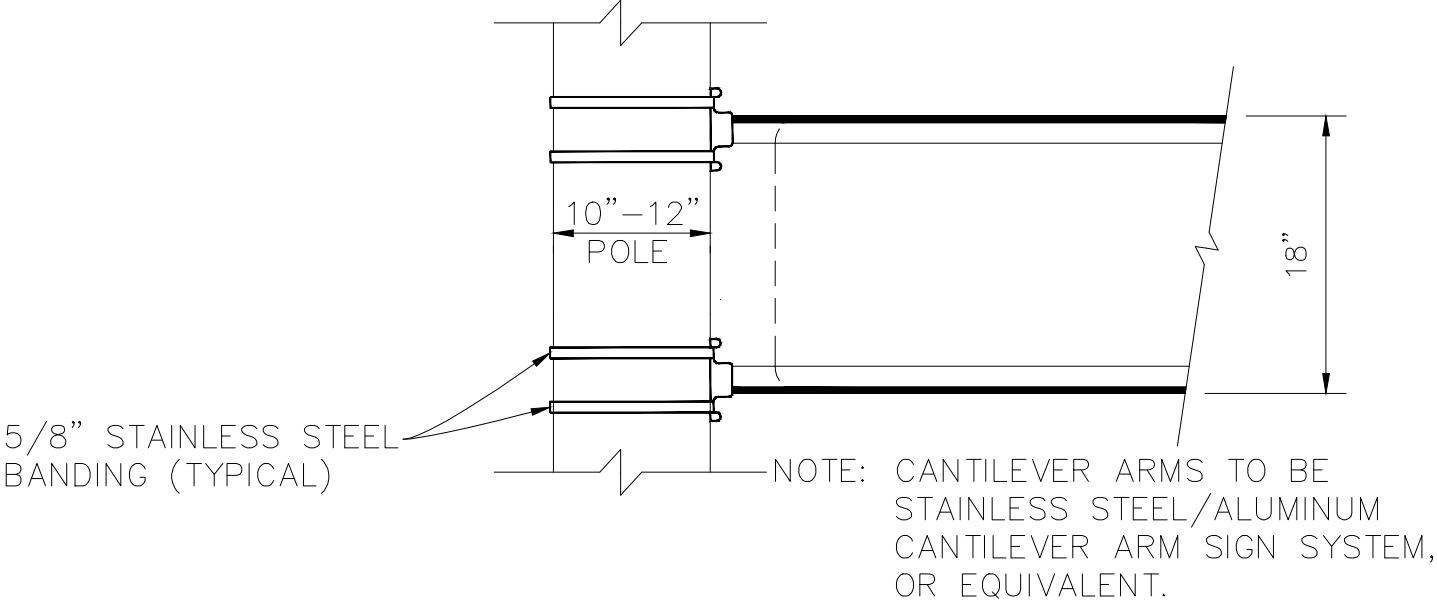
SIDE MOUNT LUMINAIRE  
COBRAHEAD - LED

			
Description: For use on 2-3/8" OD arm	C/U	Luminaire Cat ID	Color
LED			
Cobrahead - 14000 lm LED - type D	ESLC25LY	219752	Grey8

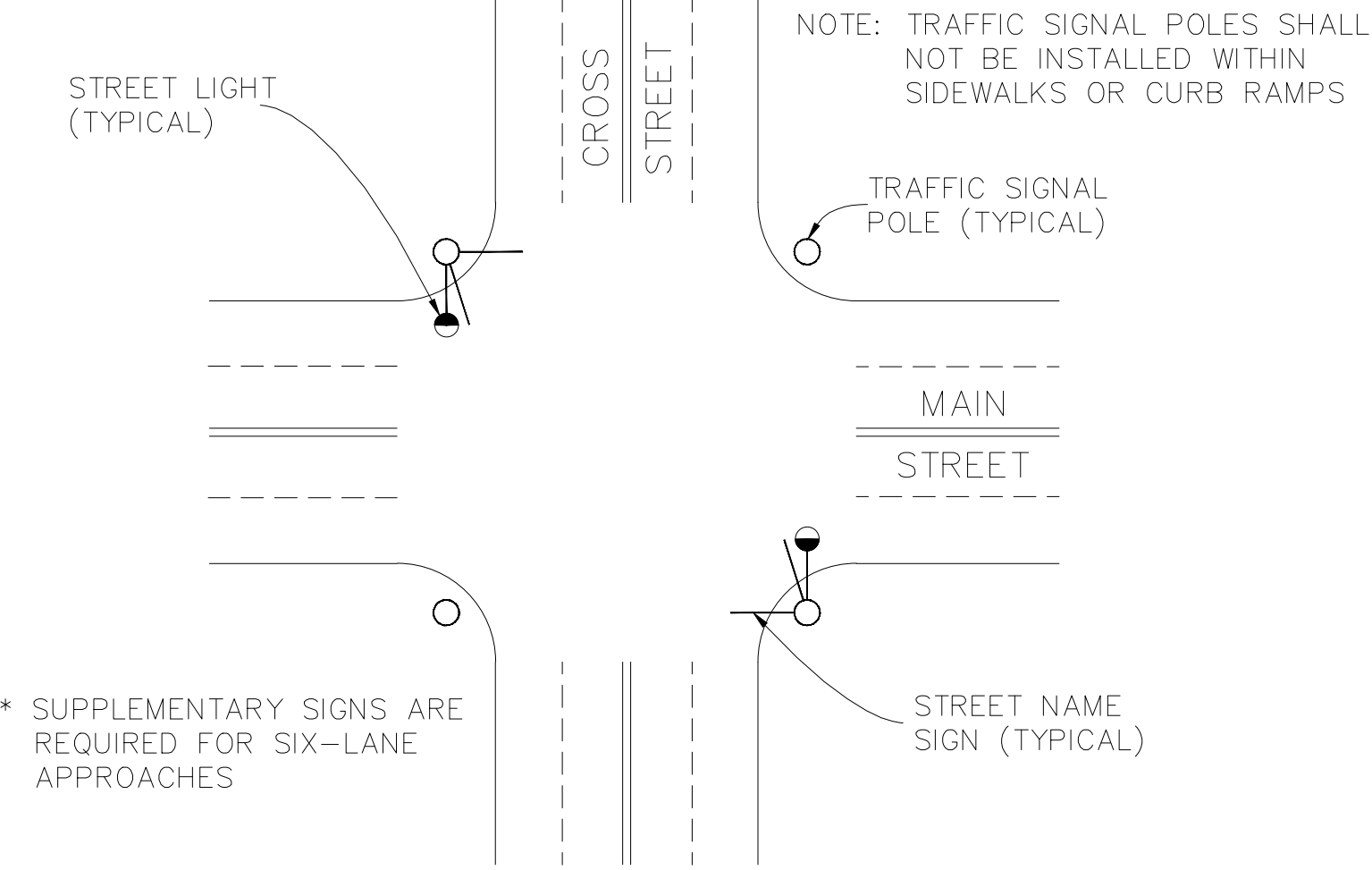
Notes:

1. C/Us include the luminaire, and the Long Life photo control.
2. Design type B, type C, type D and type E for LED luminaires. Types B, C, D and E are functional equivalents to 100, 150, 250 and 400-Watt HPS luminaires respectively. The lumens (lm) shown are the delivered lumens. Please contact EDS or the latest specification for wattage rating.
3. Design poles, mast arms, foundations etc. using sections PL-INDEX, AM-INDEX and ODL REF-INDEX.
4. Cobrahead luminaires are slip fit mounted on 2-3/8" Outside Diameter (OD) pipe mast arms.
5. Check for proper illumination levels according to type of application.
6. All standard LED Cobrahead luminaires have multi-voltage drivers rated for 120- 277 V. LED lights can be designed for 120 V, 208 V, 240 V, and 277 V systems.

STREET NAME SIGN AND BRACKET  
ON TRAFFIC SIGNAL POLE



TYPICAL INSTALLATION \*



Revisions:	Designed By: SAK	Scale: (As Shown)	<div><div>JEFFERSON</div><div>COUNTY COLORADO</div></div> <div><div>DIVISION OF</div><div>Transportation and Engineering</div><div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500</div><div>GOLDEN, COLORADO 80419</div><div>(303) 271-8495</div></div>	STANDARD 17		
	Drawn By: SAK	Date Created:		STREET NAME SIGN AND BRACKET ON TRAFFIC SIGNAL POLE - TYPICAL		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-17.dwg	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards					
		Project No.: -		Sheet -	Of -	

WATERPROOFING MEMBRANE APPLIED OVER  
ENTIRE HORIZONTAL SURFACE OF CBC.

OVERLAP EDGES OF ROLL MATERIAL 6  
INCHES MINIMUM AND SEAL.

WRAP 18" MINIMUM

CONCRETE BOX CULVERT

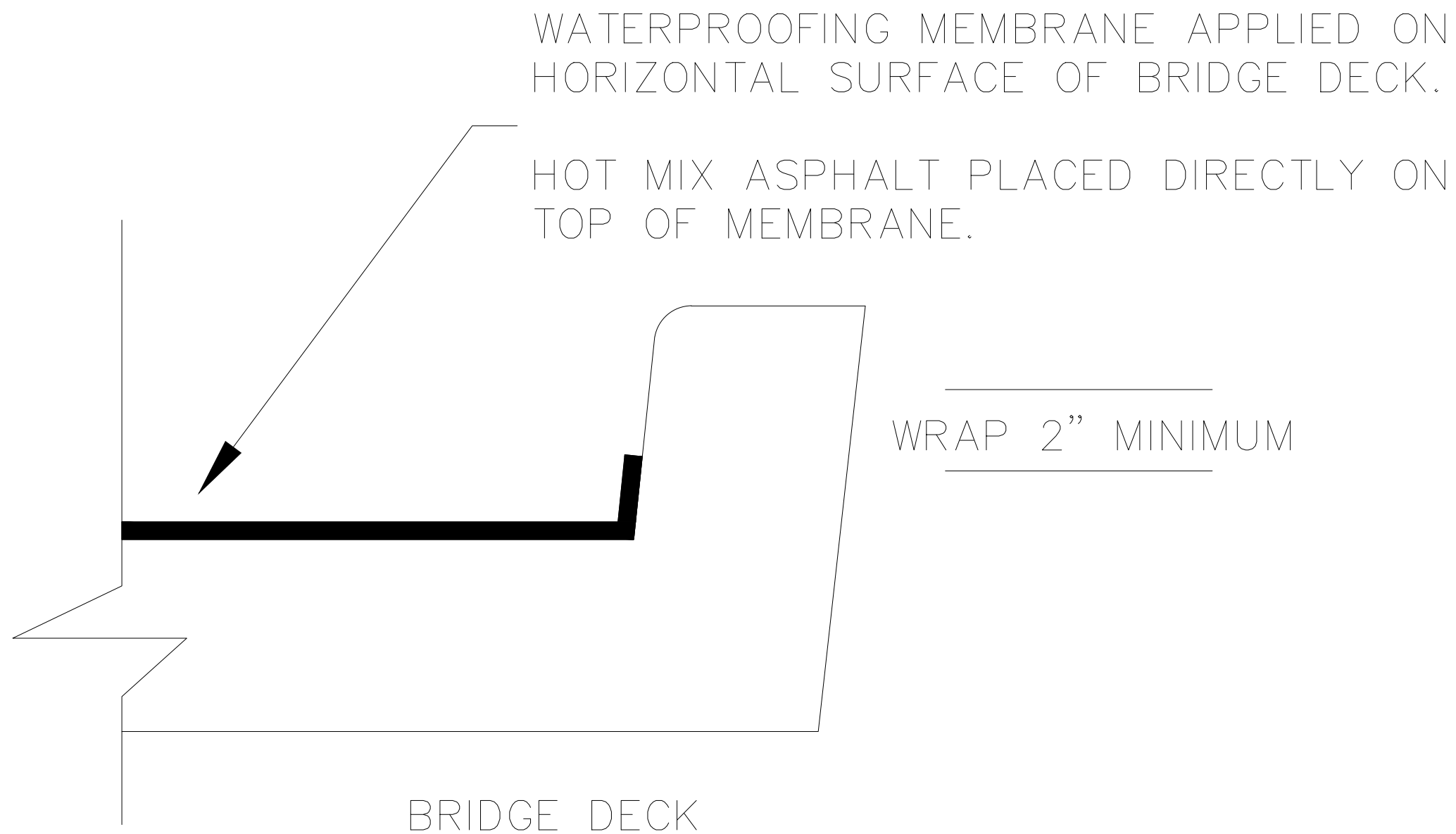
12" MINIMUM

CBC JOINT

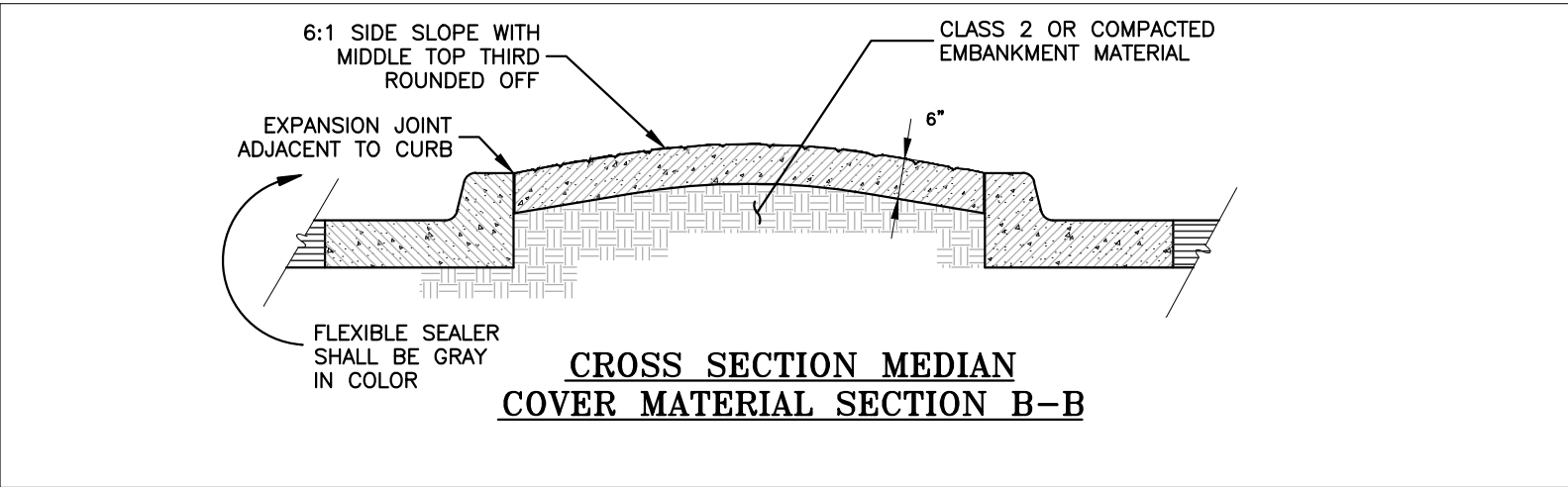
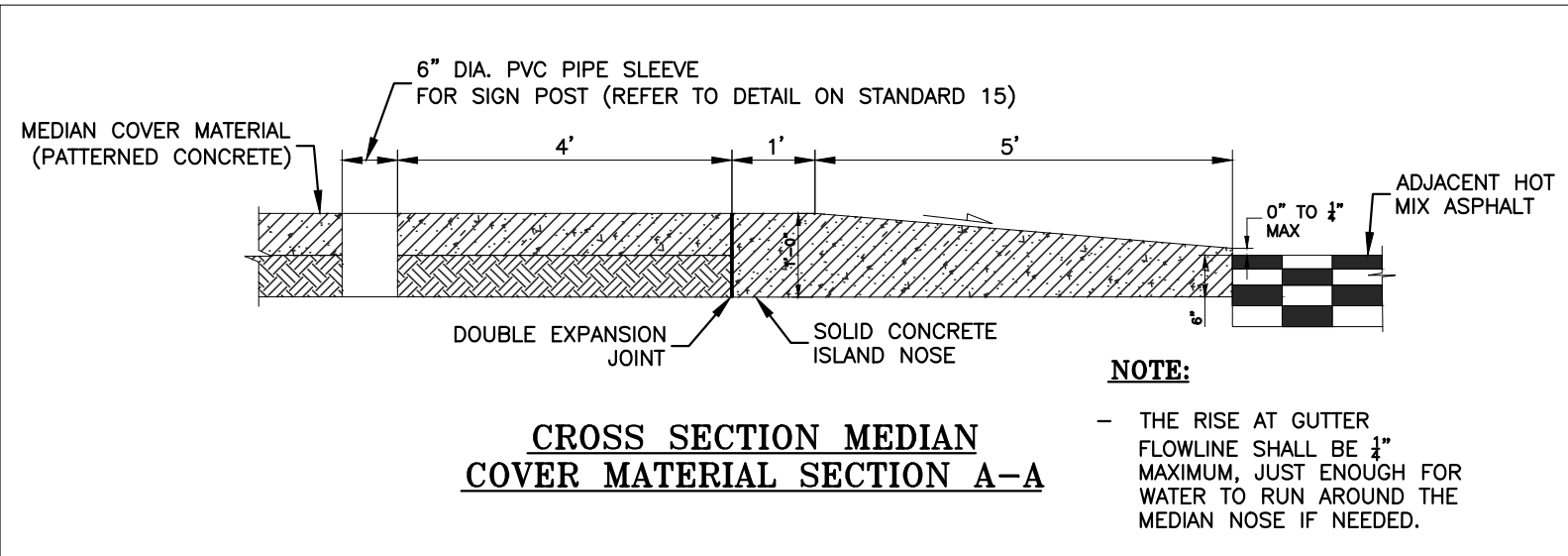
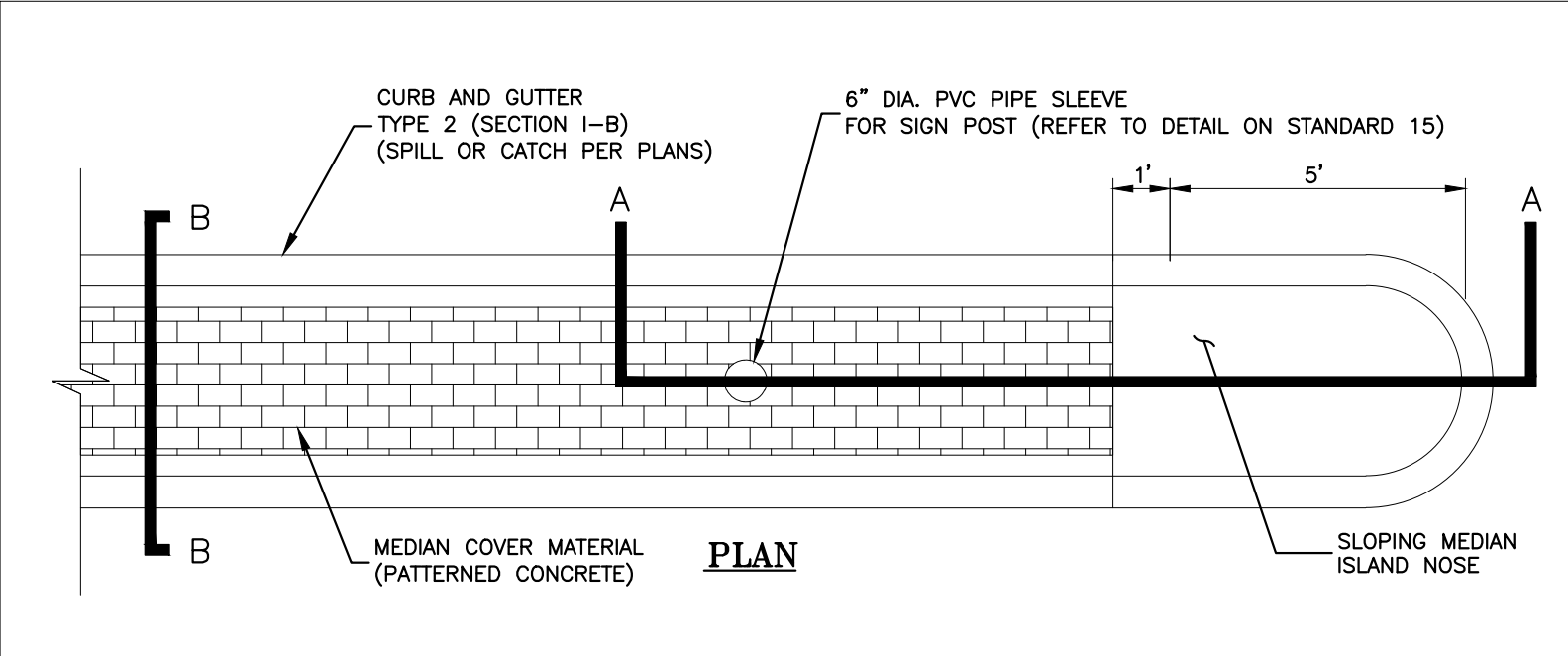
SEAL VERTICAL JOINTS WITH WATERPROOFING  
MEMBRANE OR SELF ADHESIVE ROLL MATERIAL.

JOINTS ARE SEALED ENTIRE HEIGHT OF CBC AND ON  
OUTSIDE CBC SECTIONS.

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	Drawn By:	SAK	Date Created:			WATERPROOFING MEMBRANES FOR CONCRETE BOX CULVERT				
	Checked By:	Staff	Plot Date:	1/13/2025		F.I.R. Date:				
	File:	STND-18.dwg	F.O.R. Date:			For Const. Date:				
	File Location:	G: \_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards								
					Project No.:	-	Sheet	-	Of	-

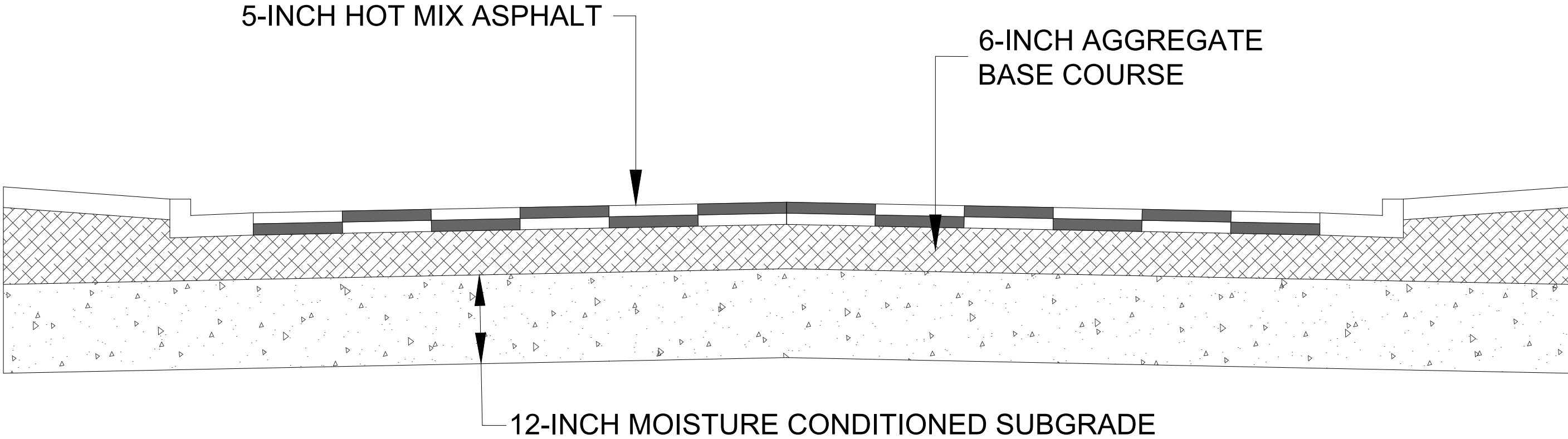



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	Drawn By: SAK	Date Created:		WATERPROOFING MEMBRANES FOR BRIDGE DECK		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-19.dwg	F.O.R. Date: For Const. Date:				
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards			Project No.: -	Sheet -	Of -



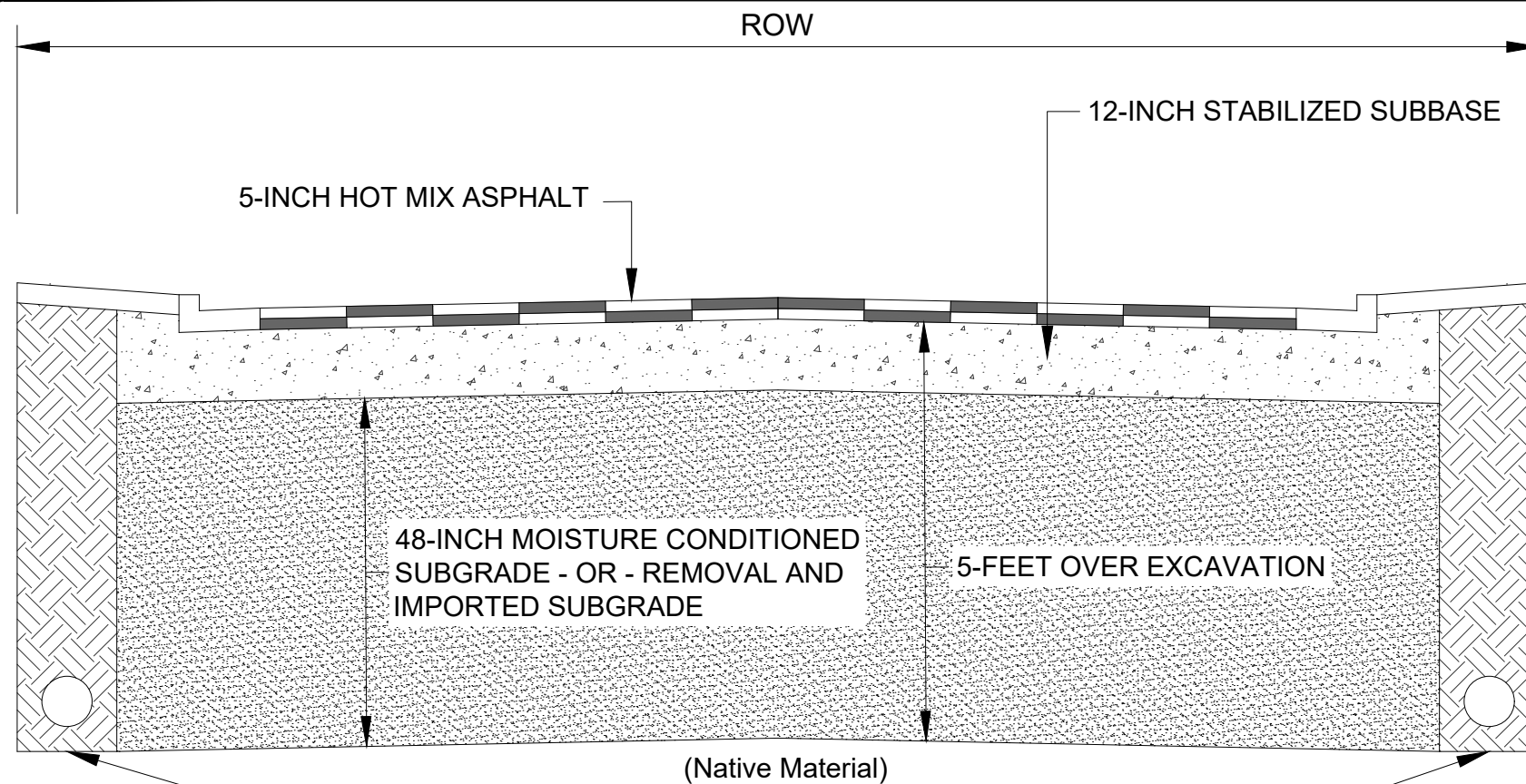
Revisions:	Designed By: SAK	Scale: (As Shown)	<b>JEFFERSON</b> COUNTY COLORADO	DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495	STANDARD 20		
	Drawn By: SAK	Date Created:			MEDIAN COVER MATERIAL - PATTERNED CONCRETE		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:			Project No.: -		
	File: STND-20.dwg	F.O.R. Date: For Const. Date:			Sheet -		
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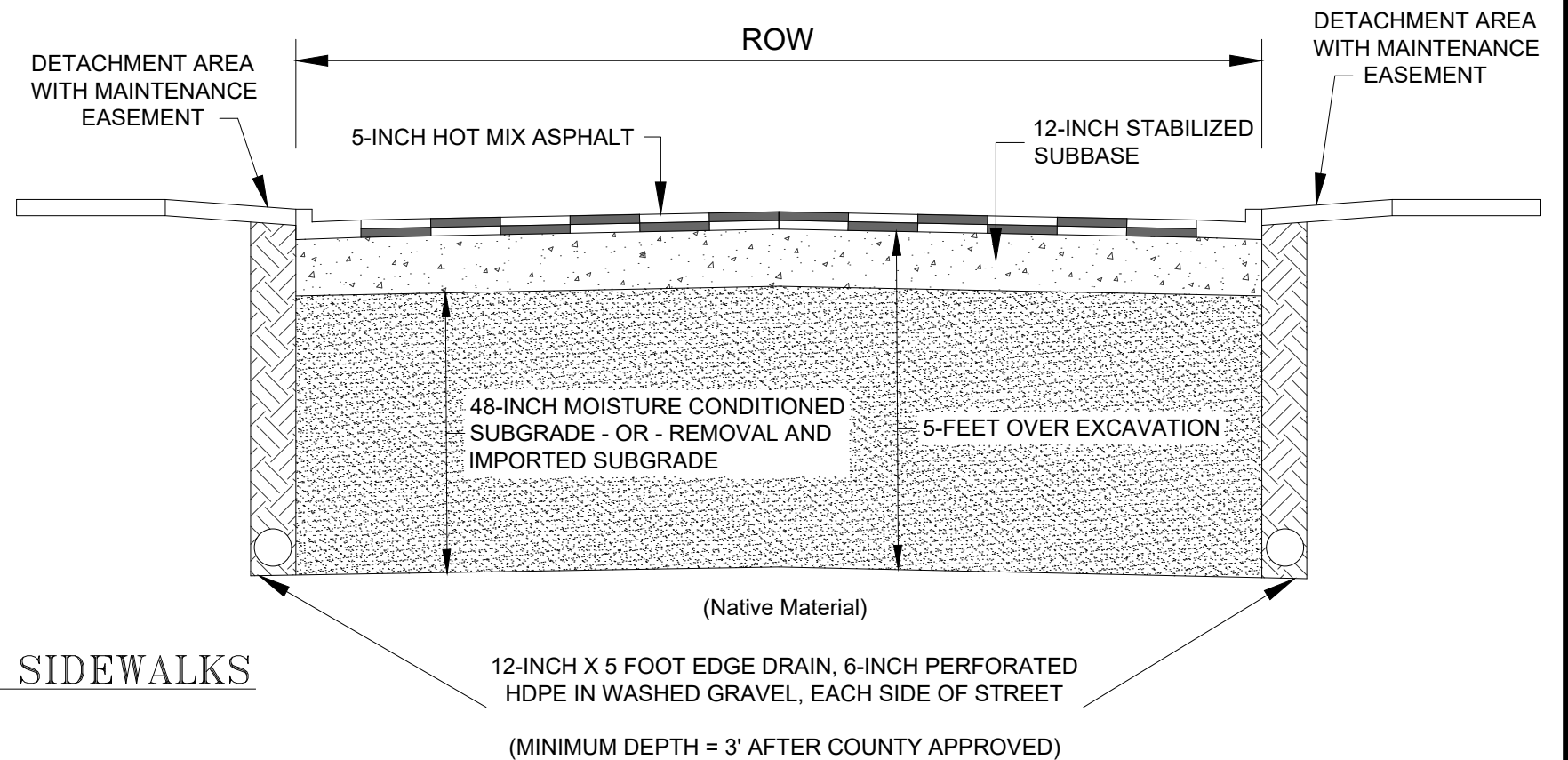


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	Drawn By: SAK	Date Created:		ZONE 1: FOOTHILLS/MOUNTAIN AREA PRELIMINARY PAVEMENT DESIGN		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-22-25.dwg	F.O.R. Date: For Const. Date:				
	File Location: G: \_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards					
			Project No.: -	Sheet -	Of -	





## ATTACHED SIDEWALKS



## DETACHED SIDEWALKS

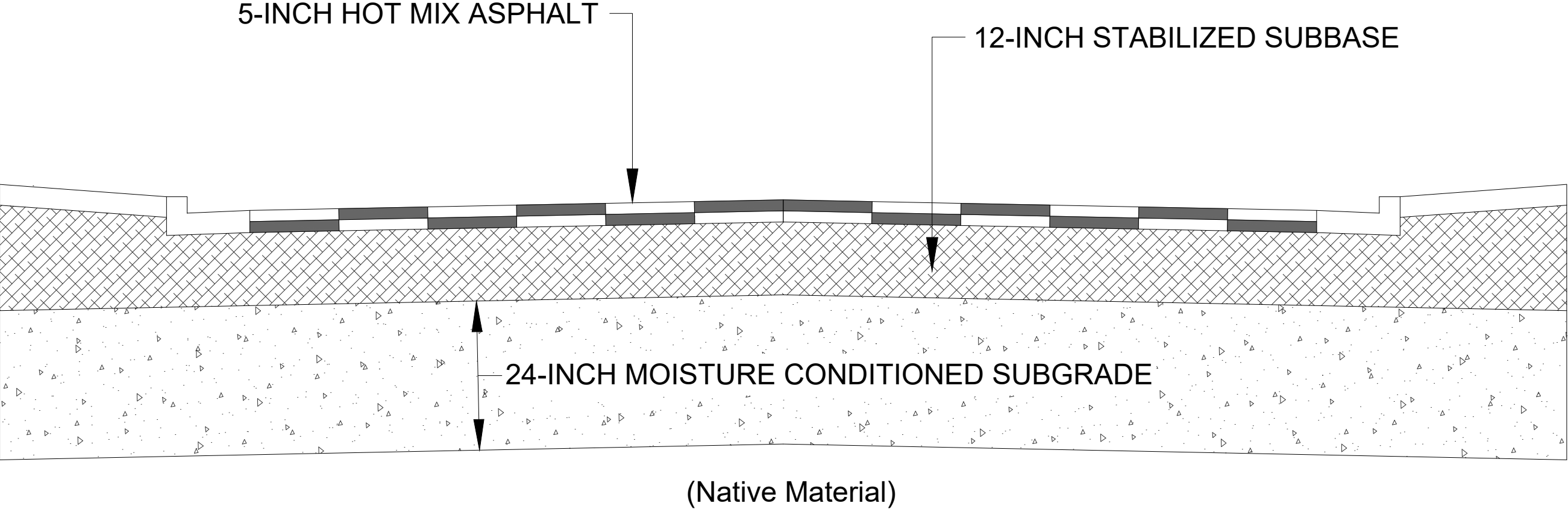
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	File: STND-22-25.dwg	F.O.R. Date: For Const. Date:
	File Location: G:\_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards	



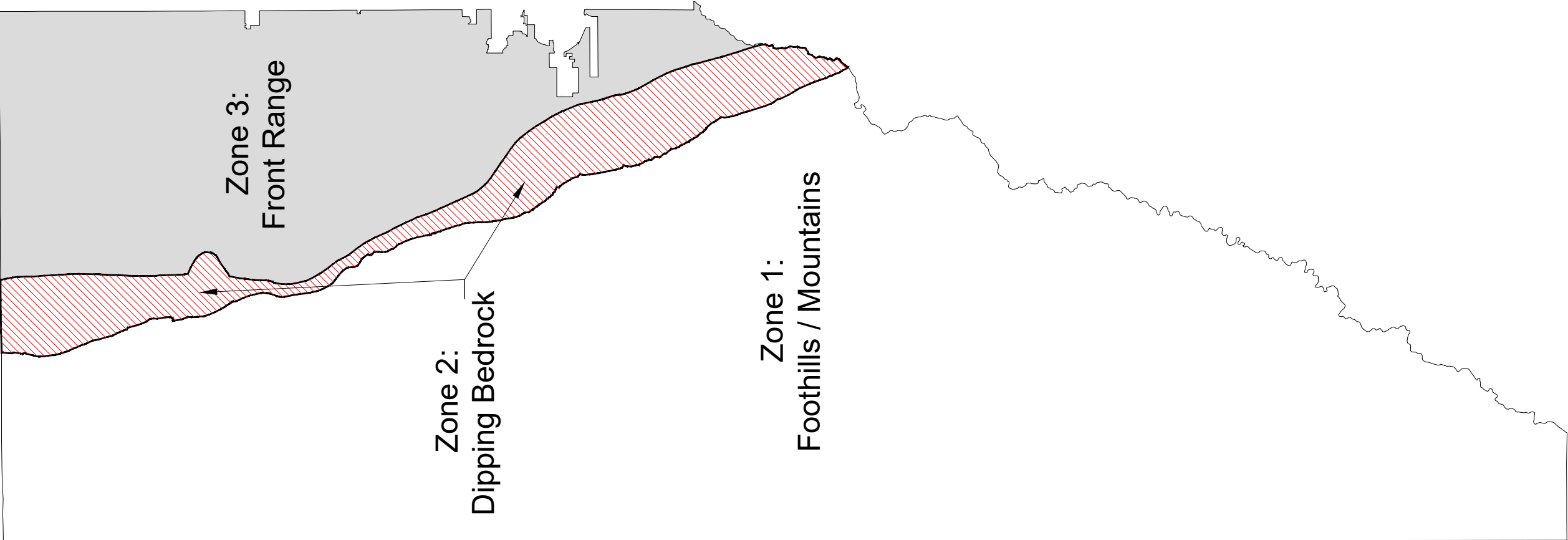
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STANDARD 23-1 & 23-2 ZONE 2: DIPPING BEDROCK AREA  
PRELIMINARY PAVEMENT DESIGN ATTACHED & DETACHED SIDEWALKS IN ROW

Project No.: - Sheet - Of -



Revisions:	Designed By: SAK	Scale: (As Shown)	<div><div>JEFFERSON</div><div>COUNTY COLORADO</div><div>DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div></div>	STANDARD 24		
	Drawn By: SAK	Date Created:		ZONE 3: FRONT RANGE AREA PRELIMINARY PAVEMENT DESIGN		
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:				
	File: STND-22-25.dwg	F.O.R. Date: For Const. Date:				
	File Location: G: \_CAD\Standards\2023 Road Standards & Templates\Standards (2023)\Drawings\T&E Manual Standards			Project No.: -	Sheet -	Of -



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	Drawn By:	SAK	Date Created:	
	Checked By:	Staff	Plot Date: 1/13/2025	F.I.R. Date:
	File:	STND-22-25.dwg	F.O.R. Date:	For Const. Date:
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STANDARD 25  
DESIGN ZONE: PRELIMINARY PAVEMENT SECTIONS

MATERIAL DATA		
COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
TAPERED TUBES	A595 GR.A OR A572	55
PLATES	A36	36
ANCHOR BOLTS	F1554 GR.55	55
GALVANIZING HARDWARE	F2329	
SIGNAL ARM CONN. BOLTS	A325	
LUM. ARM CONN. BOLTS	SAE GR.5	

FINISH DATA	
SYSTEM:	FINISH PAINT/GALVANIZED (FPGV)
BASE COAT:	HOT-DIP GALVANIZED TO ASTM A123
PRIM COAT:	NONE
FINISH COAT:	NONE/GALVANIZED
COLOR:	
SPEC:	

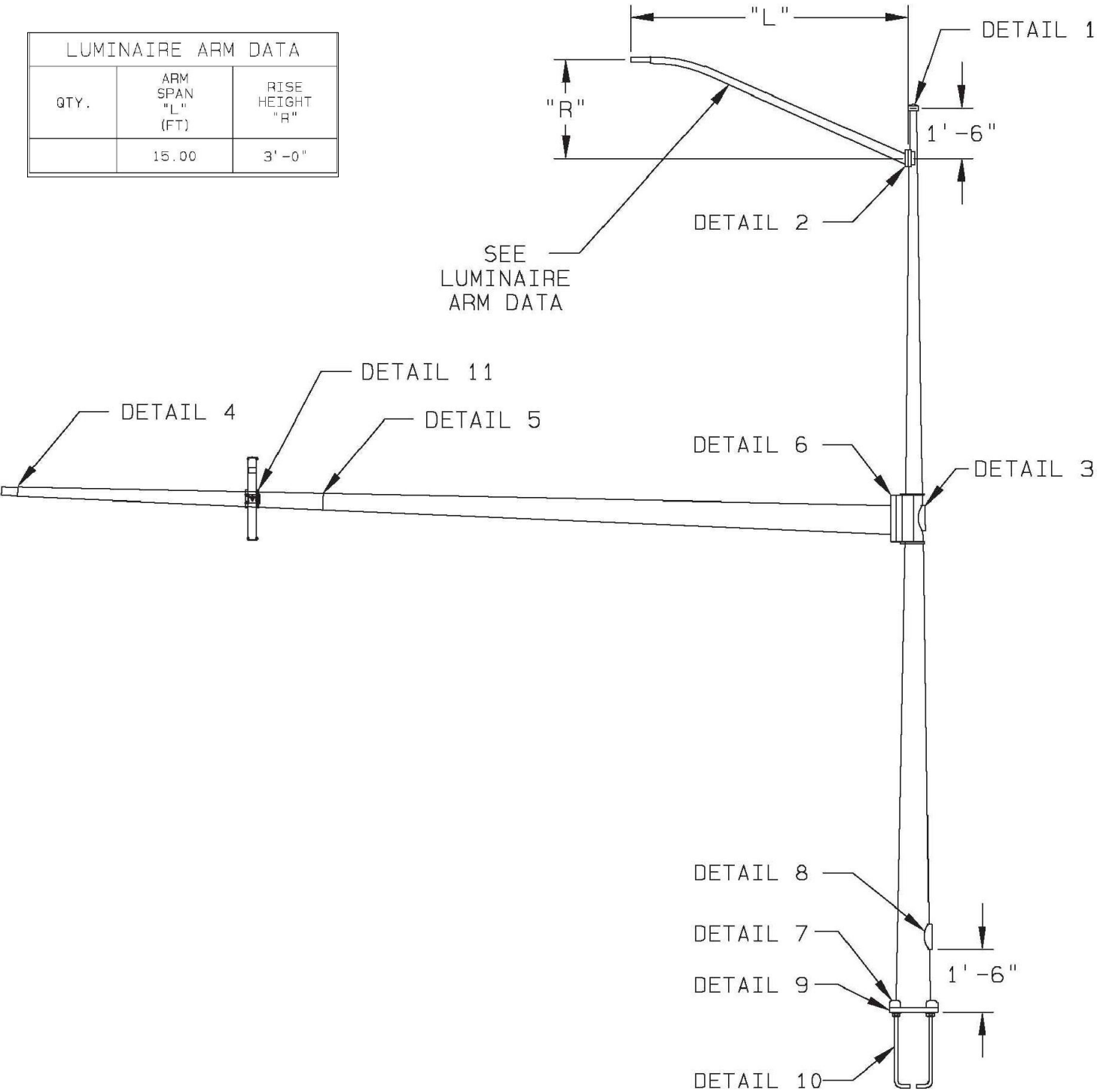
DESIGN CRITERIA:

THE SIGNAL MAST ARM TRAFFIC STRUCTURES SHOWN ON THIS DRAWING HAVE BEEN DESIGNED IN ACCORDANCE WITH THE LOADING AND NOMINAL STRENGTH REQUIREMENTS OF THE 2015 AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, FIRST EDITION" SLTS-1 INCLUDING LATEST INTERIMS. THE WIND LOADS WERE CALCULATED FROM AN ULTIMATE WIND VELOCITY OF 130 MPH WITH A MEAN RECURRENCE INTERVAL OF 1700 YEARS AND AN EFFECTIVE PERFORMANCE TESTED MITIGATION DEVICE ALLOWING FOR A FATIGUE CATEGORY OF II. THE FATIGUE LOADS WERE CALCULATED ON THE REQUIREMENTS OF SECTION 11 OF THE CODE, AND THE FOLLOWING DESIGN CONDITIONS:

- STRUCTURES ARE DESIGNED TO RESIST NATURAL WIND GUSTS BASED ON THE YEARLY MEAN WIND VELOCITY OF 11.2 MPH.
- STRUCTURES ARE NOT DESIGNED TO RESIST GALLOPING-INDUCED CYCLIC LOADS DUE TO THE USE OF EFFECTIVE MITIGATION DEVICE.
- STRUCTURES ARE DESIGNED FOR TRUCK-INDUCED GUST LOADS, AS REQUIRED BY THE OWNER OF THE STRUCTURES.

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	Drawn By: SAK	Date Created:					SIGNAL POLES DESIGN INFORMATION		
	Checked By: Staff	Plot Date: 1/13/2025		F.I.R. Date:	Project No.: -				
	File: STND-26 [SIGNAL POLES].dwg	F.O.R. Date:		For Const. Date:				Sheet -	Of -
	File Location: G:\_CAD\Standards\2025 Road Standards & Templates\Standards (2025)\Drawings								

LUMINAIRE ARM DATA		
QTY.	ARM SPAN "L" (FT)	RISE HEIGHT "R"
	15.00	3'-0"



POLE DATA								
QTY.	ITEM	DESIGN NUMBER	SINGLE ARM SPAN (FT)	POLE BASE		ANCHOR BOLT		
				BOLT CIRCLE "Y" (IN)		DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN) THREAD LENGTH "U" (IN)
	LAKEWOOD	1	20	19.00		1.50	54.00	6.00 8.00
	LAKEWOOD	1	25	19.00		1.50	54.00	6.00 8.00
	LAKEWOOD	1	30	19.00		1.50	54.00	6.00 8.00
	LAKEWOOD	2	35	20.00		1.75	84.00	6.00 8.00
	LAKEWOOD	2	40	20.00		1.75	84.00	6.00 8.00
	LAKEWOOD	2	45	20.00		1.75	84.00	6.00 8.00

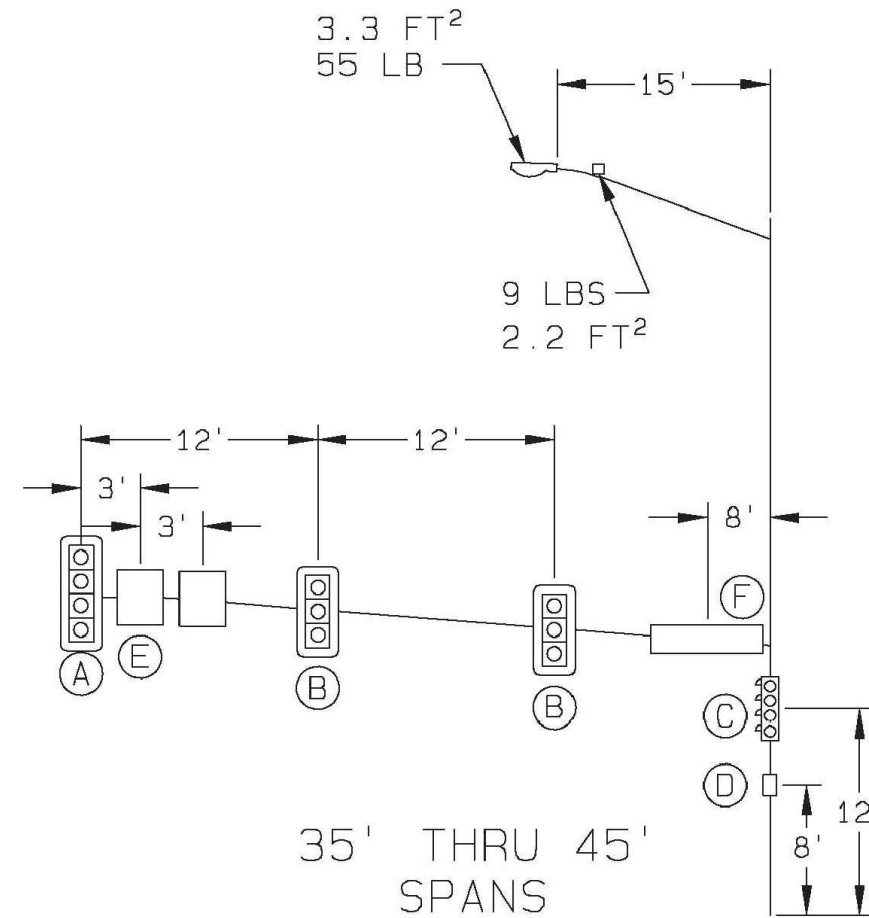
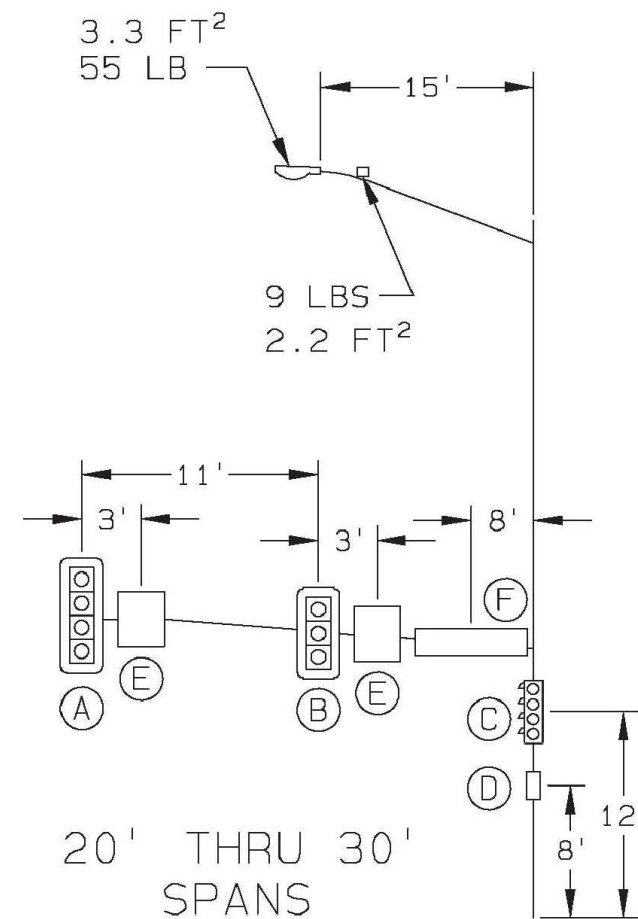
Revisions:	Designed By: SAK	Scale: (As Shown)
	Drawn By: SAK	Date Created:
	Checked By: Staff	Plot Date: 1/13/2025 F.I.R. Date:
	File: STND-26.dwg	F.O.R. Date: For Const. Date:
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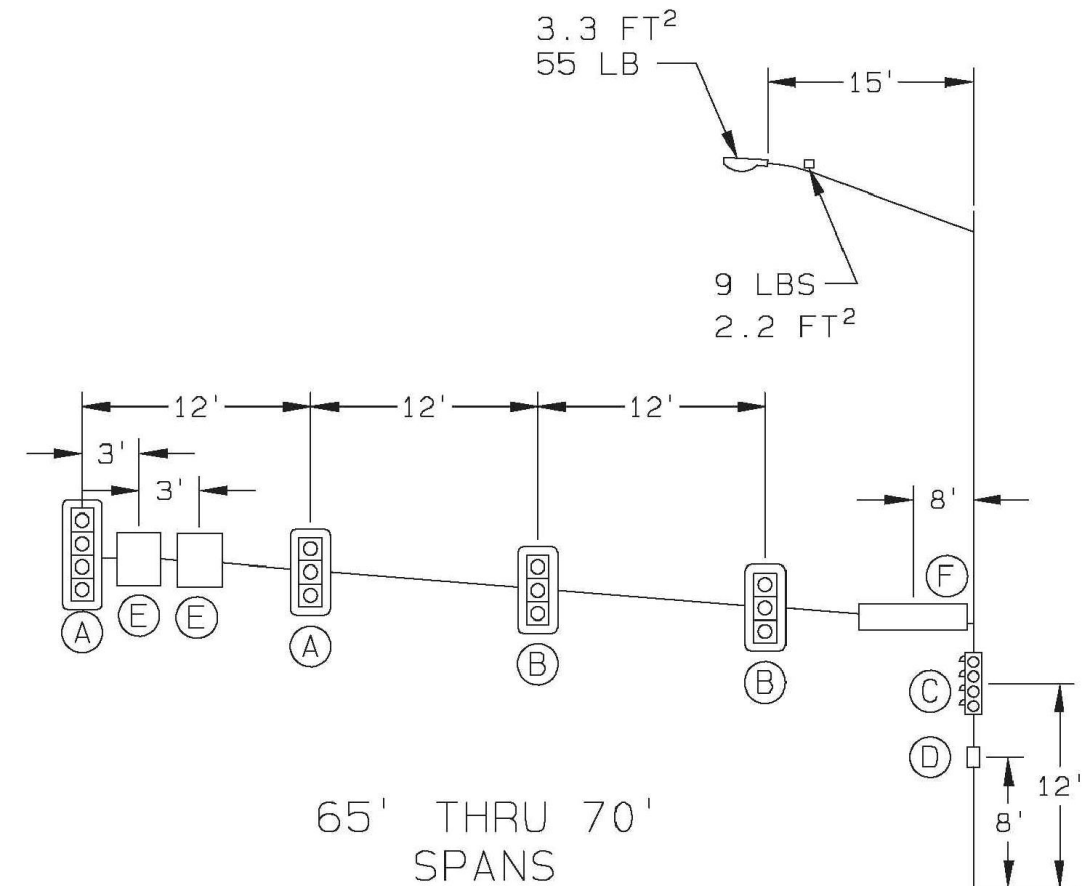
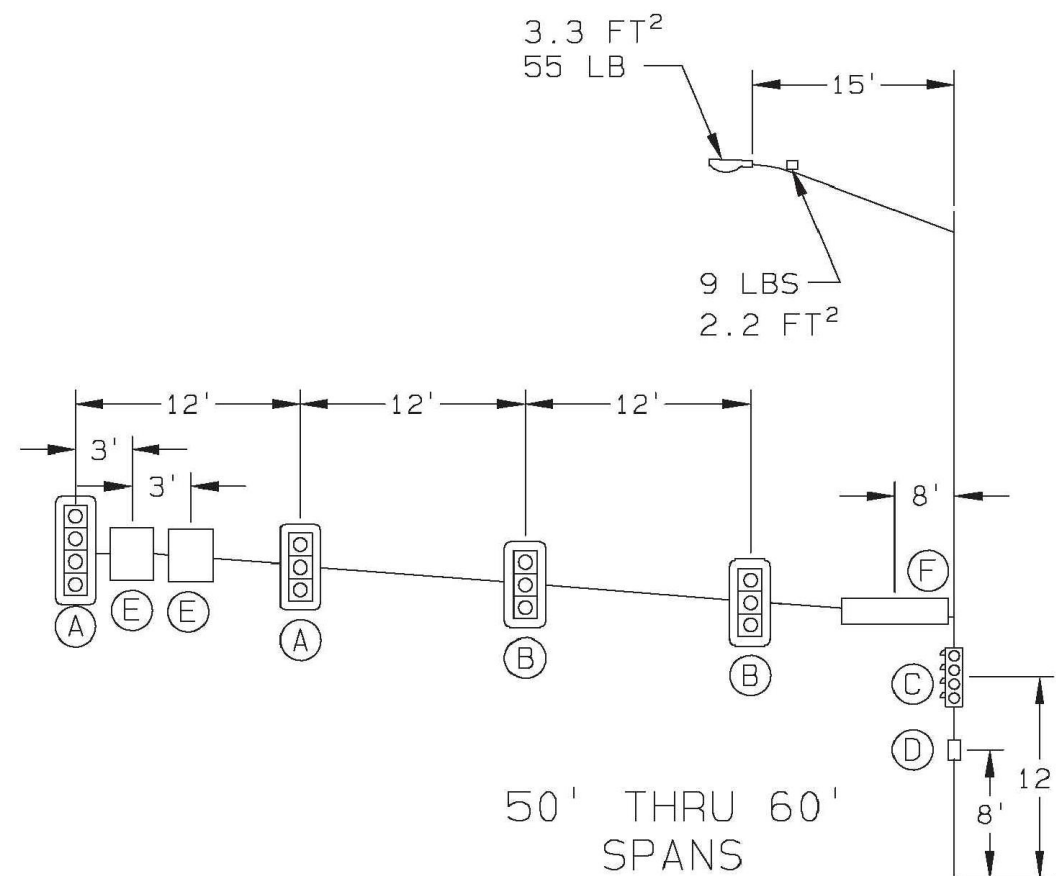
STANDARD 26-2  
SIGNAL POLES GENERAL LAYOUT

Project No.: - Sheet - Of -



DEVICE	DESCRIPTION	PROJ. AREA (FT <sup>2</sup> )	WEIGHT (LBS)
(A)	12"-4 SEC. SIGNAL WITH BACKPLATE*	11.60	65
(B)	12"-3 SEC. SIGNAL WITH BACKPLATE	8.67	38
(C)	DUAL-12"-4 SEC. SIGNAL NO BACKPLATE (VERTICAL)*	5.44	60
(D)	DUAL-16"-PEDESTRIAN SIGNAL	8.00	80
(E)	30" X 36" REGULATORY SIGN	7.50	25
(F)	18" X 84" STREET NAME SIGN	10.50	32
(G)	TR1 MITIGATOR DEVICE	1.20	38

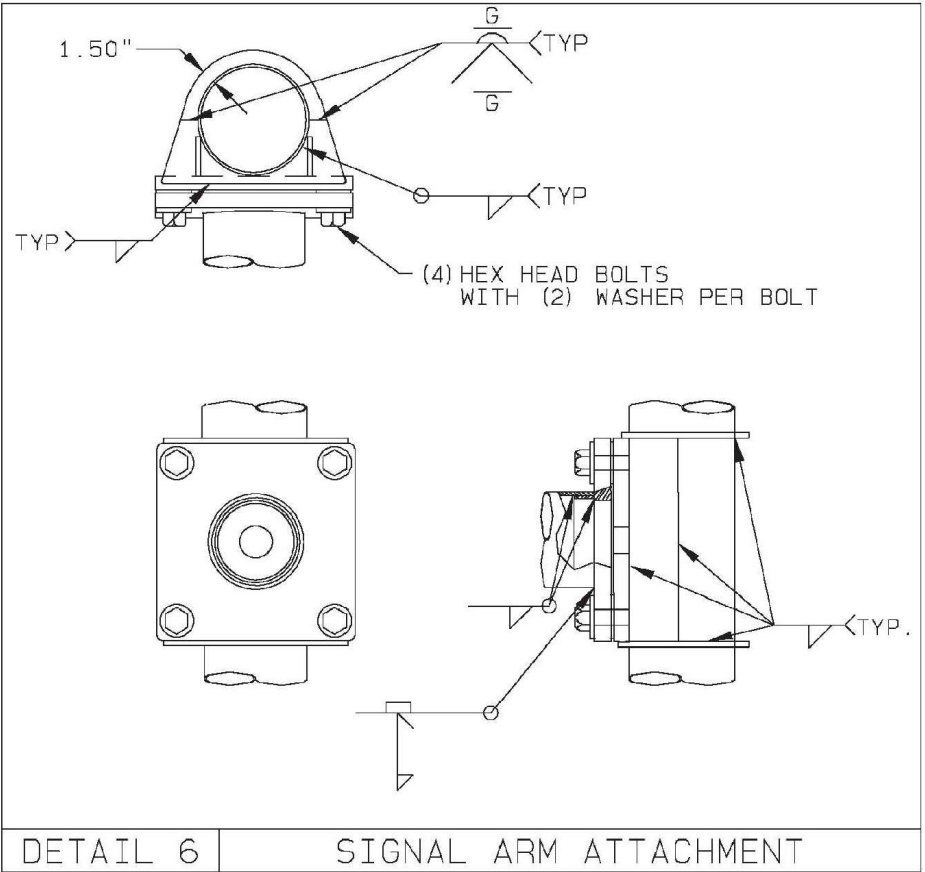
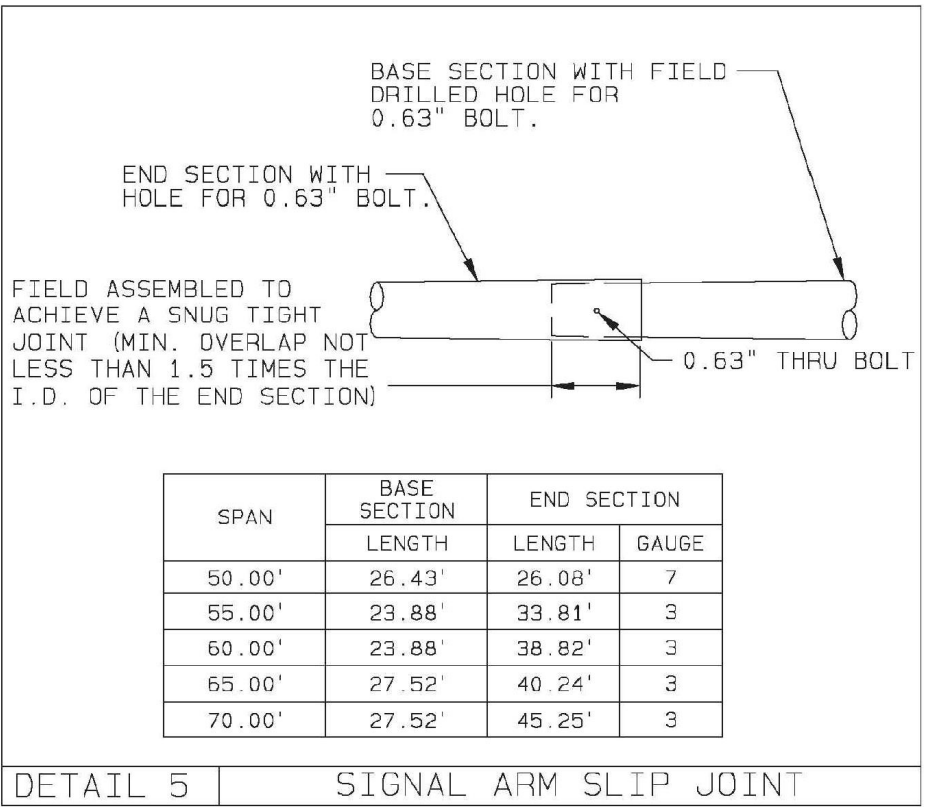
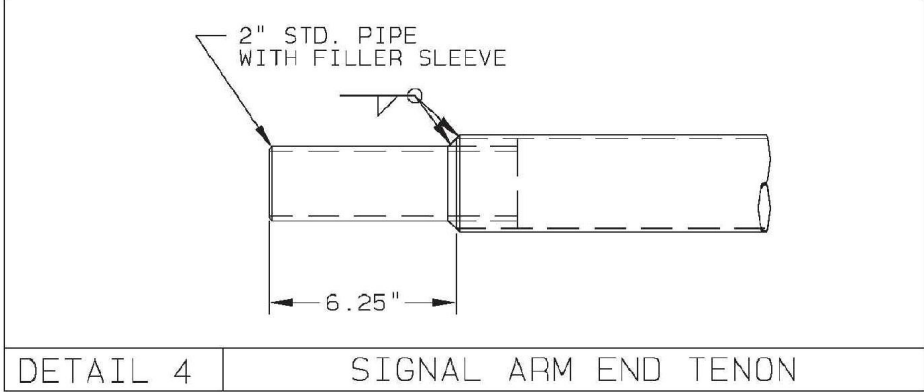
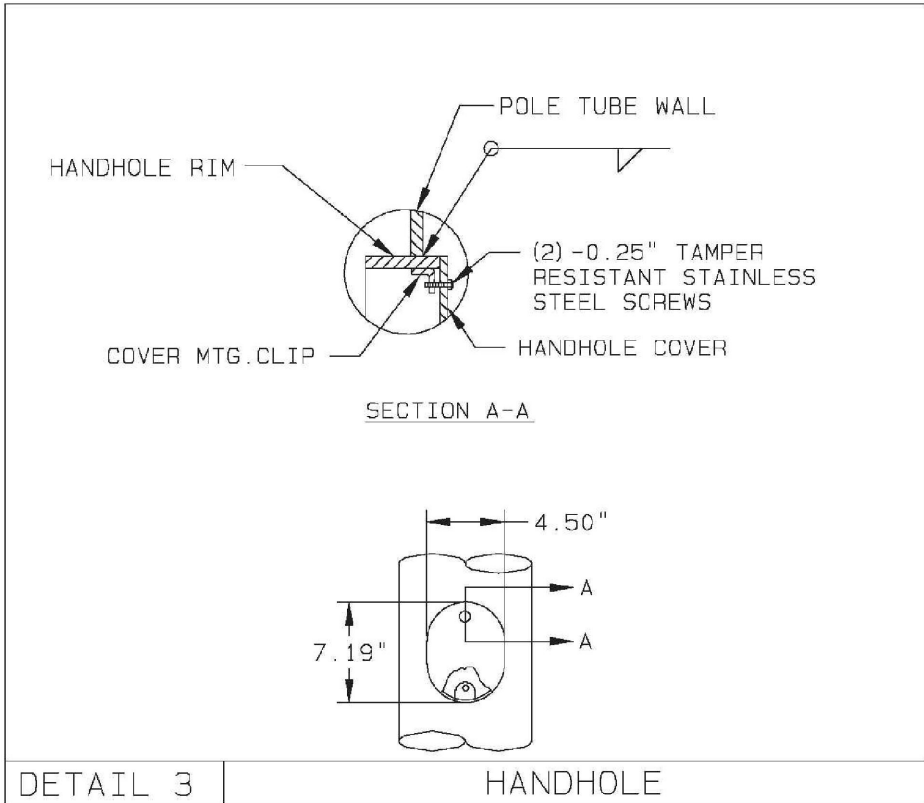
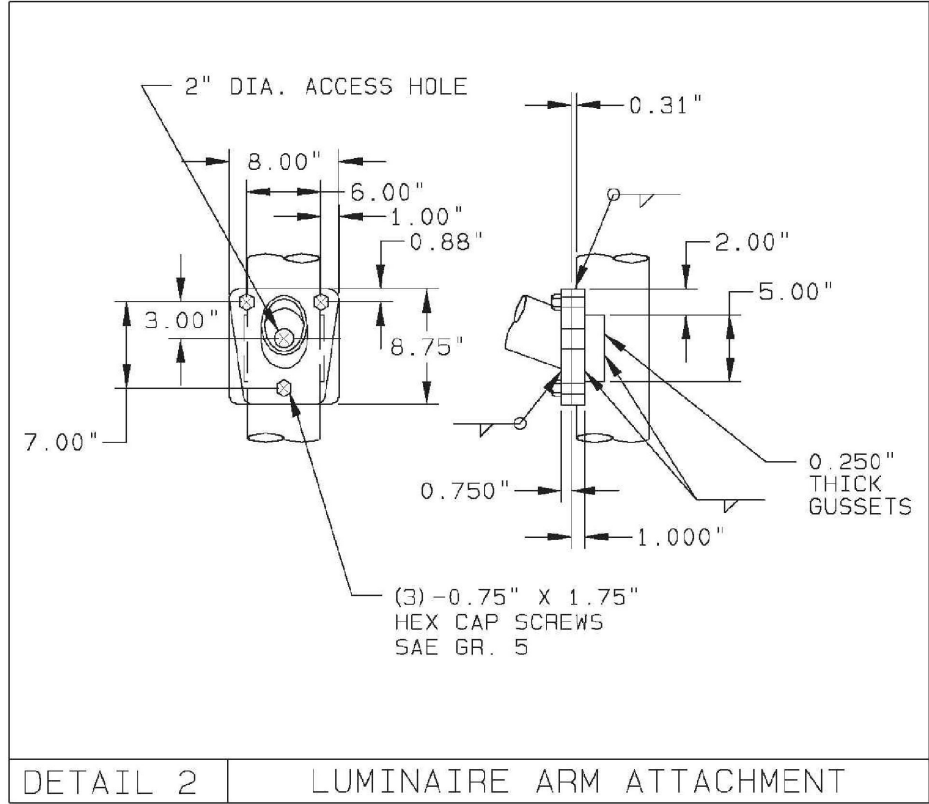
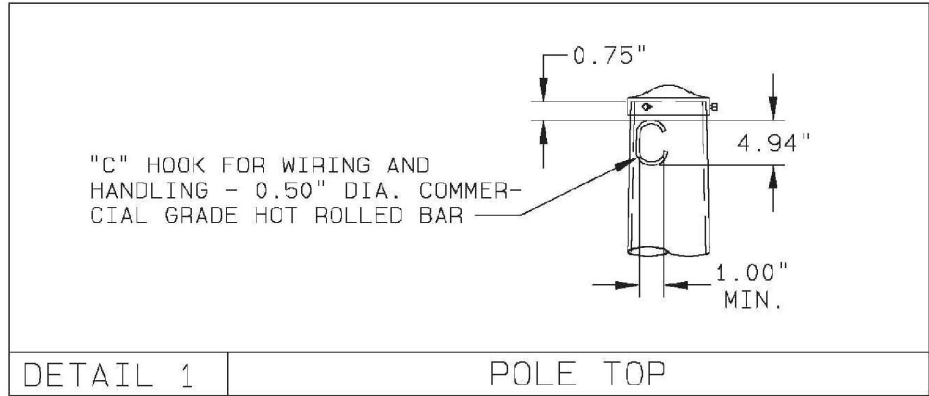
\* SEE TRAFFIC SIGNAL PLANS FOR USE OF 3-SEC OR 4-SEC SIGNAL HEADS



DEVICE	DESCRIPTION	PROJ. AREA (FT <sup>2</sup> )	WEIGHT (LBS)
Ⓐ	12"-4 SEC. SIGNAL WITH BACKPLATE*	11.60	65
Ⓑ	12"-3 SEC. SIGNAL WITH BACKPLATE	8.67	38
Ⓒ	DUAL-12"-4 SEC. SIGNAL NO BACKPLATE (VERTICAL)*	5.44	60
Ⓓ	DUAL-16"-PEDESTRIAN SIGNAL	8.00	80
Ⓔ	30" X 36" REGULATORY SIGN	7.50	25
Ⓕ	18" X 84" STREET NAME SIGN	10.50	32
Ⓖ	TR1 MITIGATOR DEVICE	1.20	38

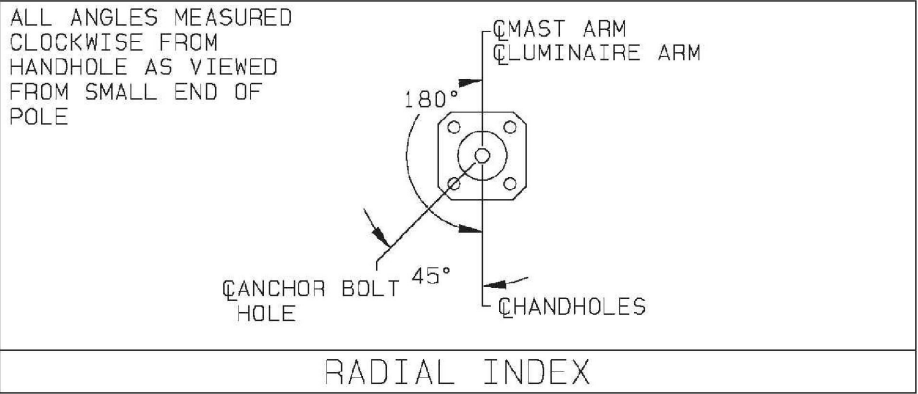
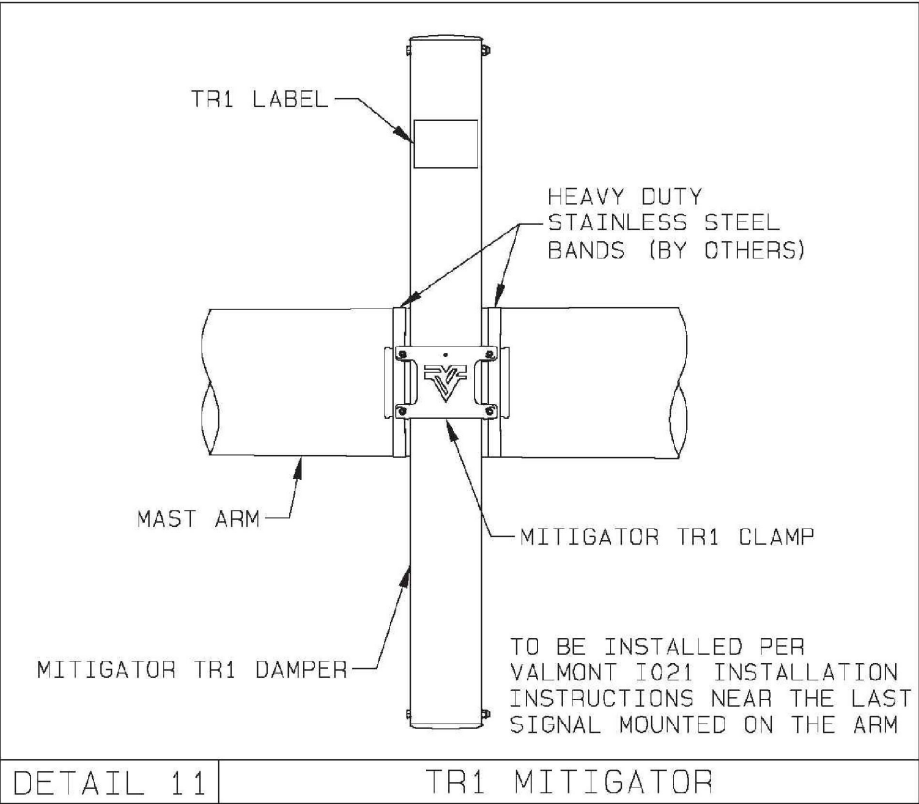
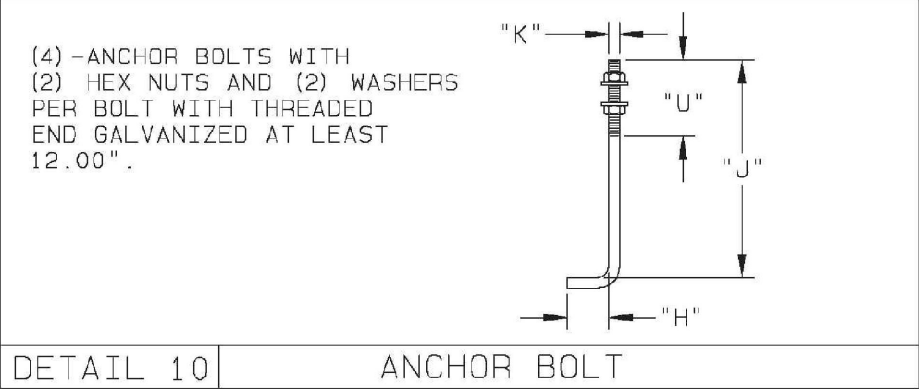
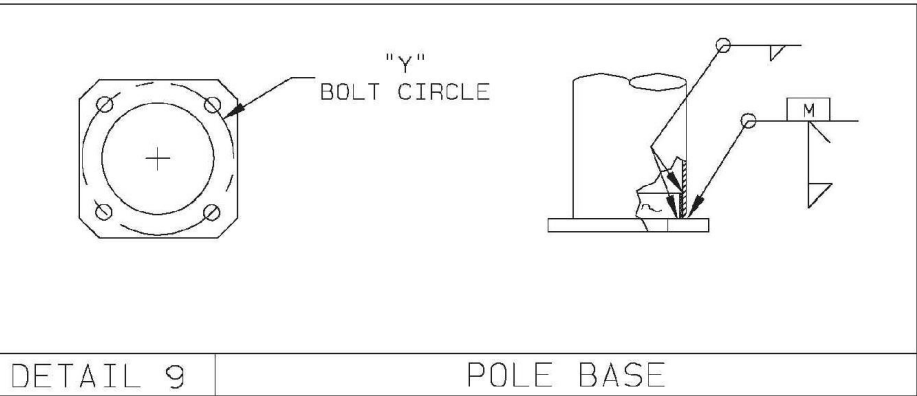
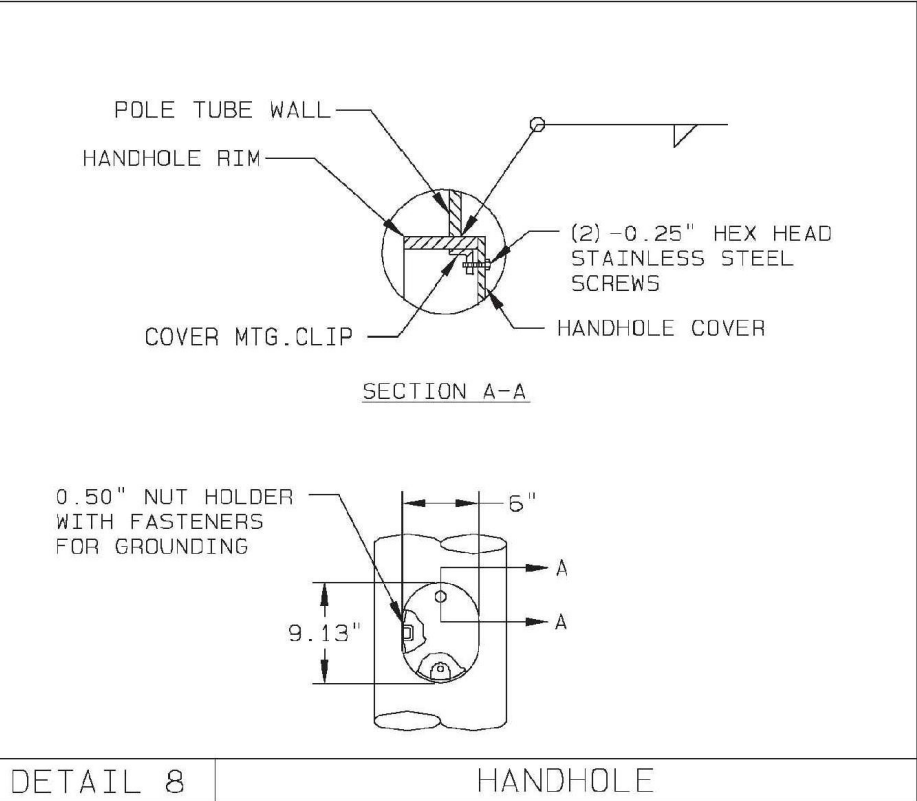
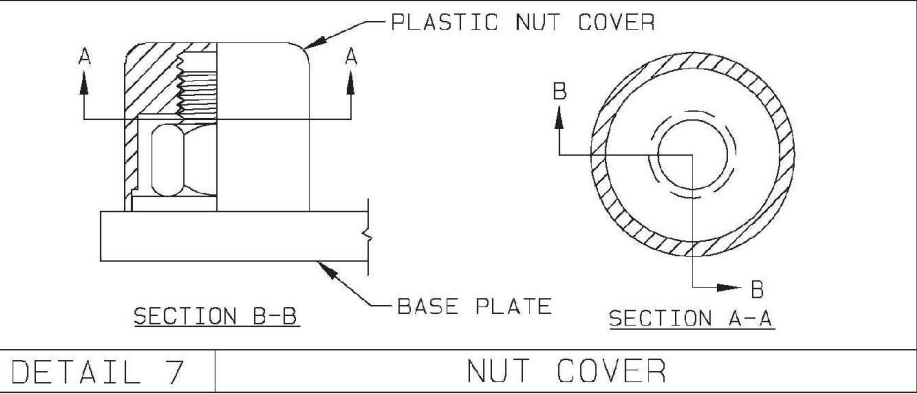
\* SEE TRAFFIC SIGNAL PLANS FOR USE OF 3-SEC OR 4-SEC SIGNAL HEADS





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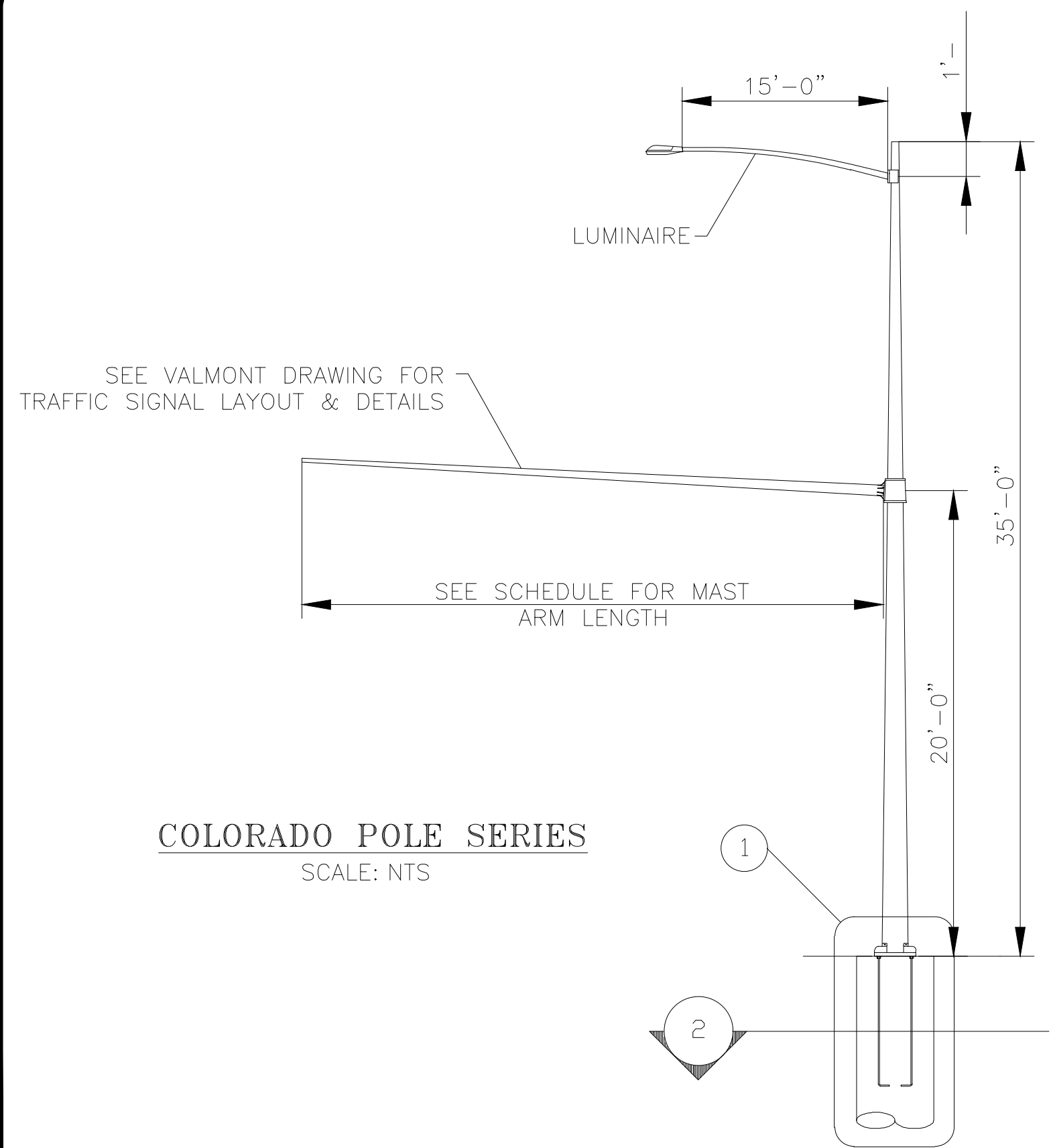
ALTHOUGH RARE, VIBRATIONS SEVERE ENOUGH TO CAUSE DAMAGE CAN OCCASIONALLY OCCUR IN STRUCTURES OF ALL TYPES. BECAUSE THEY ARE INFLUENCED BY MANY INTERACTING VARIABLES, VIBRATIONS ARE GENERALLY UNPREDICTABLE. THE USER'S MAINTENANCE PROGRAM SHOULD INCLUDE OBSERVATION FOR EXCESSIVE VIBRATION AND EXAMINATION FOR ANY STRUCTURAL DAMAGE OR BOLT LOOSENING. THE VALMONT WARRANTY SPECIFICALLY EXCLUDES FATIGUE FAILURE OR SIMILAR PHENOMENA RESULTING FROM INDUCED VIBRATION, HARMONIC OSCILLATION OR RESONANCE ASSOCIATED WITH MOVEMENT OF AIR CURRENTS AROUND THE PRODUCT.

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	File: STND-26.dwg	F.O.R. Date: For Const. Date:
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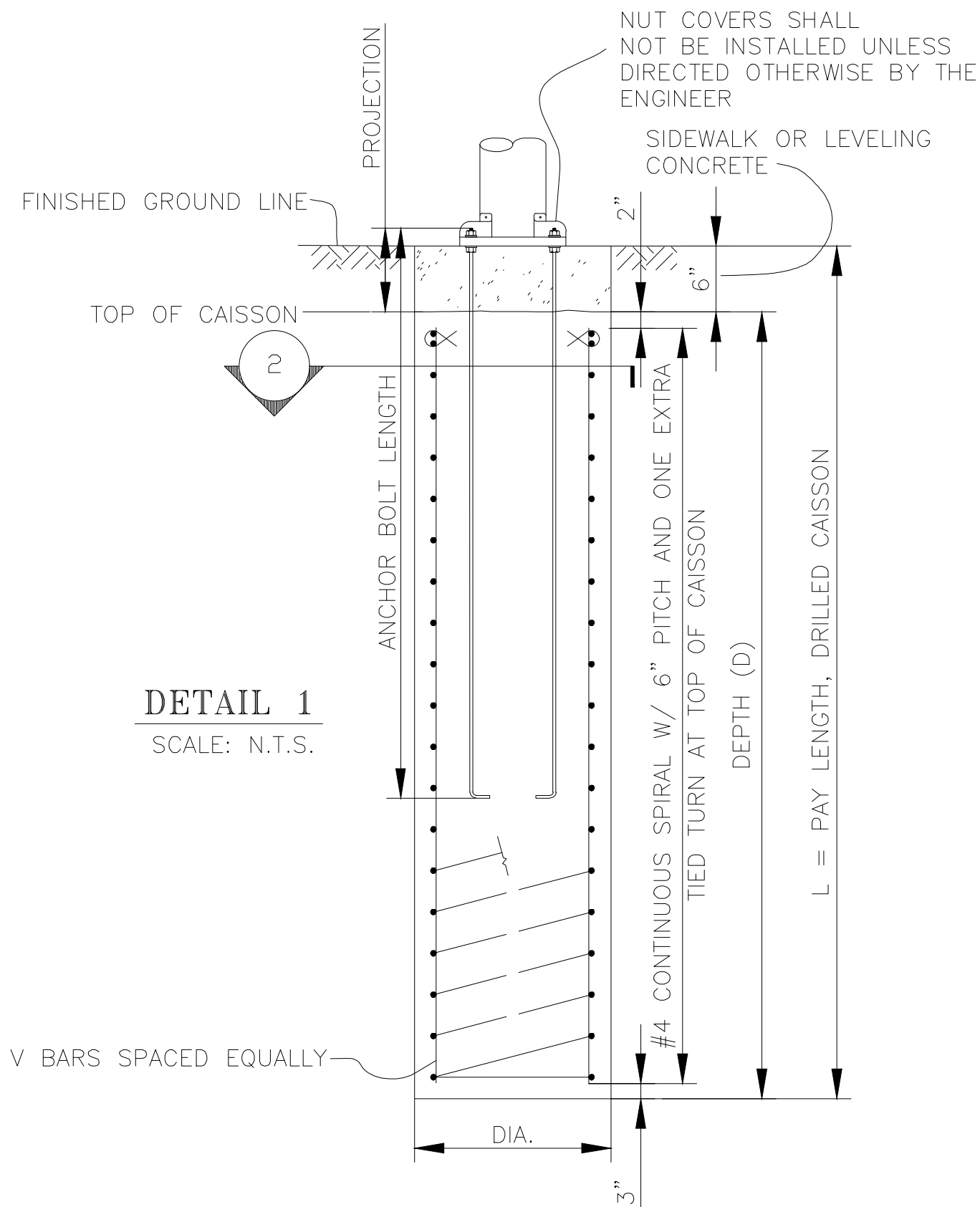
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100 JEFFERSON COUNTY PARKWAY, SUITE 3500  
GOLDEN, COLORADO 80419  
(303) 271-8495

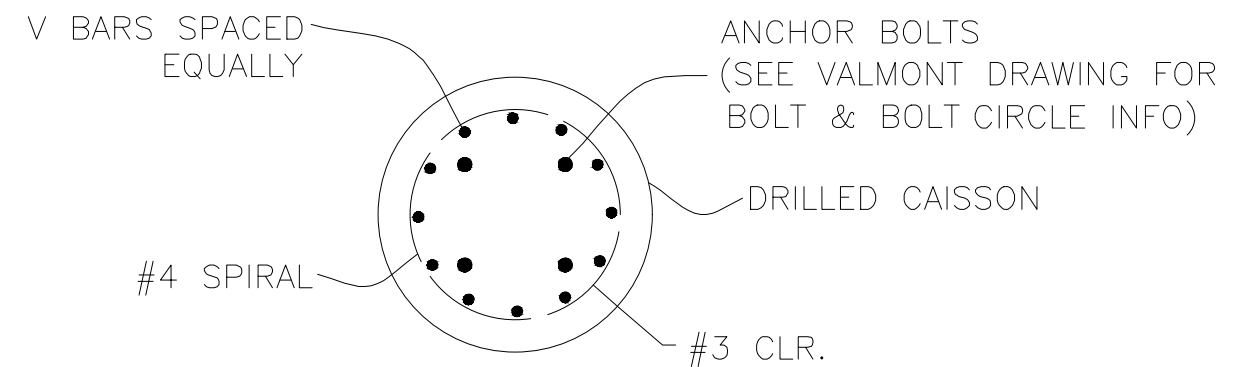
STANDARD 26-6 SIGNAL POLES DETAILS (2)		
Project No.: -	Sheet -	Of -



FOUNDATION SCHEDULE					
MAST ARM LENGTH (FT.)	CAISSON DATA				
	DIA. (IN.)	DEPTH (D) (FT.)	PAY LENGTH (L) (FT.)	V BARS	
				SIZE	TOTAL
20-30	36	13.0	13.5	#9	10
35-45	42	15.0	15.5	#9	14
50-60	48	18.0	18.5	#9	18
65-70	48	20.5	21.0	#9	18



**DETAIL 1**  
SCALE: N.T.S.



**DETAIL 2**  
SCALE: N.T.S.

Revisions:	Designed By: SAK	Scale: (As Shown)	<div><div>JEFFERSON COUNTY COLORADO</div><div>DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div></div>	STANDARD 26-8 SIGNAL POLES CAISSON DETAILS (2)			
	Drawn By: SAK	Date Created:					
	Checked By: Staff	Plot Date: 1/13/2025		F.I.R. Date:	Project No.: -	Sheet -	Of -
	File: STND-26.dwg	F.O.R. Date:		For Const. Date:			
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GENERAL NOTES

1. DESIGN OF FOUNDATIONS IS BASED ON TRAFFIC SIGNAL POLE CONFIGURATIONS PROVIDED BY VALMONT INDUSTRIES, INC. DRAWING NO. TK01274 DATED 11/06/18 FOR THE CITY OF WESTMINSTER. REFER TO JEFFERSON COUNTY TRAFFIC STANDARD DRAWINGS FOR ANY ADDITIONAL TRAFFIC POLE INFORMATION.
2. DESIGN CRITERIA: AASHTO – STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, 2015 EDITION.
3. A DESIGN WIND VELOCITY OF 130 MPH HAS BEEN USED FOR THE DESIGNS HEREIN (BASED ON INFORMATION FROM VALMONT). CAISSONS ARE DESIGNED FOR BASE REACTIONS PROVIDED BY VALMONT.
4. ALL FOUNDATIONS ON THIS SHEET ARE FOR SINGLE MAST ARM POLES.
5. THE DESIGNS HEREIN ASSUME THAT SIGNALS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING SOIL PARAMETERS:

5.1. SOIL DENSITY = 110 LB./CU.FT.

5.2. SOIL COHESION = 750 LB./SQ/FT/ FOR MEDIUM STIFF COHESIVE SOIL

5.3. SOIL Ø ANGLE = 30° FOR MEDIUM DENSE COHESIONLESS SOIL

5.4. SF = 1.5 FOR TORSIONAL RESISTANCE; 3.0 FOR FLEXURAL RESISTANCE
6. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:

6.1. SIGNALS WILL NOT BE INSTALLED WITHIN THE ROADWAY PRISM

6.2. THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY

6.3. THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG

6.4. THE FOUNDATION SOILS ARE NOT HOMOGENOUS

6.5. FIRM BEDROCK IS ENCOUNTERED

6.6. CAVING SOILS

6.7. GROUNDWATER

6.8. EXPANSIVE SOILS

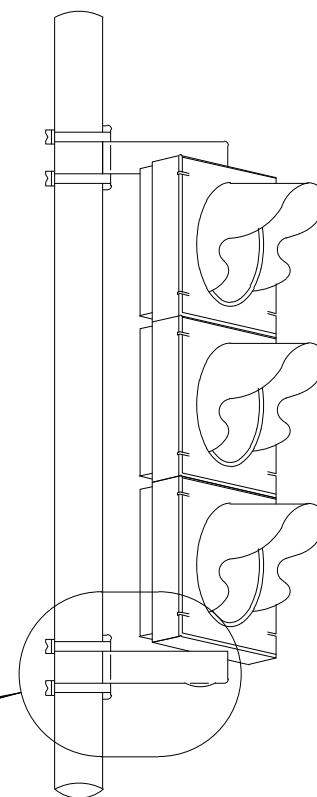
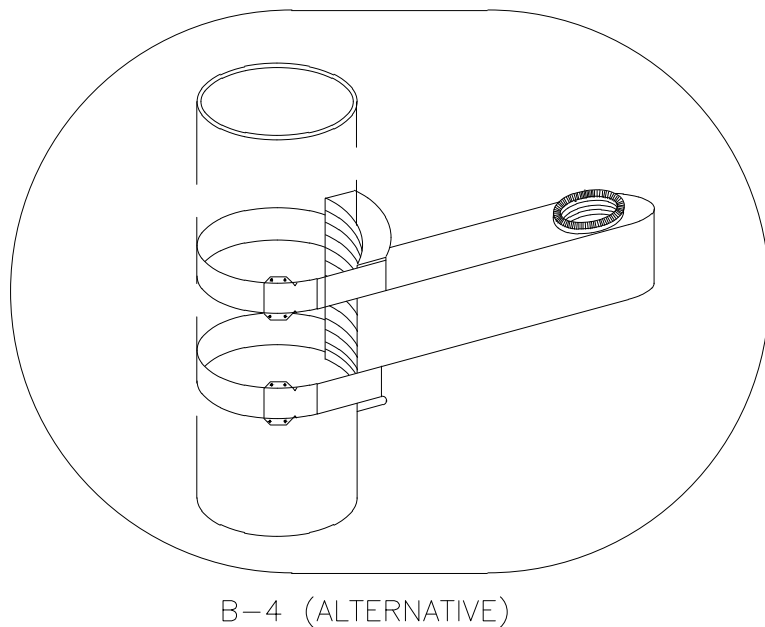
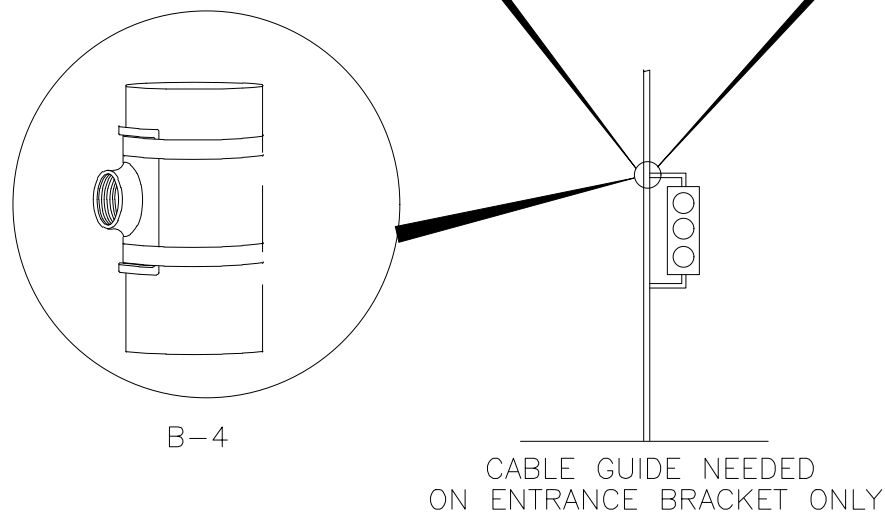
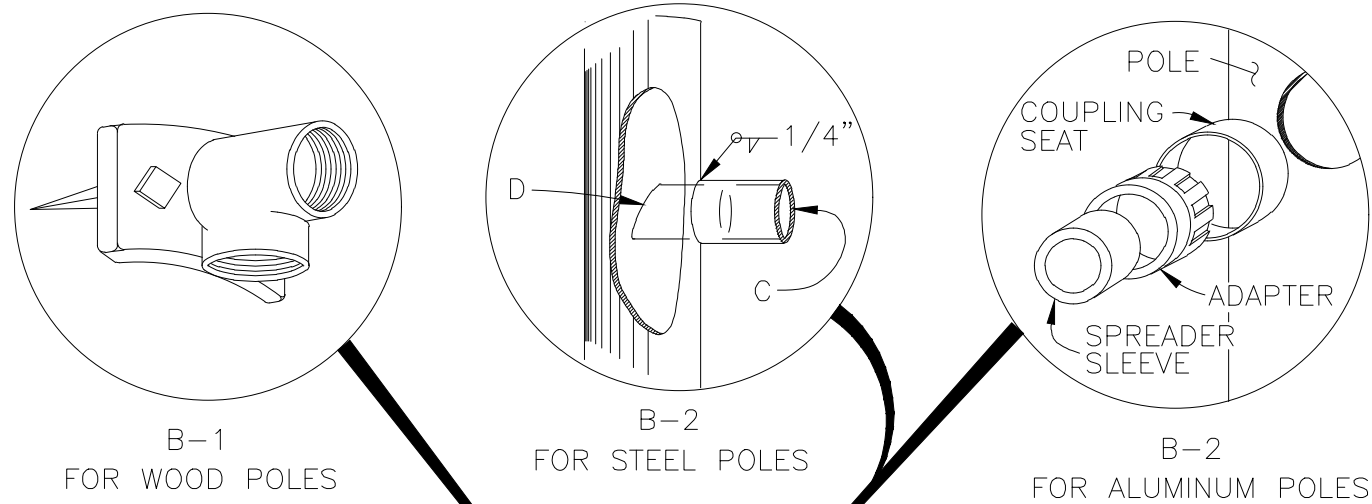
6.9. TRASH

6.10. BOTTOM OF CAISSON WILL EXTEND BELOW BOTTOM OF ANY ADJACENT BUILDING OR RETAINING WALL FOUNDATION

6.11. SLOPES GREATER THAN 10%
7. CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH.
8. CAISSONS SHALL BE CONSTRUCTED WITH AIR ENTRAINED CDOT CLASS B2 CONCRETE. REINFORCING STEEL SHALL BE GRADE 60.
9. FOUNDATION TO BE PROVIDED WITH 2 CONDUIT STUB OUTS. DIRECTION TO BE DETERMINED BY A JEFFERSON COUNTY ENGINEER AND IS TO BE CONSIDERED PART OF THE POLE INSTALLATION BID ITEM.
10. ANCHOR BOLTS. BASE PLATE, NUTS, AND NUT COVERS TO BE FURNISHED BY THE POLE MANUFACTURER.

11. CAISSON CONCRETE SHALL CURE AT LEAST SEVEN DAYS PRIOR TO THE SIGNAL STRUCTURE INSTALLATION.
12. PLUMBING OF POLES SHALL BE ACCOMPLISHED BY ADJUSTING NUTS AFTER LOADING OF MAST ARM.
13. EACH END OF CAISSON TIES TO BE TERMINATED WITH A 135° HOOK AROUND A LONGITUDINAL BAR.
14. DESIGN IS BASED ON HORIZONTAL GROUND SURFACE CONDITION IN THE VICINITY OF THE CAISSON. CAISSONS SHOULD NOT BE INSTALLED AT SITES WITH A SLOPE EXCEEDING 10 PERCENT.
15. LEVELING CONCRETE SHALL BE 3,000 PSI CLASS B AIR ENTRAINED CONCRETE.
16. YIELD STRESS OF REINFORCING STEEL SHALL BE MINIMUM 60,000 PSI.

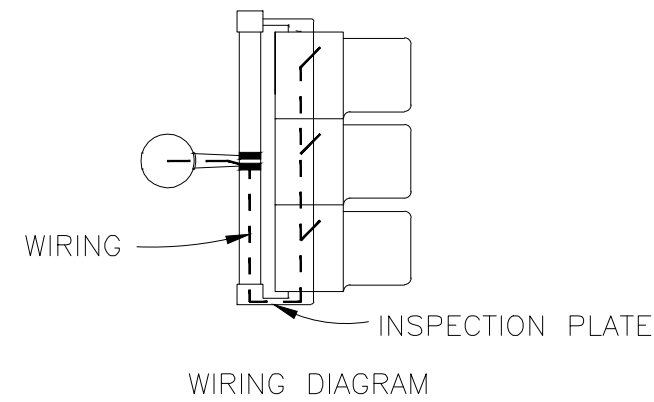
Revisions:	Designed By:	SAK	Scale:	(As Shown)	<div><div>JEFFERSON</div><div>COUNTY COLORADO</div></div> <div><div>DIVISION OF</div><div>Transportation and Engineering</div><div>100 JEFFERSON COUNTY PARKWAY, SUITE 3500</div><div>GOLDEN, COLORADO 80419</div><div>(303) 271-8495</div></div>	STANDARD 26-9							
	Drawn By:	SAK	Date Created:	SIGNAL POLES CAISSON DETAILS (3)									
	Checked By:	Staff	Plot Date:	1/13/2025		F.I.R. Date:							
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KEY

C - 2 INCH PIPE COUPLING

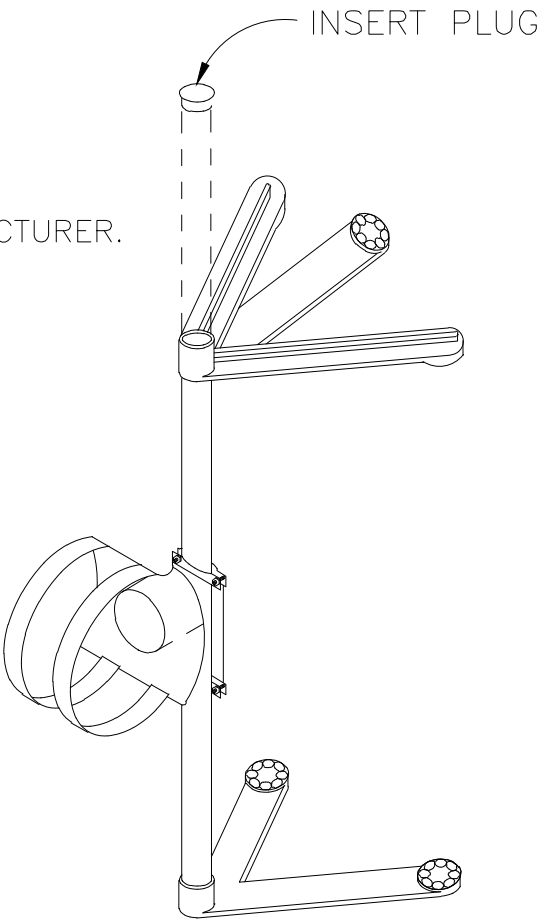
D - CABLE GUIDE. 2 INCH PIPE SHOWN. REMOVE ALL BURRS AND SHARP EDGES.



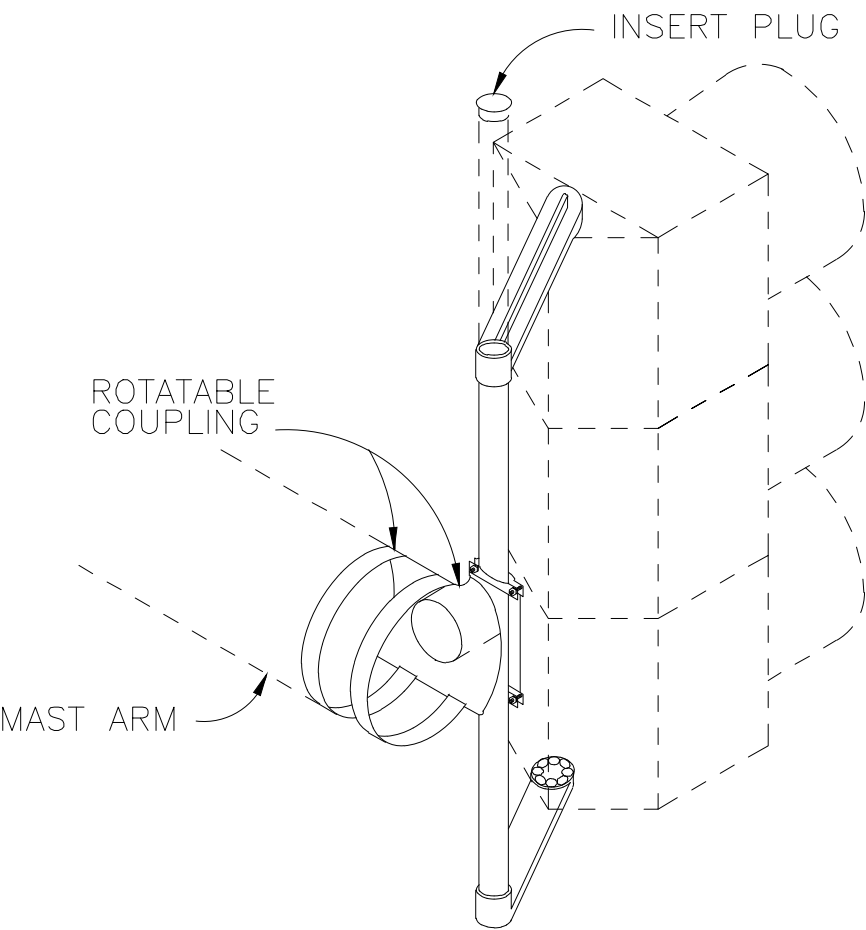
Revisions:	Designed By: SAK	Scale: (As Shown)	<b>JEFFERSON</b> COUNTY COLORADO	DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495	STANDARD 26-10		
	Drawn By: SAK	Date Created:			SIGNAL POLE & MAST ARM MOUNTING DETAILS (1)		
	Checked By: Staff	Plot Date: 1/13/2025			Project No.: -		
	File: STND-26.dwg	F.O.R. Date:			Sheet -		
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GENERAL NOTES:

- 1. PIPE COUPLINGS FOR SIGNAL BRACKETS SHALL BE EITHER 1-1/2 OR 2 INCH DEPENDING UPON THE SIGNAL HEAD TO BE INSTALLED. SIGNAL BRACKETS SHALL BE FURNISHED BY THE MANUFACTURER OF THE SIGNAL HEADS.
- 2. UNLESS OTHERWISE SPECIFIED, ALL TRAFFIC SIGNALS MOUNTED ABOVE THE ROADWAY SHALL HAVE A HEIGHT OF 17'-6", ALL SIDE MOUNTED TRAFFIC SIGNALS SHALL HAVE A HEIGHT OF 10', AND PEDESTRIAN SIGNALS AT A HEIGHT OF 8' AS MEASURED TO THE BOTTOM OF THE SIGNAL HEAD HOUSING OR BRACKET.
- 3. ALL SIGNAL HEADS SHALL BE MOUNTED IN SUCH A MANNER AS TO BE EASILY REMOVED FROM THEIR SUPPORTING STRUCTURE.
- 4. GASKET SEALING COMPOUND SHALL BE USED IN ADDITION TO ANY LEAD WASHERS REQUIRED FOR CREATING A WATER-TIGHT CONNECTION BETWEEN THE SIGNAL HEAD AND MOUNTING BRACKET.
- 5. SIGNAL HEADS SHALL BE SECURELY AFFIXED BY THE USE OF A SERRATED COUPLING OR OTHER ACCESSORIES RECOMMENDED BY THE SIGNAL MANUFACTURER.
- 6. WIRING FROM INSIDE MAST ARM THROUGH 1" FIELD DRILLED HOLE IN ARM, SHALL BE BROUGHT THROUGH THE MOUNTING SUPPORT TUBE AND LOWER ARM (AS SHOWN). FIELD DRILLED HOLES SHALL HAVE RUBBER GROMMETS INSTALLED.



MA 5-1  
MOUNTING  
HARDWARE



MA 5 ADJUSTABLE  
MAST ARM MOUNTING  
HORIZONTAL OR VERTICAL  
INSTALLATION

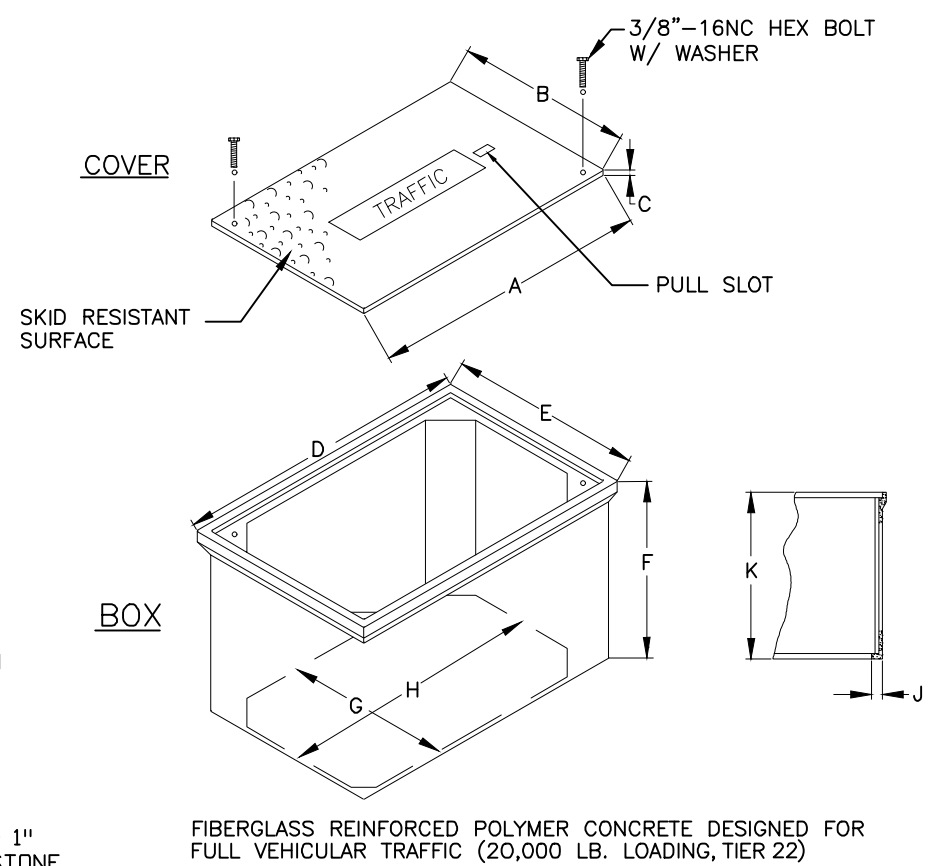
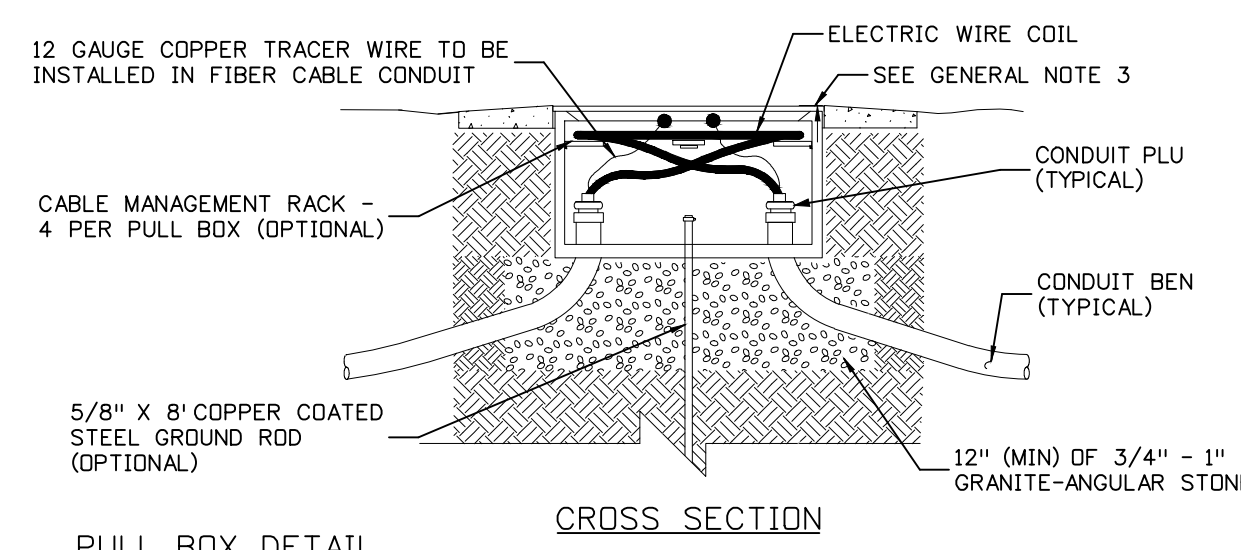
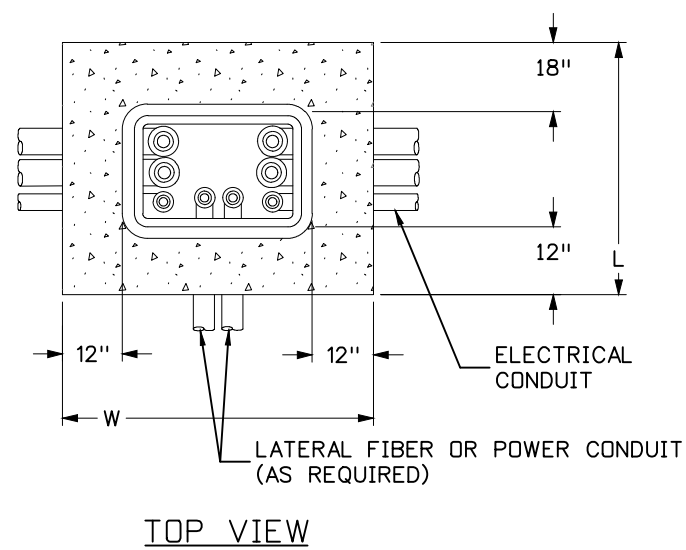
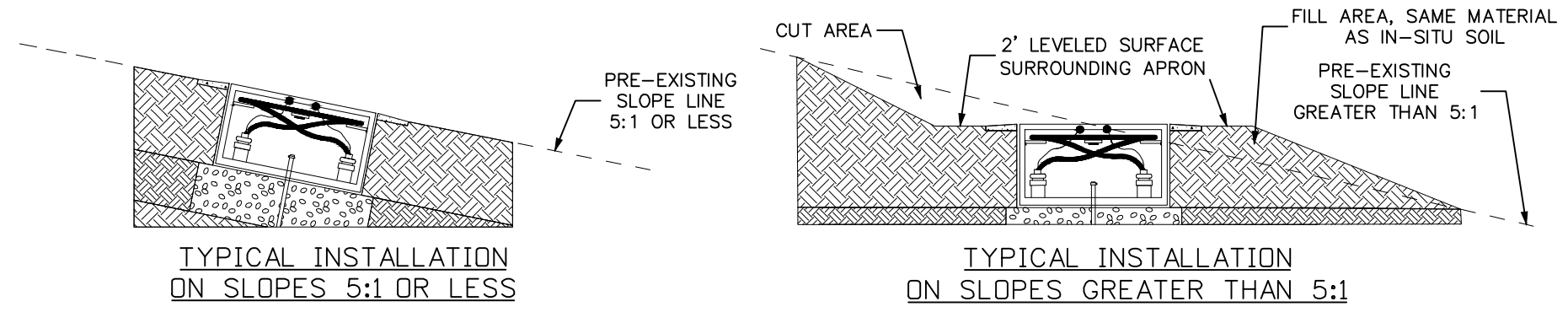
Revisions:	Designed By: SAK	Scale: (As Shown)
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STANDARD 26-11  
SIGNAL POLE & MAST ARM MOUNTING DETAILS (2)

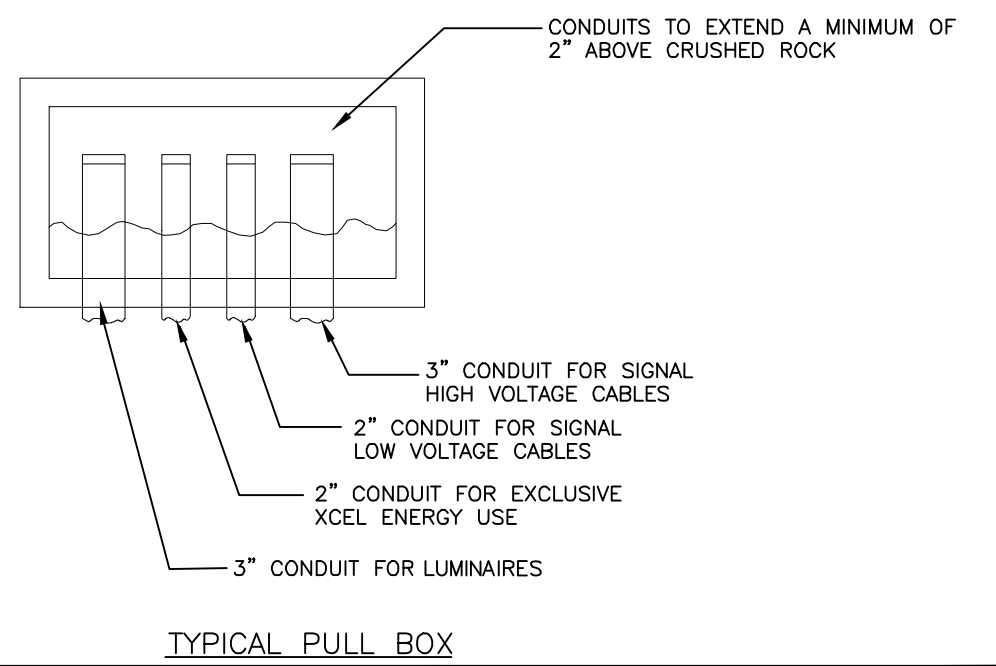
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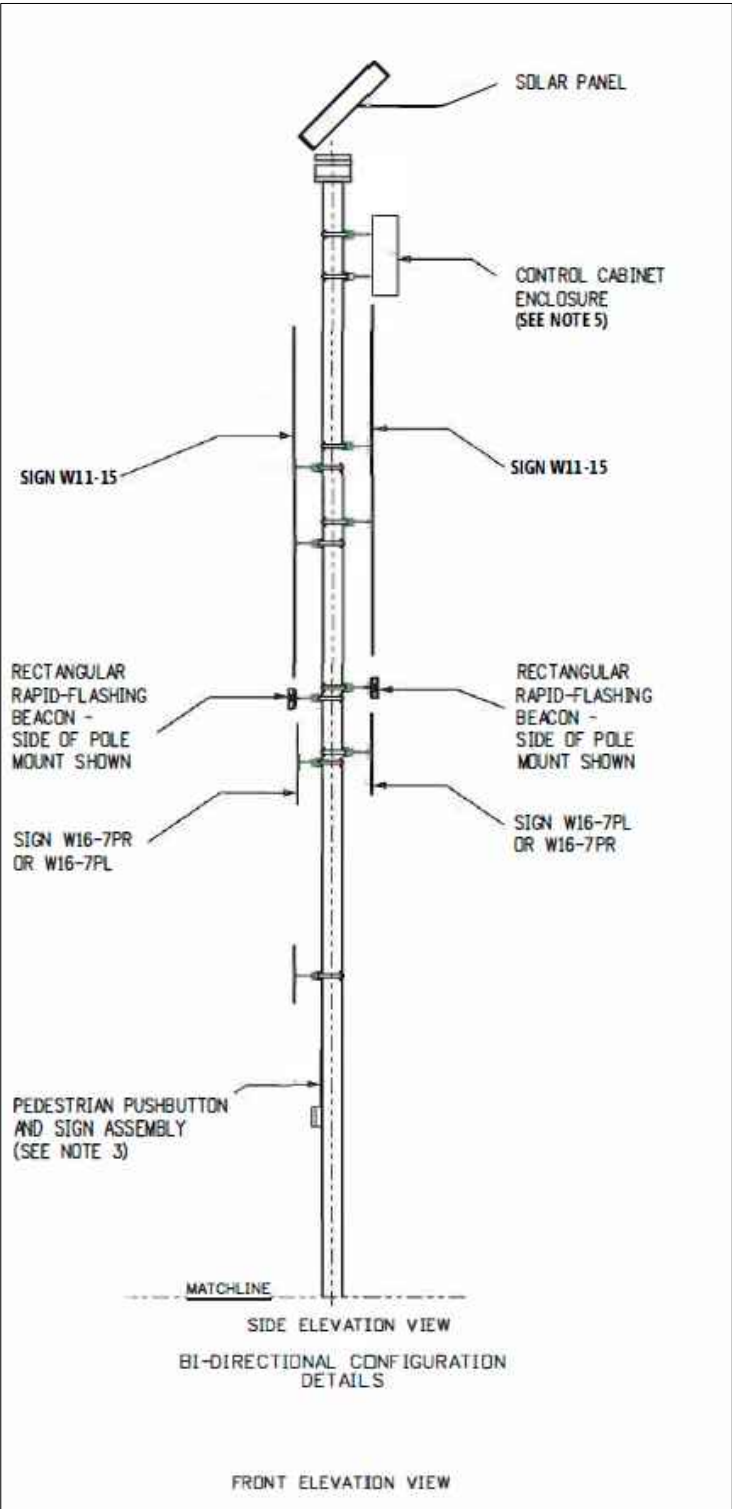
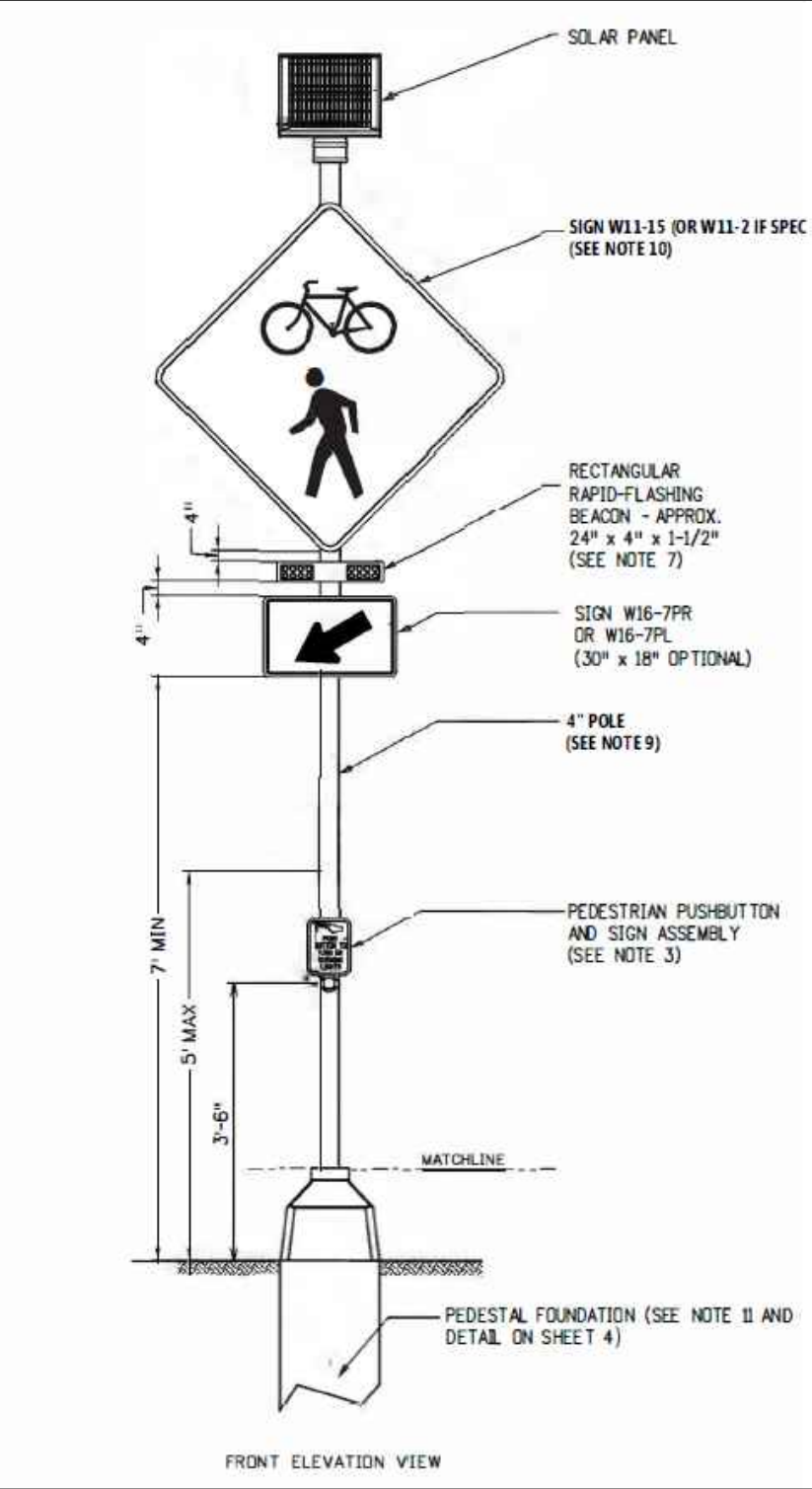


GENERAL NOTES:

1. PULL BOX DETAIL NOTES:
- A. PULL BOXES SHALL HAVE A 12-INCH WIDE MINIMUM BY 6-INCH DEEP PRE-CAST POLYMER CONCRETE APRON, EXCEPT WHEN INSTALLED AT A SIDEWALK, SLOPED AWAY FROM THE PULL BOX OPENING. THE GAP BETWEEN THE APRON AND OUTER WALL SHALL BE A MAXIMUM OF 1/4 INCH. THE COST OF THE CONCRETE APRON SHALL BE PAID FOR AS PART OF THE PULL BOX ITEM.
  - B. THE PULL BOX LID SHALL BE FLUSH WITH THE SURFACE.

TABLE OF DIMENSIONS (MINIMUMS)		
DESCRIPTION	SIZE LENGTH x WIDTH x DEPTH (IN.)	TO BE USED AT
LARGE	30x48x24	CONTROLLER CABINET, HOME RUN
MEDIUM	24x36x24	TRAFFIC SIGNAL POLE
SMALL	17x30x18	UPSTREAM DETECTOR SPLICES, INTERCONNECT





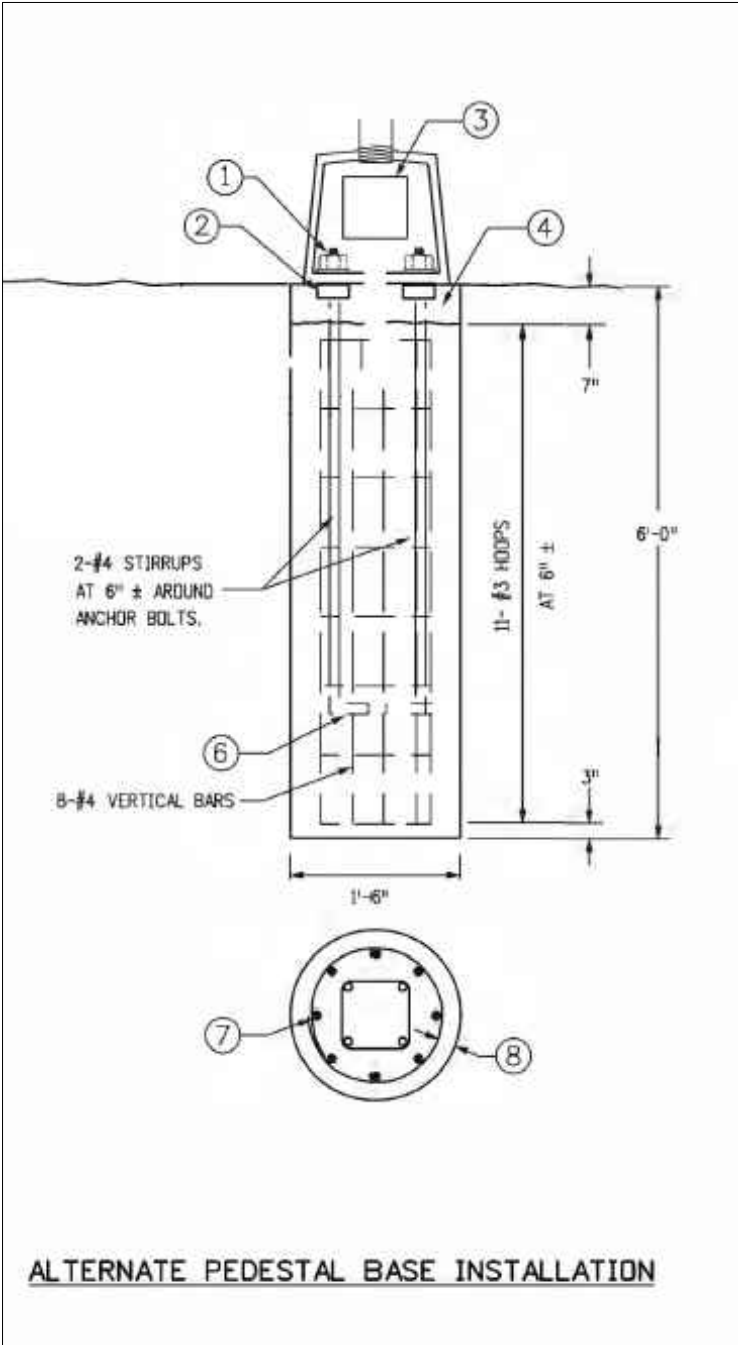
## GENERAL NOTES

1. THE RRFB SYSTEM SHALL ADHERE TO ALL ASPECTS OF THE FEDERAL HIGHWAY ADMINISTRATION, INTERIM APPROVAL 21-RECTANGULAR RAPID-FLASHING BEACONS AT UNCONTROLLED MARKED CROSSWALKS (FHWA 1A-21).
2. AN RRFB SHALL ONLY BE USED TO SUPPLEMENT A POST-MOUNTED W11-2, S1-1, OR W11-15 SIGN WITH 16-7P PLAQUE, LOCATED IMMEDIATELY ADJACENT TO AN UNCONTROLLED MARKED CROSSWALK.
3. PEDESTRIAN PUSHBUTTON AND SIGN ASSEMBLY MAY BE SEPARATE PARTS. USE R10-25 (9"x12" SIGN IN ACCORDANCE WITH 2009 MUTCD. SIGN MAY INCLUDE INTEGRATED WARNING LIGHTS.
4. TERMINATE RRFB CONNECTIONS PER MANUFACTURER'S RECOMMENDATION.
5. CONTROL CABINET ENCLOSURE SHALL BE SIZED BY THE RRFB MANUFACTURER.
6. BEACON ASSEMBLY MAY BE MOUNTED ON THE SIDE OF THE POLE AS SHOWN OR ON THE TOP OF THE POLE IF SPECIFIED.
7. RRFB DISPLAYS SHALL BE LED TYPE MEETING THE INTENSITY REQUIREMENTS OF SAE J595 FOR CLASS 1 YELLOW, BUT SHALL NOT EXCEED 1000 CANDELAS DURING DAYLIGHT AND 500 CANDELAS AFTER DARK.
8. SEE SHEET 1, 2, AND 4 FOR STANDARD BASE AND FOUNDATIONS DETAILS.
9. POLE SHALL BE ALUMINUM SCHEDULE 80 OR STEEL SCHEDULE 40 AS DIRECTED BY THE ENGINEER.
10. FOR POSTED SPEEDS OF 35 MPH OR LOWER, THE W11-2 SIGNS SHALL BE 36"x36". FOR POSTED SPEEDS OF 40 MPH OR HIGHER, THE W11-2 SIGNS SHALL BE 48"x48".
11. PEDESTAL FOUNDATION MAY BE USED FOR BOTH UNI-DIRECTIONAL AND BI-DIRECTIONAL CONFIGURATIONS. BREAKAWAY BASE INSTALLATION (AS SHOWN OF SHEET 1) SHALL BE USED FOR UNI-DIRECTIONAL CONFIGURATION ONLY.

RECTANGULAR RAPID-FLASHING BEACON (RRFB)

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GENERAL NOTES

1. POLE AND PEDESTAL MUST BE DESIGNED TO MEET THE REQUIREMENTS OUTLINED IN THE "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS LUMINAIRES AND TRAFFIC SIGNALS", PUBLISHED BY AASHTO, A WIND VELOCITY OF 100 MPH. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO, IN ACCORDANCE WITH SECTION 105.02 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

DESIGN DATA

THE DESIGNS HEREIN ASSUME THAT FLASHING BEACONS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING SOIL PARAMETERS:

SOIL DENSITY  $\gamma = 110 \text{ LB./CU.FT.}$   
SOIL COHESION = 750 LB./SQ.FT. FOR MEDIUM STIFF COHESIVE SOIL  
SOIL  $\phi$  ANGLE = 30 DEG. FOR MEDIUM DENSE COHESIONLESS SOIL  
SF = 3.0 FOR FLEXURAL RESISTANCE

CONTACT THE ENGINEER IF THE FLASHING BEACON WILL NOT BE INSTALLED WITHIN THE ROADWAY PRISM OR IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:

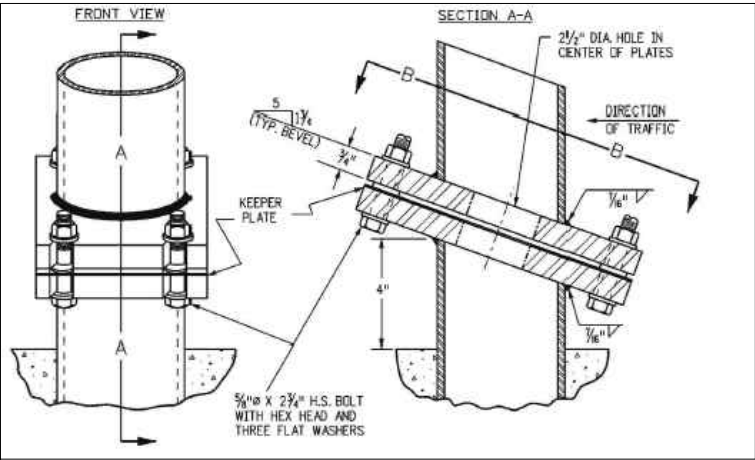
- A) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.
- B) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG.
- C) THE FOUNDATION SOILS ARE NOT HOMOGENOUS.
- D) FIRM BEDROCK IS ENCOUNTERED.
- E) A HIGH GROUNDWATER TABLE IS ENCOUNTERED.
- F) LARGE BOULDERS ARE ENCOUNTERED.

FOOTING DESIGN IS BASED ON 100 MPH WIND LOAD ON A 48"x48" DIAMOND SIGN PANEL MOUNTED 9 FT. ABOVE THE GROUND, WITH A 24"x24" RECTANGULAR PLAQUE UNDERNEATH AND A FLASHING BEACON 12" ABOVE. IF A SIGN CONFIGURATION IS PROPOSED THAT EXCEEDS THESE DIMENSIONS, THE FOOTING DESIGN MUST BE ENGINEERED AND SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO.

FOOTING NOTES

- ① HEX NUTS
- ② SQUARE NUTS
- ③ HAND HOLE SHALL BE PROVIDED.
- ④ 4 IN. MIN. NON-SHRINKABLE GROUT OVER ROUGH FOUNDATION
- ⑤ 11-#3 HOOPS AT 6" ±
- ⑥ INSTALL ANCHOR BOLTS (FURNISHED WITH POLE) PER MANUFACTURER'S TEMPLATE PRINT (FURNISHED WITH ORDER)
- ⑦ MINIMUM OVERLAP OF 12 IN.
- ⑧ 1-1/2 IN. CLEARANCE FOR HOOPS

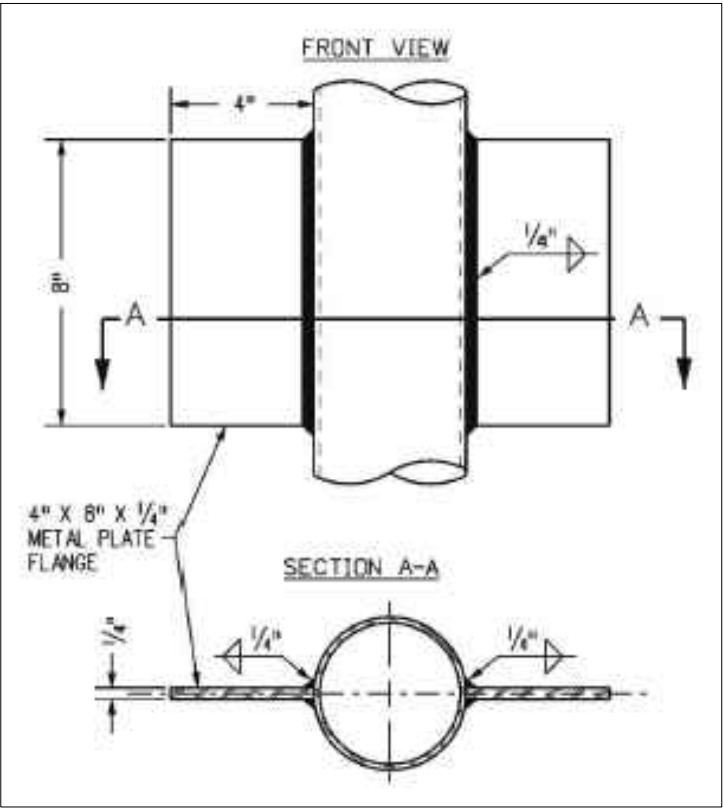
CAISSON DESIGNS REQUIRE THAT THE CAISSON BE FOUNDED IN COMPACT SAND, CLAY OR SANDY CLAY. IF, BY VISUAL INSPECTION OF THE HOLE, OTHER MATERIAL IS PRESENT, THE CAISSON DESIGN SHALL BE MODIFIED AS DETERMINED BY THE ENGINEER.



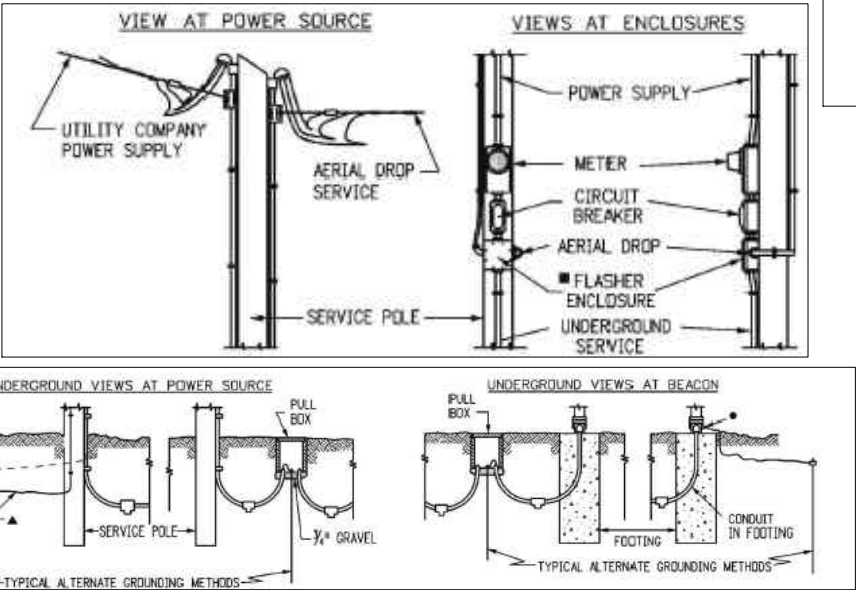
**BREAK-AWAY ASSEMBLY BOLTING PROCEDURE**

1. ASSEMBLE POST TO FOOTING WITH BOLTS—ONE FLAT WASHER ON EACH BOLT TOP AND BOTTOM, AND ONE FLAT WASHER AND THE KEEPER PLATE BETWEEN THE BREAK-AWAY PLATES. USE BRASS SHIMS TO PLUMB THE POST.
2. TIGHTEN ALL BOLTS TO MAXIMUM POSSIBLE WITH A 12"–15" PIPE WRENCH TO BED WASHERS AND SHIMS TO CLEAN BOLT THREADS, THEN LOOSEN EACH BOLT IN TURN AND RE-TIGHTEN IN A SYSTEMATIC ORDER TO 450 INCH-POUNDS TORQUE.
3. BURR THREADS AT JUNCTION WITH NUT USING A CENTER PUNCH TO PREVENT NUT LOOSENING.

**TYPICAL BREAK-AWAY ASSEMBLY DETAILS**



**POST ANCHOR DETAILS**

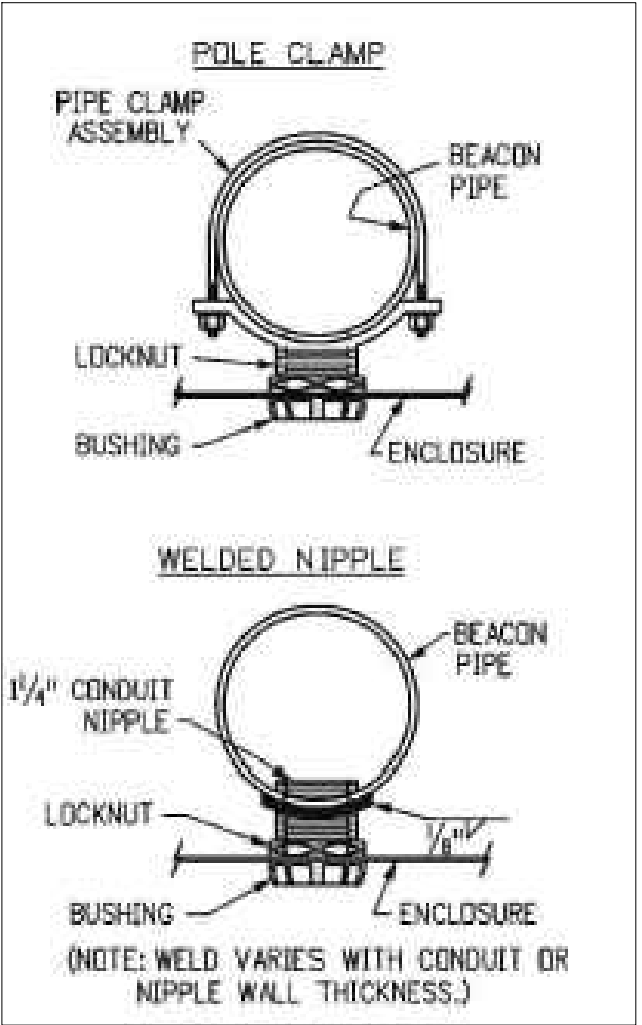
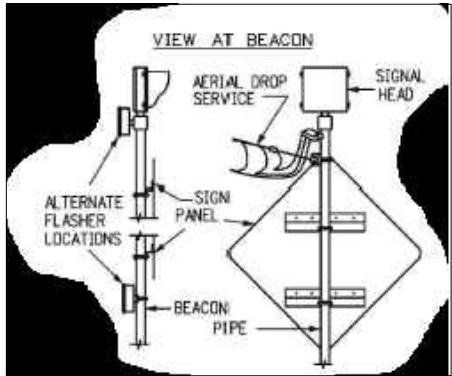
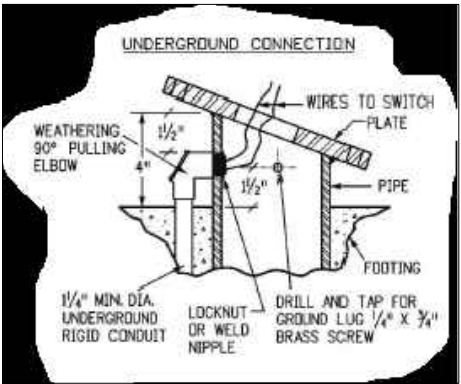
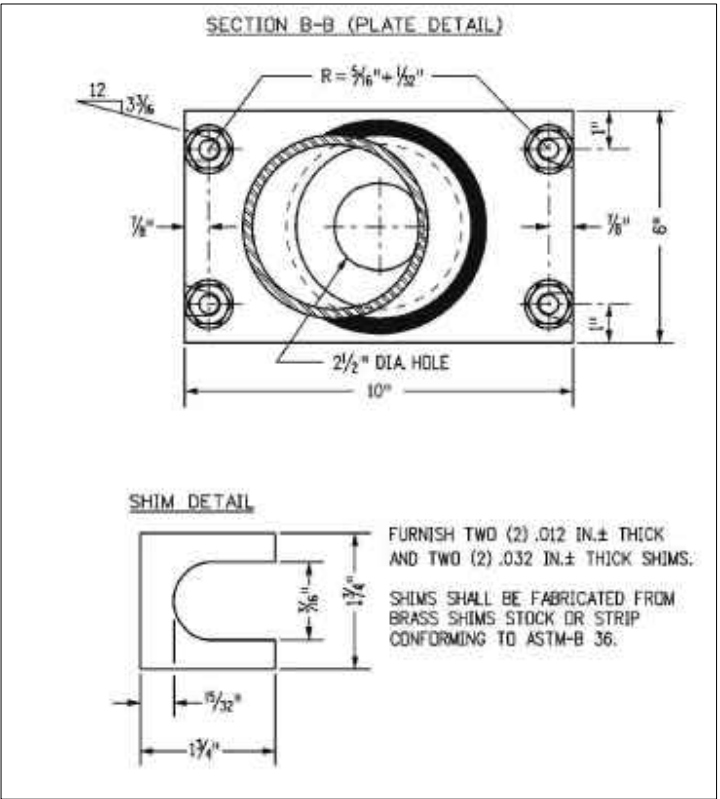
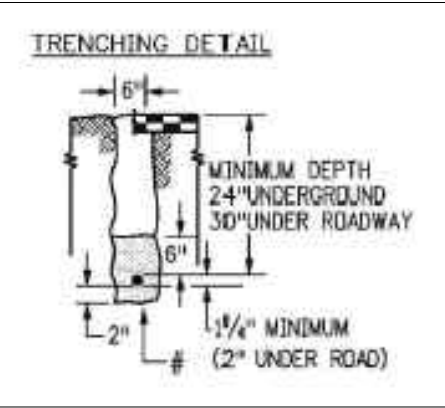


**TYPICAL ELECTRICAL SERVICE DETAIL**

**NOTES**

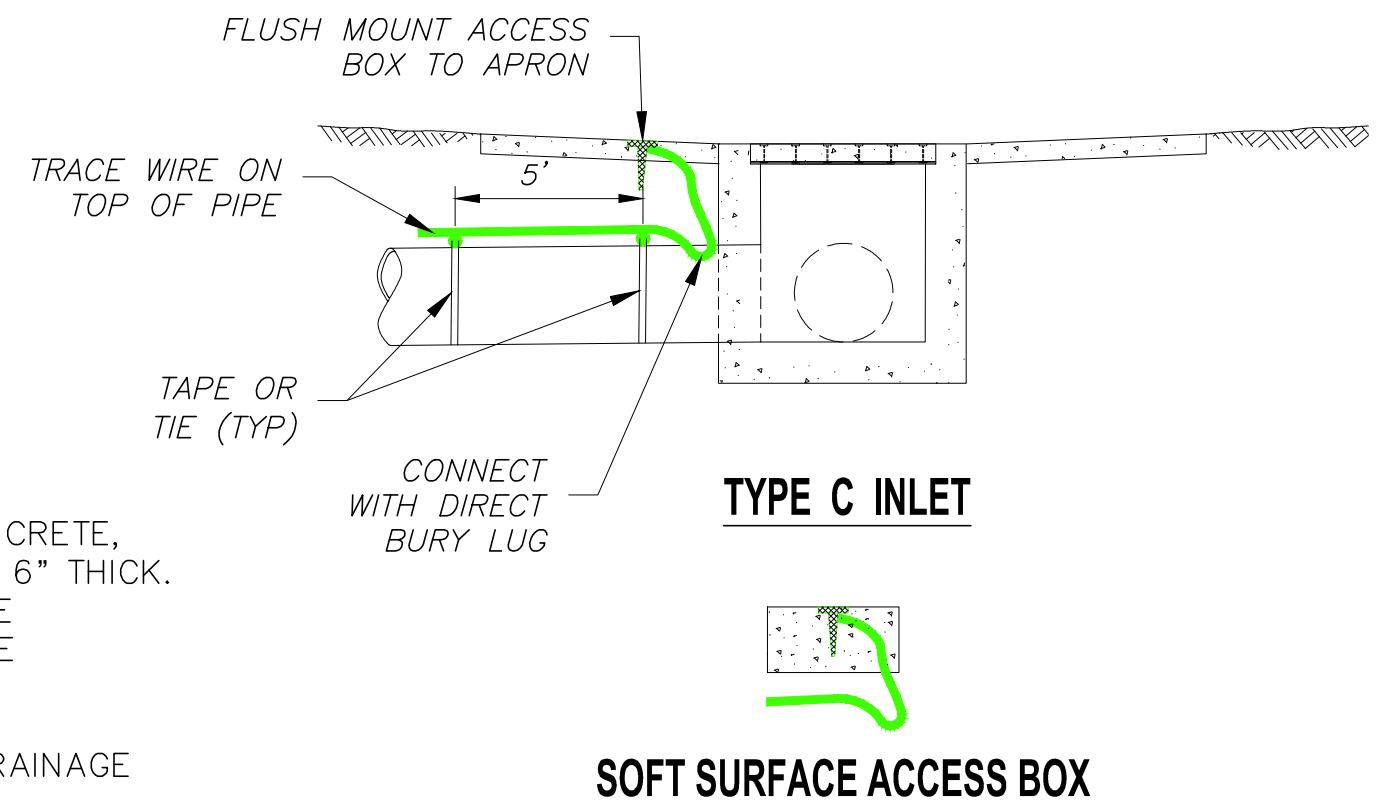
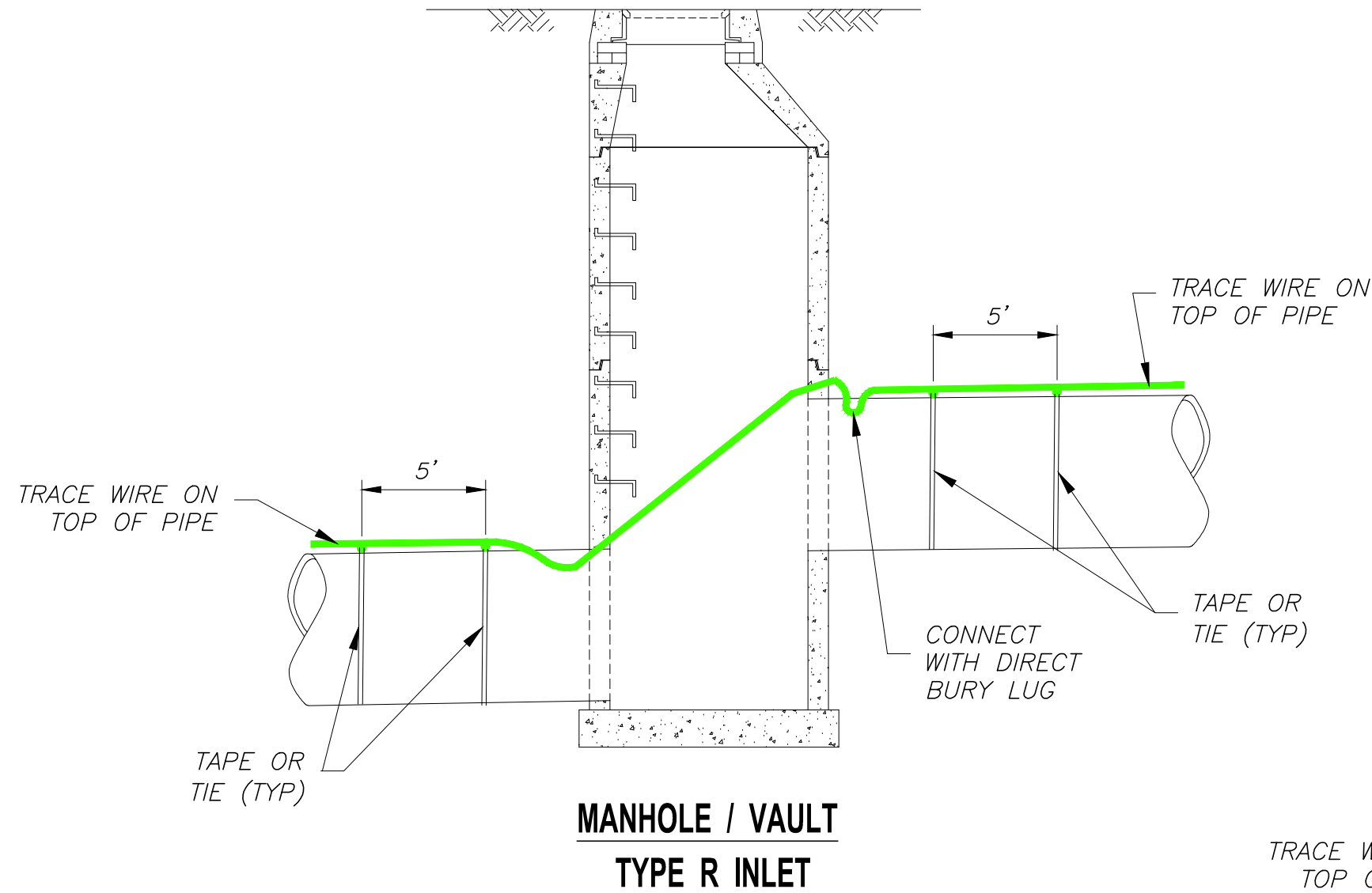
LOCATION AND CONFIGURATION OF ELECTRICAL EQUIPMENT IS DIAGRAMMATIC ONLY (USE ANY METHOD COMPLYING WITH THE GENERAL NOTES).

- ▲ EXISTING GROUND AT SERVICE POLE; OTHERWISE PULL THRU CONDUIT OR ATTACH TO CONDUIT AND TAP OFF UNDERGROUND.
- DRILL AND TAP PIPE FOR 1/2" ROUND ROUND HEAD BRASS SCREW, 3/4" LONG, FOR GROUND LUG
- PROVIDE WEEP HOLE WITH AERIAL DROP SERVICE.
- # BEDDING MATERIAL FOR CONDUIT SHALL BE PLACED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.



**TYPICAL PIPE ATTACHMENTS**

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## NOTES

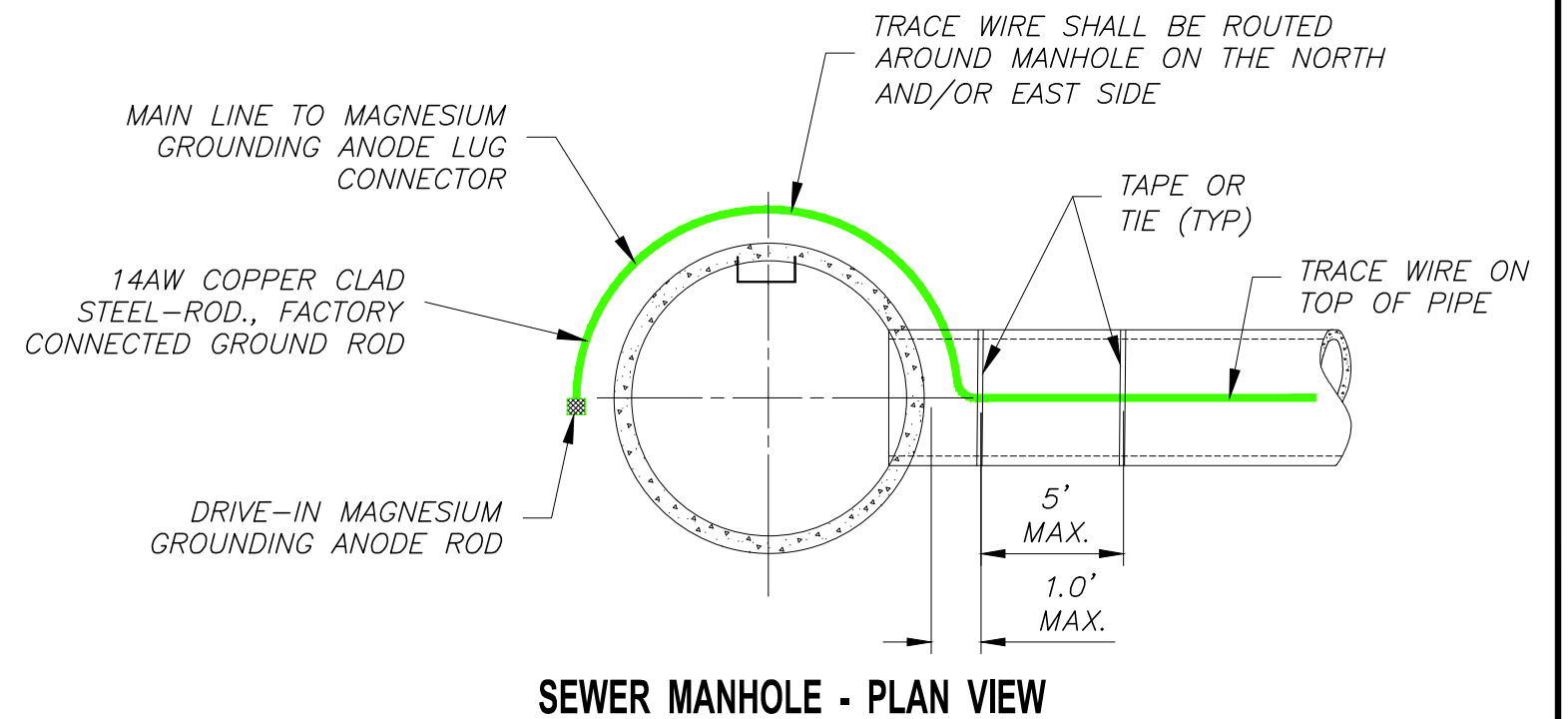
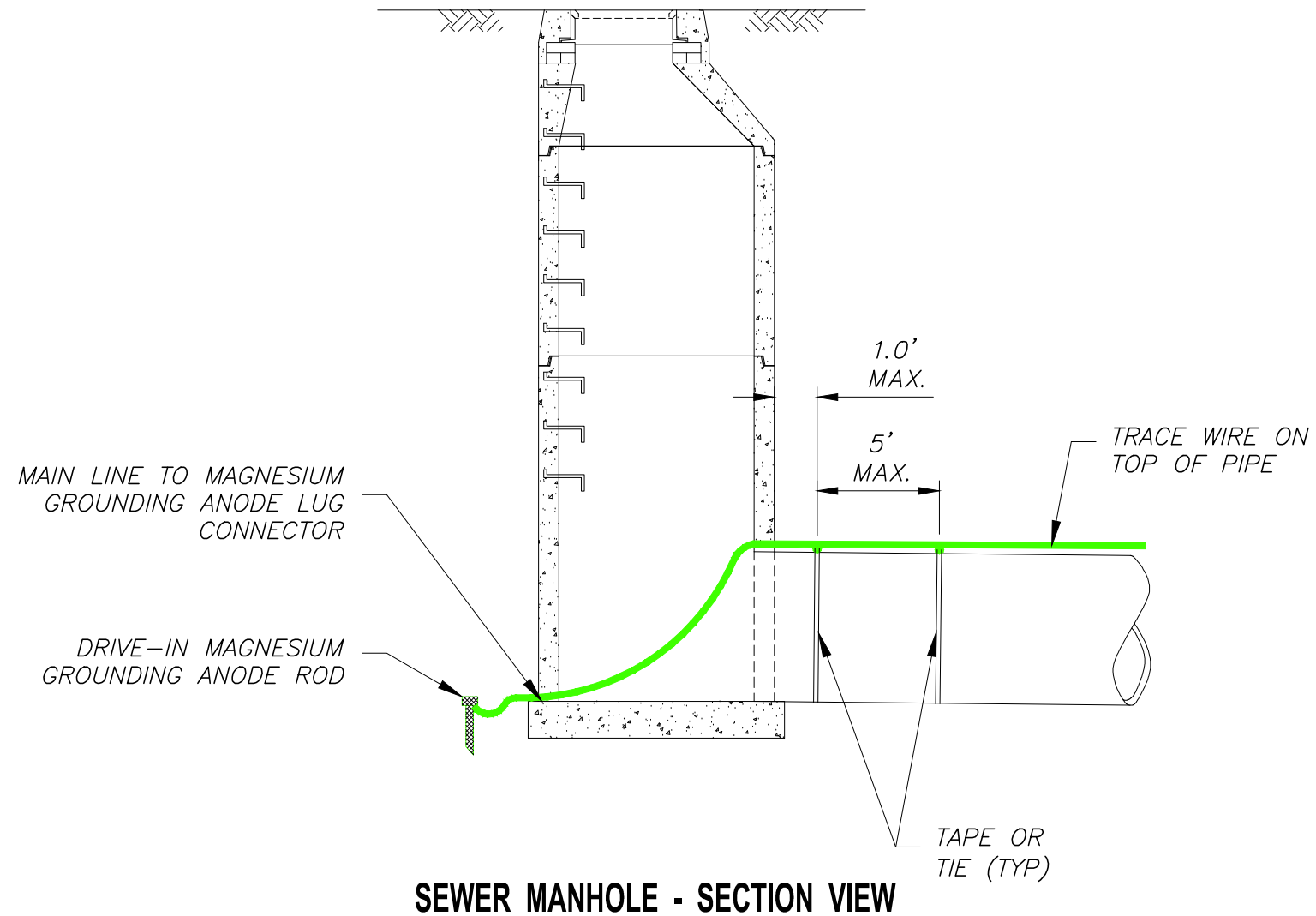
1. IN LOCATIONS WHERE THE ACCESS BOX CANNOT BE PLACED WITHIN EXISTING CONCRETE, THE ACCESS BOX SHALL BE PLACED WITHIN A 12" X 12" CONCRETE PAD THAT IS 6" THICK. THE TEST STATION PAD SHALL BE INSTALLED FLUSH WITH THE ASSET AND IN THE DETACHED SIDEWALK AREA OR BEHIND THE SIDEWALK. TEST BOXES SHALL NOT BE INSTALLED IN THE ROADWAY.
2. THIS DETAIL SHALL APPLY TO ALL STORM SEWER, EDGE DRAINS, OR ROADWAY DRAINAGE STRUCTURES.

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STANDARD 28-1		
UTILITY WIRE INSTALLATION LOCATION - STORM SEWER (1)		
Project No.: -	Sheet -	Of -

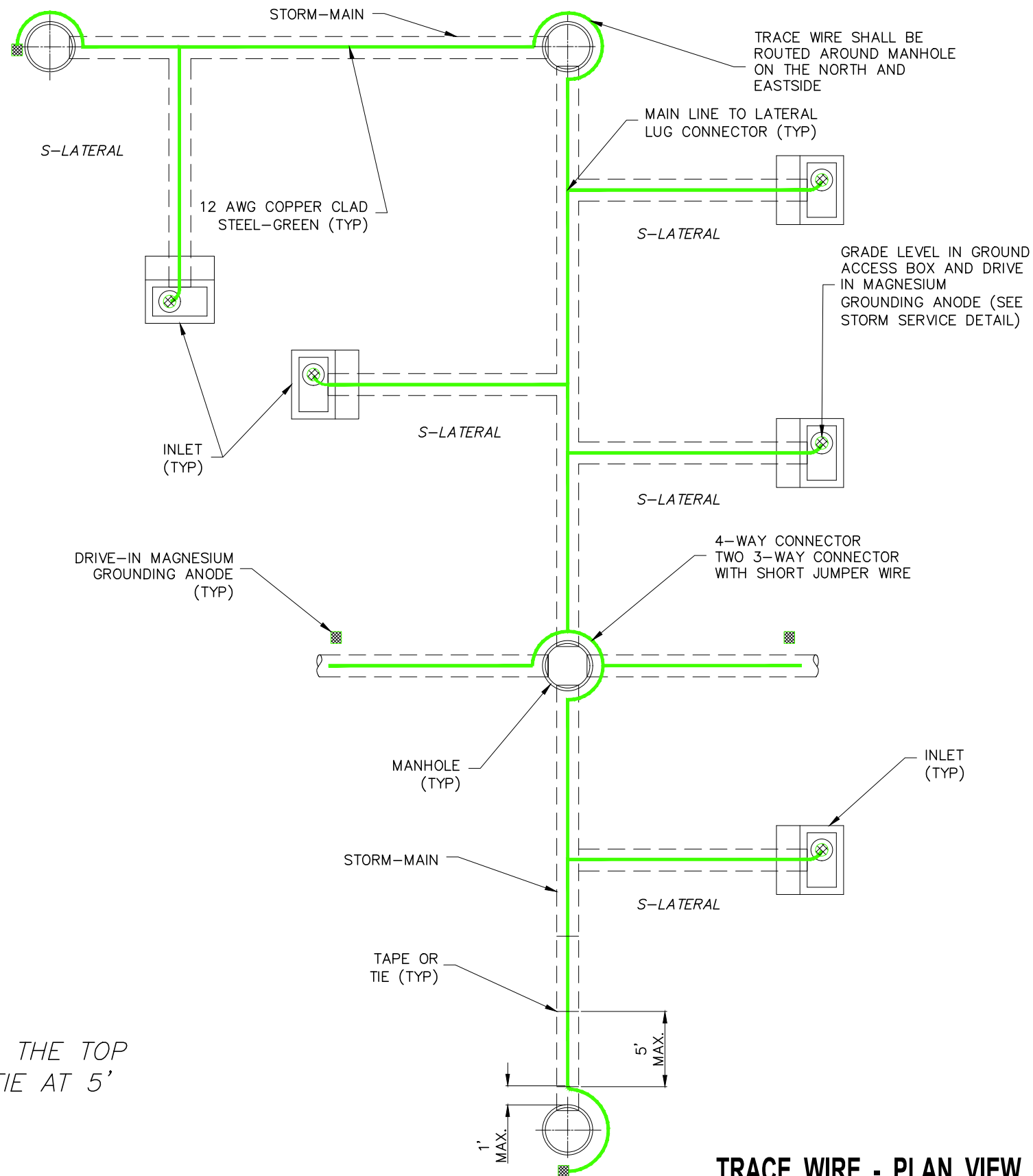


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STANDARD 28-2		
UTILITY WIRE INSTALLATION LOCATION - STORM SEWER (2)		
Project No.:	Sheet	Of



TRACE WIRE - PLAN VIEW

NOTES:

1. WIRE SHALL BE INSTALLED ON THE TOP OF THE PIPE WITH TAPE OR TIE AT 5' INTERVALS.

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				Project No.: -	Sheet -	Of -

# REFERRAL COMMENTS

# **1<sup>ST</sup> REFERRAL COMMENTS**

## 1st Referral Comments and Response Log

Source of Comment	Comment	Staff Response
Adams County	1. For Property in the Jefferson County MS4 Stormwater Permit area, should you provide more requirements if one (1) acre or more is disturbed results? Applicant should be responsible for operation and maintenance report and a SWMP for installation and maintenance of Erosion and Sediment Control. A Builder/developer is more responsible for adhering to all the regulations regarding illicit discharge.	This may be considered for future regulation updates however this was not a part of this regulation update process.
	2. Would addition of infiltration testing are used within the Soil/Geologic Investigation Report Based on percolation rates and converting MPI (minutes per inch) to feet per second? Then, the available surface area of the filter media within say a Sand Filter Basin would be used to multiply the feet per second value to determine the cubic feet per second value. Could that be discussed in the regulation?	Staff agrees that the engineer could convert these values however this was not a part of this regulation update and may be considered for future updates.
	3. Removal of K Factor evaluation when determining what type of Land Disturbance Permit is required; this would help make it less confusing.	Removal of the K factor was completed through a separate regulation update process.
Arapahoe County	No comments	Acknowledged
Broomfield	3.3.3.2. Is this true? Indiana just south of HWY 128 is posted 50mph but your GIS shows it as a Minor Arterial.	This would apply to new Minor Arterials. Eventually, the County will undertake a County-wide speed limit survey to evaluate whether these still apply. The lower end of this range applies more frequently on roads vs. streets are more likely to be higher
	3.6.4 Where did these come from? They don't seem to match Green Book	These standards were not included with this update, but can be reviewed for the next TDCM update



3.7.2 Why are you removing this? We have this in our specs and I am interested in reason for change to know if we should include this in our next update.	The County wants to prevent trees' trunks from obstructing visibility. Also, to maintain more consistency with keeping the foliage outside of the vision clearance triangle
3.7.2.1 How did you get these numbers? They don't match Green Book or CDOT?	These standards were not included with this update, but can be reviewed for the next TDCM update
3.7.3.2 What is your Warrants for needing turn lanes? CDOT? Harmelink?	Up to the study author, but usually CDOT
3.7.6 I really like this. How did you get these numbers? Broomfield may look at stealing some of this info in our next specs update.	These are legacy values. Please reach out when Broomfield is updating specs. We are happy to discuss further!
Do you have any time constants on Traffic Control? For example Broomfield does not allow TC on arterials between 7-9a and 4-6p. We also have restrictions around schools during school drop off pick up times.	Yes. The County limits construction hours to 7a-7p, and lane closures to 8:30a-3:30p
Trip Generation Memorandum: Can this be used on any type of road class? What about location to a signalized intersection. Does it need to look at requirements for turn lanes? Take a look at Broomfield Basic TIS in Broomfield Standard and Specs 162.02.03.	This can be used on any roadway class, but is only for developments generating less than 800 trips
Existing Roadway System: Road classification and speed??	This is implied as part of a roadway description
How did you determine? Broomfield was using 2yr.	The County generally uses 3 years for in-house traffic count and crash data relevance.
Broomfield requires this info in the appendix for our basic study. The aerial for drive spacing and the direction distribution have been very helpful.	The TA is used earlier in the process, when specific site plan, accesses, distribution, etc. are unknown. The TA will be required for the rezoning, and subsequent Site Development plans and Plats require the more comprehensive TIS

	None of these typical include parking. Does the County not allow on street parking?	On street parking is allowed but only for specific templates.
Conifer and South Evergreen Community Committee (Paul Olsen and Chuck Newby)	Section 3.4 Standard Templates: Under 'Private street/road templates and Non-maintained streets/roads in County ROW templates', minimum requirements for private driveways are undefined. Additionally, the table references LDR Section 15, which contains roadway design requirements; however, during many design and construction scenarios, the TDCM and LDR Section 15 document will be in conflict; therefore, the Committee recommends that roadway design and construction requirements be removed for LDR Section 15.	This can be explored during a future reg update that includes both TDCM and LDR. At this time, no LDR changes are proposed.
	Section 3.7.8 Non-Maintained Roads in County Right-of-Way, Driveways, and Private Street/Roads, and Non-Maintained Roads in County Right-of-Way Standards: Template 18 only addresses the cross section, it does not address the plan view.	Curve radius is defined in 3.7.8.1.1, other horizontal features, such as pull-offs, turnarounds, intersections, etc. use separate Standards
	Section 3.7.8.1.1 Curve Radius: A 30' curve radius will not be adequate for emergency vehicles in many scenarios; therefore, the curve radius specification should be situationally based. Also, please address the clear space beyond the pavement limits to accommodate emergency vehicle overhangs, that is, those areas beyond its wheelbase.	This is a minimum curve radius. All new driveways are reviewed by the applicable Fire Protection District, to determine if specific circumstances require a larger radius
	Section 3.7.8.1.2 Width: The Committee has determined that 500' is too long a distance; therefore, the width specification should be based and justified by the length of hose that the firefighting apparatus carries.	Staff has worked with the Fire Protection Districts on this language/requirements.
	Section 3.7.8.1.3 Grade: Grade limitations are generally positive; however, the TDCM also needs to address the maximum change of grade from one roadway section to another. In many scenarios, going from 12% down to 12% up in a short distance will be a safety hazard. Additionally, there should be an explanation for this statement reading, for example: "Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West". Moreover, all other possible orientations should also be specified.	This is addressed in Section 3.6.4 requiring minimum K values for Sags/ Crests based on design speed.

Section 3.7.8.2.1 Curve Radius: What is this 30' curve radius based upon? There needs to be a reference or justification for this specification: It could be that a 30' radius is not sufficient in many scenarios.	See above.
Section 3.7.8.2.2 Width (For a street/road serving up to 15 dwelling units): Will parking be allowed on these roadways? What about horizontal and vertical obstructions? This width specification should situationally based.	On-street/road parking is not permitted per the provided detail.
Section 3.7.8.3: The use of the clause, "The off-site driveway or private road shall meet requirements of this section" is ambiguous. Such as clause as this must clearly state, in detail, the requirements that the roadway design and construction is required to meet. As this section is written, it is not clear what would constitute an unacceptable roadway or driveway design! There are no details or drawings to clearly show what the minimum acceptable roadway and driveway. This section must include a statement similar to the following, "The documentation shall include scale drawings upon which fire protection district approved turning templates are overlayed". Additionally, my reaction to the following statement, "Such statement shall bear the professional engineer's seal, signature and date,..." is that, as a professional engineer, I (Paul Olson) would not risk my professional engineer's license to approve plans for an on-site driveway or private roadway in a circumstance where the actual requirements are so ill-defined. Moreover, if the driveway cannot safely accommodate a fire protection district apparatus then there is NO condition where an exception should be granted — this requirement should be deleted completely — inasmuch as it is not clear how Jefferson County Staff will judge any requested exemption under this clause. In my opinion (Paul Olson), this clause will only cause Staff and the public significant, ongoing difficulties that are unnecessary. Again, there are no templates or drawings that detail the minimum requirements for driveways as they intersection with the county roadway!	Reference section 3.7.8 for minimum driveway requirements. Subsection 3.7.8.3.3, required a detailed explanation of how a fire apparatus will access the site, this explanation can be narrative or graphical, at engineer's discretion As per the Alternate Standard Request (ASR) process as defined in the LDR, any exceptions to engineering standards must be approved by a registered Professional Engineer, to be considered by the County. This requirement aligns with that ASR process. This is why it must be approved by a PE that it can accommodate a fire apparatus
The following are the Committee's specific comments with respect to the TDCM Transportation Studies Appendix:	NA

General: This section is greatly improved! However, it needs better section numbering to match the rest of the document and there needs to be a separate section on Traffic Signals which would include a specification for engineering studies of MUTCD Warrants and Alternatives.	Numbering differs because it is an appendix, not a section
Requirements for Transportation Studies (TS): The trip generation analysis should include both weekdays and weekend. This is particularly important for commercial developments but also residential developments in the vicinity of commercial developments such as shopping centers. For mountain area developments, the study should also analyze the impact of major transportation corridors. For example, a currently active proposed development within the Conifer/Aspen Park community — the proposed Conifer Center PD, Case No. 20-111200RZ — should study the impact to U.S.-285 in the Turkey Creek Canyon. This is a major bottleneck, in particular for emergency access and routes for evacuation.	Typically, the heaviest traffic generation is on weekdays. However, in unique circumstances where there is higher trip generation on a weekend, County staff will request additional analysis be completed for weekends.  The County does not maintain any limited-access Freeways, and intersection operations are the limiting factor for County roadways corridors. Developments impacting State highway facilities, such as US 285, are referred to CDOT for review and comments on impacts to those facilities.
Trip Generation Summary Table: Columns to be modified in and added to the table, "1) columns for Weekdays AM Peak & PM Peak, 2) columns for Saturday AM Peak & PM Peak, and 3) columns for Sunday AM Peak & PM Peak	Typically, the heaviest traffic generation is on weekdays. However, in unique circumstances where there is higher trip generation on a weekend, County staff will request additional analysis be completed for weekends.

Existing Area Conditions: The discussion of existing traffic counts is inadequate. This section needs to set clear requirements for traffic counts: Automated Daily Counts need to be collected for at least two weeks; Turning Movement Counts, that they are now mostly automated, should be collected based upon the peaks periods identified in the daily counts; Turning Movement Counts shall NOT be collected on Monday, Friday or the day before or after a holiday weekend; and Turning Movement Counts will be required on weekends for commercial and residential developments in the vicinity of a commercial development. All counts shall be sufficient to clearly identify peaks and to show that the analysis is not based upon the lowest volumes collected. All counts shall establish the average daily volumes as well as the peak hour volumes.	It would be unreasonable for the County to require two weeks of traffic data. The County requires the same standard for counts that the County uses for the annual traffic count program: "All counts are to be collected over a 24-hour continuous period on a typical weekday, not including Fridays or Mondays, from 12:00 AM to 11:59 PM. No Friday, Monday, weekend, or holiday counts, and no data collection during inclement weather". This language will be added to this section.
Background Traffic: Are you requiring the inclusion of outputs from the Denver Regional Council of Governments (DRCOG) travel demand model? If so there should be a step to calibrate the impacted subsection of the model to current conditions.	At a minimum, the County only requires that the projected background traffic be interpolated from the DRCOG's TDM's Model Assigned Traffic Volumes to fit the horizon years of the proposed development.
Project Traffic: Trip distribution shall be based upon the trip tables in the DRCOG model. If there are none then a Origin and Destination Study should be provided. The DRCOG model shall be run with the traffic generated by the proposed development.	An Origin and Destination Study is an unreasonable requirement for developers. The County reviews trip distribution and the methodology used by developers.

	<p>Levels of Services (LOS): These determinations shall be supported by Volume to Capacity Ratios (V/C). The LOS determinations themselves are not an accurate depiction of the traffic situation. For example the V/C could be on the lowest edge of a LOS range say V/C of 0.80 is it really LOS C and be judged as acceptable, however, in reality it is worse. Would a facility that operates at LOS D or V/C of 0.90 for 12 consecutive hours a day be acceptable? What are the limits on how many hours a day that a facility could operate in congested conditions? An hour in the peaks may be OK but not more. Jefferson County Transportation and Engineering Level of Service Criteria for Arterials is based on Volume-to-Capacity Ratios Level of Service Description V/C: A. Free-flow conditions with unimpeded maneuverability, stopped delay at signalized intersection is minimal, that is, on the order of 0.00 to 0.60. B. Reasonably unimpeded operations with slightly restricted maneuverability. Stopped delays are not bothersome at 0.61 to 0.70. C. Stable operations with somewhat more restrictions in making midblock lane changes than LOS B. Motorists will experience appreciable tension while driving at 0.71 to 0.80. D. Approaching unstable operations where small increases in volume produce substantial increases in delay and decreases in speed of 0.81 to 0.90. E. Operations with significant intersection approach delays and low average speeds of 0.91 to 1.00.</p>	<p>The County uses LOS as a measure of congestion. The nuanced differences between using LOS vs V/C is too detailed for standard requirements. If a traffic study shows LOS D or better, the intersection operates acceptably regardless of the V/C. LOS D or better is acceptable regardless of how many hours of the day are at LOS D.</p>
	<p>Signalized Intersections: The TDCM should require proposed signal phasing plus the proposed timings, cycle times, phase timings, vehicle and pedestrian clearance intervals, controller settings, detection zone placements, etc. Projected queue lengths shall be calculated. Engineering studies as required by the MUTCD shall present all the signal warrants even the ones that are not met and they shall include at least a week of 15 minute counts.</p>	<p>Requirements for signals are specified under the "Improvement Analysis" section of the appendix. The County requires developers evaluate Warrant 2 - Four Hour, unless unique conditions would make a different signal warrant apply. Only one Warrant needs to be met for a signal to be considered. MUTCD Signal Warrant analysis does not require a week of 15 minute incremental traffic counts.</p>
Building Safety	No comments.	Acknowledged.

Elk Creek Fire	3.7.8 - we support this clarification.	Acknowledged.
	3.7.8.1.3.1 - we support this proposed change to improve the safety of occupant evacuations and fire apparatus access. In addition, this increased clearance on each side of the driveway would provide better sunshine access to help melt snow and ice, especially on excessive grades. I find many driveways that have been approved for grade variances iced over and impassable in the winter because they're in the shade.	Acknowledged.
	3.7.8.1.4 - we support this proposed change. The increase to 15% grade has been our practice for many years with the appropriate fire mitigation system, which is a residential fire sprinkler system. This change would make the increase to 15% automatic without having to obtain approval from the fire districts.	Acknowledged.
	3.7.8.1.7 - we support this proposed change to improve the safety of occupant evacuations and fire apparatus access.	Acknowledged.
	3.7.8.1.4 - Turnarounds. I'd recommend that a maximum cross grade be added to turnarounds. It's very difficult and can be unsafe to turnaround a large fire apparatus when the grade is over 4%. I would also recommend that the location of the approved turnaround be located a minimum of 30 feet away from the building exterior to keep fire apparatus away from the collapse zone and radiant heat. We recently had major paint damage to two fire apparatus that was too close to a house fire.	To be addressed with the next referral.
	3.7.8.2.4 Exception - Grades - I'd recommend that P2904 sprinkler systems be added after NFPA 13D. These are nationally recognized fire sprinkler systems that comply with the code.	To be addressed with the next referral.
	3.7.8.2.5 - we would support this proposed change if it were modified to add the applicable building, fire, and wildland codes. Since this section covers private roads serving more than one dwelling unit it's important that they also meet fire and wildland codes to improve the safety of occupant evacuations and emergency vehicle access.	To be addressed with the next referral.

	3.7.8.3 #4 - I'd recommend that P2904 sprinkler systems be added after NFPA 13D. These are nationally recognized fire sprinkler systems that comply with the code.	To be addressed with the next referral.
	3.7.8.3 - Who's responsibility is to determine if the offsite driveway or private road meets the requirements in this section ? At this time we require the applicant to have a civil engineer evaluate the offsite for compliance and provide the fire district a written report.	Staff agrees that it is the responsibility of the applicants Civil Engineer. To provide clarity with the next referral.
Planning Engineering	Complete	Acknowledged.
Evergreen Fire	3.7.8 - We support this clarification.	Acknowledged.
	3.7.8.1.2 – We support this proposed change to increase the safety of the residents and first responders.	Acknowledged.
	3.7.8.1.3 - We support this proposed change allowing the 15% grade to be automatic without having to gain approval from the fire district. With this grade increase an automatic fire sprinkler system allows for increased safety of the occupants and mitigates the fire hazard surrounding the structure.	Acknowledged.
	3.7.8.2.2 - We support this proposed change to improve the safety occupants and responders and allow for pullouts to be modified depending on site topography.	Acknowledged.
	3.7.8.2.4 - We would support this proposed change if it were modified to add the applicable building, fire, and wildland codes. Since this section covers private roads serving more than one dwelling unit it's important that they also meet fire and wildland codes to improve the safety of occupant evacuations and emergency vehicle access.	Update made.
	3.7.8.3 – We support these changes but believe that further clarification will be needed to determine the parameters for item 3 and determining a fire district serving the residence safely and effectively.	Further clarification to be provided regarding requests for relief.
Foothills Fire	3.7.8 - We support this clarification.	Acknowledged.
	3.7.8.1.2 – We support this proposed change to increase the safety of the residents and first responders.	Acknowledged.



	3.7.8.1.3 - We support this proposed change allowing the 15% grade to be automatic without having to gain approval from the fire district. With this grade increase an automatic fire sprinkler system allows for increased safety of the occupants and mitigates the fire hazard surrounding the structure.	Acknowledged.
	3.7.8.2.2 - We support this proposed change to improve the safety occupants and responders and allow for pullouts to be modified depending on site topography.	Acknowledged.
	3.7.8.2.4 - We would support this proposed change if it were modified to add the applicable building, fire, and wildland codes. Since this section covers private roads serving more than one dwelling unit it's important that they also meet fire and wildland codes to improve the safety of occupant evacuations and emergency vehicle access.	Update made.
	3.7.8.3 – We support these changes but believe that further clarification will be needed to determine the parameters for item 3 and determining a fire district serving the residence safely and effectively.	Further clarification to be provided regarding requests for relief.
Barbara Ford	The MANUAL is an Engineering Document, and is not intended to be “flexible”, as one Planning Commissioner stated, and one Staff Planner expressed, astonishingly, at the July Hearing. Staff Engineer Nathan Seymour also expressed his willingness to employ “flexibility” in the Engineering designs, even an unspecified design offered by a Fire Chief.	There are instances where an existing standard within the Manual cannot be met and it is necessary for an applicant to request relief. The relief requests may be approved if the applicant can demonstrate that alternate solutions or designs will not be detrimental to or contrary to the Purpose of this Regulation and will be in harmony with the general purpose and intent of the provision for which a waiver is sought and that strict compliance with such provision would be impossible or impractical.

<p>Engineering Standards are not reducible or flexible so that accommodations can be made for those developers who cannot meet the Standards. Professional Engineers don't consider flexibility in "engineering designs" that get around the Standards as a Professionally-ethical or acceptable approach to design and construction, because that is precisely how one would go about increasing the likelihood of failure, of roads, bridges, buildings, etc.</p>	<p>See response above.</p>
<p>For the Commissioner who is a licensed Professional Engineer, who expressed that he would not use his seal for projects where developers (his clients) could not meet Engineering Standards, I have the following questions: a. Would you use your seal if the "certified statement" complied with the MANUAL Minimum Engineering Standards? b. What do you interpret a "certified statement" to mean? c. Do you agree that a "qualified" professional structural engineer in Jefferson County, likewise be allowed "flexibility" to design bridges and buildings that don't meet Engineering Standards for some clients who cannot meet Standards? d. Do you agree (with Staff) that Road Engineering Standards are only relevant as to whether they can carry emergency equipment, or might the Road Engineering Standards have additional value and significance? e. Do you agree that approving a development that will increase traffic on a noncompliant private mountain road that does not meet even the Minimum Engineering Standard in a high to extreme wildfire environment may present safety issues? Who should bear that liability?</p>	<p>Any requested for relief are required to be signed and sealed by the applicants engineer. Staff will review the relief process for private streets/roads more closely to provide clarity as to what should be submitted to Staff for review.</p>
<p>P&amp;Z Staff licensed engineers saw no issue in case 19-104466PF, and allowed the Fire Chief to "approve" the non-compliant road to carry significantly more traffic. The PC and Board agreed with Staff.</p>	<p>The regulations do currently state that the appropriate Fire Protection District may approve alternative standards. Staff is currently working to change this process so that relief requests are approved by the County with input from the Fire Protection District.</p>

<p>P&amp;Z STAFF INTEND TO DELAY COMPLIANCE WITH MANUAL ENGINEERING STANDARDS UNTIL AFTER SUBDIVISION APPROVAL Staff intends that compliance with the Manual Engineering Standards be demonstrated at the time of acquisition of a building permit, instead of prior to Board approval of the development/subdivision. This revision is contradictory to the LDR, the MANUAL, Colorado Revised Statutes, and a Colorado Court of Appeals decision (see below). From page 3 of the Engineering Manual: 1.2. Jurisdiction The requirements of this MANUAL shall apply to all subdividers, developers ....designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations. The foregoing design and construction of transportation systems are subject to review and approval by the County pursuant to any County regulation or requirement. 1.3. Purpose and Effect Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads. All land development or any other proposed construction submitted for approval under the provisions of the LDR and/or ZR as applicable, shall include adequate transportation system analysis and appropriate transportation system design. Such analysis and design shall conform to the criteria set forth herein....”</p>	<p>For a subdivision, the applicant is required to submit to the County construction plans showing how the existing and proposed on and offsite roads will be improved to meet County Standards. Any requests for relief of these standards would be reviewed at this time. These plans are required to be approved by the County prior to recordation of the subdivision.</p>
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<p>The Colorado Court of Appeals found that the Board of County Commissioners (in a Mineral County case<sup>3</sup>) abused its discretion because it approved a development where the required provision for access was not secured before awarding its approval of the development. “III. Access A. State Law Section 30-28-133.1, C.R.S.2007, provides: Subdivision plan or plat-access to public highways. No person may submit an application for subdivision approval to a local authority UNLESS the subdivision plan or plat provides, pursuant to section 43-2-147, C.R.S., that all lots and parcels created by the subdivision will have access to the state highway system in conformance with the state highway access code.”... “We do not read the plain language of this statute to allow postponing access beyond the application for final subdivision approval. The statute imposes a condition (“unless”) on a current activity (“submit an application”) and uses a present tense term (“provides”). This condition would be meaningless if the application need only address how access might be obtained in the future. See Black's Law Dictionary 1224 (6th ed. 1990) (“Provide” is defined as “To make, procure, or furnish for further use, prepare. To supply; to afford; to contribute.”).” “While “will have access” expresses the future tense, in our view that wording reflects the three-phase progression of all regulated land development: (1) planning; (2) approval; and (3) build out. Thus, a subdivision “will have access” only when its internal roads have been completed and connected with a state highway. But that connection must still be provided for in the application.” The Court found “... an abuse of discretion because the subdivision might never have the required statutory access”.</p>	<p>Acknowledged.</p>
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<p>Likewise, the Court would also find unlawful the postponement of the statutory access requirement until the time of issuance of a building permit, as P&amp;Z Staff now proposes. If a developer cannot meet the Minimum Engineering Standards for the access route, then the access has not been secured as State Law requires. The Court required that the application must have such provisions prior to Board approval. "According to James A. Kushner, Subdivision Law and Growth Management § 7.14 (2006), "Final approval constitutes recognition that all conditions for subdivision approval imposed by the local government body have been satisfied." We adopt this definition because it furthers prudent land use policy. A final approval creates vested development rights under which a reasonable developer could start construction. See Jafay v. Bd. of County Comm'rs, 848 P.2d 892, 902 (Colo.1993). But if a condition set forth in a purported final approval is not met, then the status of improvements made during the interim would be uncertain."</p>	<p>Acknowledged.</p>
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	<p>Furthermore, the Court recognized the burden that such postponements into the future present to objectors and other interested parties (see below), a burden that Jeffco Staff, the PC and the Board do not seem to recognize in a continuing effort to postpone critical considerations and demonstrations until after Board approval. This was done for numerous issues in case 19-104466PF, and the Board failed to make adequate (or any, in some cases) provisions for them – road, water supply, off-site drainage, etc, leaving a significant burden to us, our neighbors and also to future perspective buyers of the parcels, exactly as the Court of Appeals discourages in the Mineral County case. “Such a conditional final approval would also burden the zoning authority to revisit and perhaps modify the condition or extend the time for compliance. A similar burden would fall on members of the public who opposed the development, but would have to continue appearing at subsequent proceedings to preserve their opposition whenever the zoning authority revisited the condition. See § 24-67-104(1)(e), C.R.S.2007 (the county resolution must set “forth the procedures pertaining to the application for, hearing on, and tentative and final approval of a planned unit development which shall afford procedural due process to interested parties”).”</p>	Acknowledged.
Open Space	No Comment	Acknowledged.

Jeffco Planning	<p>Maybe y'all already talked about this, but assuming these are approved as written, how will it be communicated that a Sprinkler system is required if grades over 15% are approved for on-site driveways? (3.7.1.8.4. &amp; 3.7.8.2.5) Is this something that could be noted painfully obvious for the review planner in the GPA to ease the review of the subsequent BP? Perhaps an even easier option would be to require the same letter from the homeowner to install the system that is required for off-site driveways of the same grade? "4) a written statement from the property owner that a fire sprinkler system will be installed per NFPA 13 D at the time of Building Permit." Also love what y'all did with the traffic impact analysis sections. Excited see imagine proposed mitigations and to have so many fun tables for applicants to complete. Anyway we could require them to evaluate bicycle trip generation and parking as well? Certainly a personal wish list item so feel free to disregard.</p>	This will be accomplished through the letter from the Fire Protection District associated with the BP.
Public Health	No Comment	Acknowledged.
Road and Bridge	No Comment	Acknowledged.

CDOT	<p>Please note that most CDOT Rights of Way in Jefferson County are functionally classified, by which we would look to our rules and standards outlined in Code regarding access spacing, and a long list of design elements &amp; considerations. Usually, if/when County standards are better and safer than CDOT's we will go with the stronger standards. Our standards do not define RoW widths, as we rely on and respect those of the local agencies. For example, if a landscaped center median is needed, that would be defined by the local agency, not CDOT. This is a frequent mis-conception by developers. When a plan like the 2018 West Connect PEL was adopted by your local officials, and it already has cross sections within it, should those not be used instead of these? Under the referral materials forward to us, we see but are not quite clear of the distinction and rule of when a suburban roadway design is warranted that is different from the rural and mountain roadway design. We are not sure for example, how the county determines when the major collector with curb, gutter &amp; sidewalk is needed, and when it is not. Recent instructions CDOT staff is given from the State political level (Transportation Commission) is to advocate for more Multi-modal accommodations in our rights of Way, offering choices over driving. In great part this translates to share the road and sidewalks. We noted that many of the profiles do not show these elements and seem to have a minimum threshold based on ADT. That seems to be counterintuitive since the purpose of multi-modal is to lessen the dependency of vehicles for short trips.</p>	<p>Thank you for your comments. The County's roadway templates are meant to be utilized in conjunction with the County's Major Thoroughfare Plan (MTP). The MTP identifies not only the functional classification of each County roadway, but also whether each is considered a Street, requiring curb, gutter and sidewalk, or a Road, which would not require curb, gutter or sidewalk. This distinction is generally along the 6400' elevation line, but there are some exceptions. I've attached the MTP for your reference. Thank you.</p>
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<p>As a suggestion: CDOT has put forward a checklist of strategies called TDM, which describes some of these public improvements – which these roadway cross sections might engage or adapt to. I wish to share three examples in Jefferson County that might illustrate some real question of how these translate (i.e. which template applies?): A heavily traveled 2-lane corridor with bus service (such as SH 75-Platte River Rd) Should there not be a sidewalk and auxiliary lane for a bus pull out and pedestrian landings? (noted: this road has multi-jurisdictions) • A heavily traveled 2 lane mountain corridor such as SH 74 through Evergreen. Should there be a sidewalk on both sides and maybe room for parallel parking? • The collector of Rainbow Hills Rd – currently under consideration to be relocated &amp; rebuilt located inside a split diamond interchange of I-70, would it be under the standard of the file called Temp 5, or Temp 11 or 12 noting the developer has a park-n-ride and tourist oriented development proposed – with a lot of pedestrians anticipated. If I was a property owner, I would like to know on either corridor example above which minor arterial or collector standard applies.</p>	<p>Thank you for your comments. The County's roadway templates are meant to be utilized in conjunction with the County's Major Thoroughfare Plan (MTP). The MTP identifies not only the functional classification of each County roadway, but also whether each is considered a Street, requiring curb, gutter and sidewalk, or a Road, which would not require curb, gutter or sidewalk. This distinction is generally along the 6400' elevation line, but there are some exceptions. I've attached the MTP for your reference. Thank you.</p>
<p>CDOT uses the most current M &amp; S Standards on roadway design. Please note they were recently updated/revised on Sep 6, 2022.</p>	<p>Acknowledged. Jefferson County also follows these standards.</p>

	<p>Lastly and very important, is that CDOT follows the Utility Accommodation Code and our rights-of way allow wet and dry utilities to share and cross our right of way under certain rules. Along interstates and expressways, we discourage any manholes in the roadway and push utilities as far to the outside of right of way as possible. Roadways with higher speeds generally greater than 40 mph, be very careful of allowing manholes in the roadway. Routine access into a manhole translates into lane closures and delays, which we try to avoid by better design. Relocating utilities is a very costly factor in roadway design and rebuild. It is recommended you add a general note about what rules should be followed to accommodate utilities in each roadway cross section. Indeed, it is complicated when storm pipes, traffic signals and traffic lights exist there too and it all has to fit.</p>	Acknowledged. To be incorporated into the overall ULUC discussion.
South Metro Fire Rescue	No comments.	Acknowledged.
Xcel Energy	No objection to these proposals.	Acknowledged.
Engineering Geologist	Clarify that pavement design should include private and non-County maintained roads.	To be updated accordingly.
Jeffco T&E	No comments.	Acknowledged.



November 23, 2022

Lindsey Wire, P.E.  
Jefferson County Planning and Zoning  
100 Jefferson County Parkway  
Golden, Colorado 80419

Re: Transportation Design and Construction Manual Regulation Amendment

Thank you for including the Adams County Community and Economic Development Department in the review for the Transportation Design and Construction Manual Regulation Amendment. Adams County has reviewed all the attached documents and while the County is in support of the subject request, we would like to provide the following comments:

1. For Property in the Jefferson County MS4 Stormwater Permit area, should you provide more requirements if one (1) acre or more is disturbed results? Applicant should be responsible for operation and maintenance report and a SWMP for installation and maintenance of Erosion and Sediment Control. A Builder/developer is more responsible for adhering to all the regulations regarding illicit discharge.
2. Would addition of infiltration testing are used within the Soil/Geologic Investigation Report Based on percolation rates and converting MPI (minutes per inch) to feet per second? Then, the available surface area of the filter media within say a Sand Filter Basin would be used to multiply the feet per second value to determine the cubic feet per second value. Could that be discussed in the regulation?
3. Removal of K Factor evaluation when determining what type of Land Disturbance Permit is required; this would help make it less confusing.

Please do not hesitate to reach out to Adams County with any questions or concerns.

Thanks,

**Steve Krawczyk P.E, CFM**  
Civil Engineer III, Community and Economic Development  
ADAMS COUNTY, COLORADO  
4430 S Adams County Pkwy, 1st Floor, Suite W2000B  
Brighton, CO 80601  
O: 720.523.6854



November 23, 2022

Lindsey Wire, P.E.  
Jefferson County Planning and Zoning  
100 Jefferson County Parkway  
Golden, Colorado 80419

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Civil Engineer III, Community and Economic Development  
ADAMS COUNTY, COLORADO  
4430 S Adams County Pkwy, 1st Floor, Suite W2000B  
Brighton, CO 80601  
O: 720.523.6854

## Lindsey Wire

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**From:** Terri Maulik <TMaulik@arapahoegov.com>  
**Sent:** Monday, November 7, 2022 12:59 PM  
**To:** Lindsey Wire; PZ-Regulation-Revisions  
**Cc:** Referrals  
**Subject:** --{EXTERNAL}-- AC Case No O22-369 re: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

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Lindsey,

Thank you for the opportunity to review and comment on this project. The Arapahoe County Planning Division has no comments; however, other departments and/or divisions may submit comments.



**TERRI MAULIK**

**Planning Technician** | Public Works and Development - Planning Division

6924 S Lima St., Centennial Co 80112

O: 720-874-6840 | M: 720-874-6650

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Many County services can be accessed online. You are encouraged to visit our website at <https://www.arapahoegov.com/519/Public-Works-and-Development> [\[arapahoegov.com\]](http://arapahoegov.com). Please consider emailing us at [planning@arapahoegov.com](mailto:planning@arapahoegov.com) as this email inbox is monitored by several staff members. You may also call (720) 874-6650 to leave a message.

---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Wednesday, November 2, 2022 2:44 PM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual

**CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#).

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Wednesday November 23, 2022.

Sincerely,

Planning and Zoning Staff

**Lindsey Wire, P.E.**

Planning & Zoning  
Engineering Supervisor  
303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



Planning and Zoning is open to the public and appointments are strongly encouraged. Virtual and in-person appointments are available Monday through Thursday. County offices are closed on Fridays. Please schedule [appointments](#) [[jeffco-planning-and-zoning-hqorx.appointlet.com](http://jeffco-planning-and-zoning-hqorx.appointlet.com)] and submit [applications](#) online. Go to [planning.jeffco.us](http://planning.jeffco.us) for more information.

**Traffic Review**

Jessica Upchurch  
jupchurch@broomfield.org  
303-438-6238

# Jefferson County Transportation Design & Construction Manual

JEFFERSON COUNTY, COLORADO PLANNING AND ZONING DIVISION

***Revision Dates***

*The Transportation Design & Construction Manual, formerly known as Roadway Design & Construction Manual, adopted by the Board of County Commissioners of Jefferson County, Colorado on March 21, 1995, has since been amended on the following dates:*

*December 5, 1995*

*May 12, 1998*

*March 23, 1999*

*October 1, 2002*

*July 1, 2003*

*November 25, 2003*

*December 5, 2006*

*May 20, 2008*

*October 13, 2009*

*November 24, 2015*

*July 17, 2018*

*December 17, 2019*

~~XX-XX-XX~~

Jefferson County Planning and Zoning Division

100 Jefferson County Parkway, Suite 3550, Golden, Colorado 80419

303-271-8700 • <http://planning.jeffco.us>

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**General Provisions**

**1.1. Short Title**

These regulations together with all future amendments shall be known as the “Jefferson County Transportation Design and Construction Manual” (hereafter called MANUAL) as referenced in the Jefferson County Land Development Regulation (hereafter called LDR) and the Jefferson County Zoning Resolution (hereafter called ZR).

**1.2. Jurisdiction**

The requirements of this MANUAL shall apply to all subdividers, developers or other landowners, their employees, agents or contractors designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations. The foregoing design and construction of transportation systems are subject to review and approval by the County pursuant to any County regulation or requirement.

**1.3. Purpose and Effect**

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads. All land development or any other proposed construction submitted for approval under the provisions of the LDR and/or ZR as applicable, shall include adequate transportation system analysis and appropriate transportation system design. Such analysis and design shall conform to the criteria set forth herein. Technical criteria not specifically addressed in this MANUAL shall follow the provisions of the American Association of State Highway and Transportation Officials (AASHTO) “A Policy of Geometric Design of Highways and Streets”, as amended; the Colorado Department of Transportation (CDOT) Design Standards, as amended; and the Manual on Uniform Traffic Control Devices (MUTCD), as amended.

**1.4. Enactment Authority**

The LDR has been adopted pursuant to the authority conferred within: Article 28 of Title 30 (County Planning); Article 2 of Title 43 (State, County, and City Highway Systems); Article 20 of Title 29 (Land Use Control and Conservation); and other applicable sections of the Colorado Revised Statutes, as amended.

This MANUAL is adopted by resolution of the Board of County Commissioners, as the authority provided by which the County promulgates the LDR.

**1.5. Amendment and Revisions**

These criteria may be amended as new technology is developed and/or if experience gained in the use of this MANUAL indicates a need for revision. Amendments and revisions will be made by resolution of the Board of County Commissioners.

## **1.6. Enforcement Responsibility**

It shall be the obligation of the Board of County Commissioners acting through the Department of Development and Transportation to enforce the provisions of this MANUAL.

## **1.7. Review and Approval**

The County will review all submittals for compliance with this MANUAL. An approval by the County does not relieve the owner, engineer, or designer from responsibility of ensuring that the calculations, plans, specifications and construction are in compliance with the MANUAL and accepted engineering practices.

## **1.8. Interpretation**

In interpretation and application of the provisions of the MANUAL, the following shall govern:

1.8.1. The provisions shall be regarded as the minimum requirements for the protection of public health, safety, comfort, convenience, prosperity, and welfare of the residents of the County.

1.8.2. Whenever a provision of this MANUAL and any other provision of the LDR or any provision in any law, ordinance, resolution, rule, or regulation of any kind, contains any restriction covering any of the same subject matter, whichever restrictions are more restrictive or impose higher standards of requirements shall govern.

1.8.3. This Jefferson County Transportation Design and Construction Manual was adopted by the Board of County Commissioners on March 21, 1995. Any amendments to this MANUAL shall be immediately effective upon its adoption by the Board of County Commissioners. All applications shall be subject to the provisions of this MANUAL that are in effect at the time of the formal application submittal, unless otherwise specified by the Board of County Commissioners resolution.

## **1.9. Relationship to Other Standards**

If the State or Federal Government imposes stricter criteria, standards, or requirements, these shall be incorporated into the County's requirement after due process and public hearings needed to modify the County's regulations and standards.

### *Chapter 2*

## **Construction Drawing Requirements**

### **2.1. General Requirements**

Construction drawings must be submitted in Portable Document Format (PDF) unless otherwise approved for hard copy submittal, to scale, shall be a complete package, which includes all details and documentation necessary for the construction of the proposed improvements. The plans shall be prepared by, or under the direction of a professional engineer, registered in the State of Colorado, and qualified in the field of civil engineering.

The final set of plans (hard copy) for each drawing shall be 24" x 36", unless otherwise approved by the County, and shall contain a title block, sheet number, scale, north arrow, and date.

The developer's engineer shall comply with Colorado Revised Statute 9-1.5-101 through 9-1.5-108 "Excavation Requirements" when the nature of work proposed (1) will involve a contract with Jefferson County (this shall include, but not be limited to binding agreements such as permits and Subdivision Improvement Agreements); (2) will involve primarily Horizontal Construction and not the construction of buildings; (3) will involve excavation that exceeds two (2) feet in depth and that is a contiguous 1,000 square feet, or involve Utility Boring; and (4) requires the design services of a licensed professional engineer. Existing and Proposed Subsurface Utilities shall be identified on the design plans in accordance with ASCE 38 Standards. For more information please reference the Colorado Revised Statutes and Federal Highway Administration websites.

## 2.2. Cover Sheet

A cover sheet should be provided with each submittal which contains the following:

1. A vicinity map at a minimum scale of 1" - 2000' which shows the location and name of all arterial streets/roads within one mile of the proposed development and all streets/roads within the proposed development.
2. A legend, scale, and north arrow.
3. General notes.
4. Index of sheets.
5. Seal, signature, and date of the professional engineer responsible for plan preparation.
6. A permanent benchmark description and location based on USGS datum. At least one permanent benchmark must be established within each subdivision or filing thereof, located on public property.

If a cover sheet is not provided, the above information shall be included on the first sheet of the submittal.

## 2.3. Plan

The plan view shall include but not be limited to, the following:

1. The scale shall be a minimum of one (1) inch to fifty (50) feet and shown on the plan.
2. Locations and dimensions of existing and proposed improvements, property lines, easements, and Right-of-Way. Plan view limits shall extend 100 linear feet before the Point of Beginning, and 100 linear feet after the Construction End. Each Point of Beginning and Construction End shall be clearly labeled and identified with stationing.
3. Names of streets/roads.
4. Survey line ties to section or quarter corners.
5. Survey lines and centerline stationing. Stationing shall be equated to flowline stationing at horizontal radius curves, cul-de-sacs, and other departures from normal roadway cross sections.
6. Centerline stations for all intersecting roadways and commercial driveways.
7. Existing and proposed street/road improvements (sidewalk, curb, gutter, pavement limits, bridges, culverts, inlets, manholes, asphalt core sample locations, guardrails, curb ramps, etc.). Existing improvements shall be clearly depicted by a dashed line; proposed improvements shall be depicted by a solid line and or greyscale or hatching. Plans shall include existing and proposed limits for asphalt pavement, including areas of milling and overlaying, as well as new asphalt placement. All items shall have a corresponding legend.
8. Curve layout including radius, degree of curve, deflection angle, length of curve, point of curvature, and point of tangency.
9. Elevations and station shall be noted for all curb returns, points of curvature, points of tangency, and high or low points of all vertical curves. The existing and proposed percent cross slope shall be repeated on the plan sheets at select points. Include elevations and cross slopes, existing and proposed, for all lanes of intersection improvements, regardless if construction is planned for opposing streets.
10. Rate of super elevation.
11. Typical template(s) for streets/roads.
12. Match lines and consecutive sheet numbers.
13. Key map.
14. A minimum of one (1) permanent bench mark, based on United States Geological Survey's datum, fully described, within each subdivision or filing thereof.

15. Existing and proposed utilities and structures, including but not limited to: water, fire hydrants, sanitary sewer, storm sewer, telephone, gas, electric, cable television, fiber optic. Existing utility pothole information shall be organized on a separate plan sheet to identify location, depth, utility type, pipe size and material, conflicts with proposed improvements, and other information obtained during subsurface investigation. Subsurface investigation shall include new laterals or service connections to existing main lines and be clearly shown on separate plan sheets. \*

16. Stations and critical elevations of all utility and drainage appurtenances. \*

17. Construction phasing. \*

18. Major Collector and/or Arterial intersection design at a scale of one (1) inch to twenty (20) feet. \*

19. Traffic signal design at a scale of one (1) inch to twenty (20) feet. \*

20. Signing and Striping Plan.

20. Noise attenuation measures/details. \*

21. Trails. \*

22. Sediment and erosion control measures/details. \*

23. Landscaping. \*

\*May be included on separate plan sheets.

## 2.4. Profile

The profile shall include, but not be limited to the following:

1. The scale shall be a minimum of one (1) inch to five (5) feet for street profiles and a minimum of one (1) inch to ten (10) feet for road profiles, and be shown on the plan.
2. Existing (dashed line) and proposed (solid line) grades.
3. Continuous centerline stationing for the entire portion of the existing and proposed roadway shown in the plan. Clearly label centerline stationing for all intersecting roadways and commercial driveways.
4. All design elevations shall be centerline, flowline, back of curb, or lip of gutter.
5. Vertical curve data including length of curve, P.V.C., P.V.T., P.V.I., beginning and end grades. All vertical curves shall be symmetrical.
6. Curb return profiles at a horizontal scale of 1" = 10' and vertical scale of 1" = 1'.
7. All existing curbs, gutters, sidewalks, culverts or storm sewers, ditches and irrigation structures and asphalt adjacent to the proposed design, as well as the same such features that are 100 linear feet before the Point of Beginning and continue for 100 linear feet beyond the Construction End. Basis for existing grades shall be as-built elevations at intervals not to exceed fifty (50) feet. All existing grades, locations and alignments shall be field surveyed by a licensed Professional Land Surveyor for design of the proposed improvements. Previously approved designs are not an acceptable means of establishing existing grades.
8. Separate flowline or top of curb profiles shall be provided for all proposed curb and gutter, including for design of cul-de-sacs and any other departure from a 2% street/road cross slope. In addition, cross-sections at intervals not to exceed 50 feet are required if a departure from a normal cross-slope is proposed.
9. Existing and proposed utilities. \*

\*May be included on separate plan sheets.

## 2.5. Cross Sections

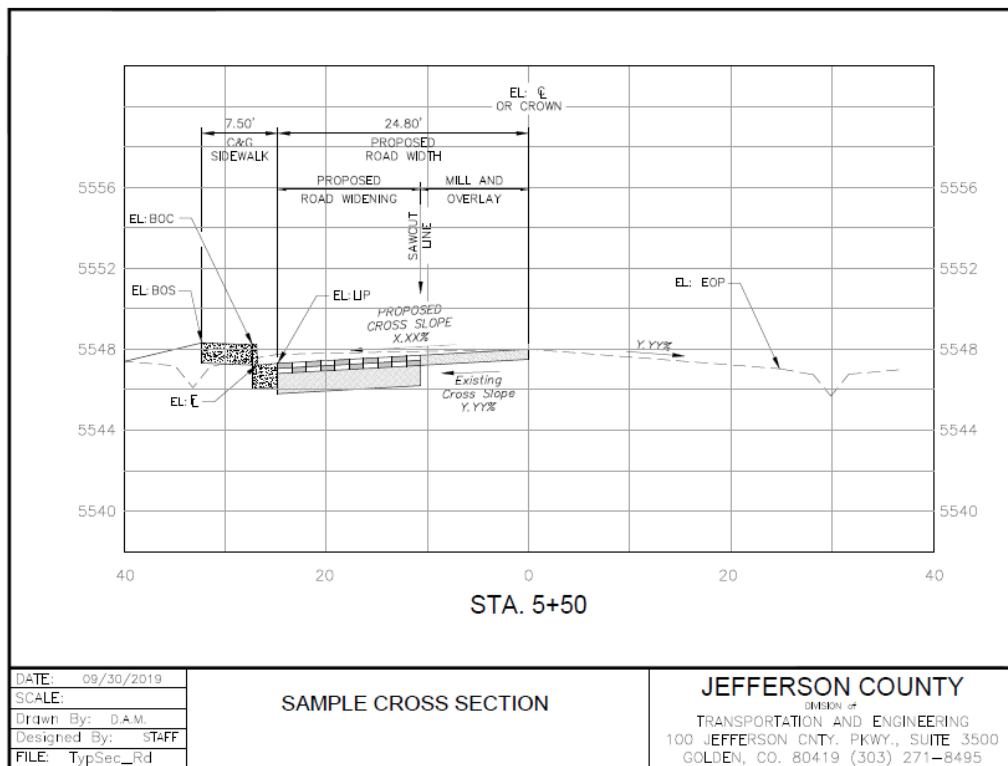
1. On widening or matching projects, or as required by the Jefferson County Planning & Zoning, cross sections of the proposed new construction and existing improvements within the Right-of-Way shall be provided at survey stationing at a maximum of fifty foot Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

intervals and at locations of cross culverts. The scale shall correspond to that used on the plan and profile.

2. Cross sections shall identify both the existing or matching percent cross slope of the roadway, as well as percent proposed cross slope.
3. Cross sections shall identify the elevation at the point of match for widening projects for each station interval.
4. Cross sections shall identify the proposed new road segment in gray scale or other hatching.
5. Cross sections shall identify the proposed pavement treatment or alterations, such as mill and overlay of the match point; as well as the proposed new pavement section and respective lifts asphalt.
6. Core samples shall be collected from the existing roadway prior to construction to determine the existing asphalt depth and condition. Such cores shall not exceed 4-inches in diameter and shall be collected at the centerline of the existing road, as well as edge of existing asphalt. The existing depth of asphalt shall be represented on the cross sections.
7. Proposed widening shall avoid cross sections with gross inverts or peaks at the match point. Normal roadway cross sections shall follow AASHTO design criteria that limit the minimum cross slope to 1.5% and maximum cross slope to 3.0%. Cross slope grade change shall not exceed +/- 0.5% as measured every 50 linear feet along the station intervals. There shall be no change in existing cross slope greater than +/- 1.0% from the match point to the proposed edge of asphalt, or the flow line or the lip of the gutter pan.

Refer to Figure 2-1 "Sample Cross Section" below:

Figure 2-1 - Sample Cross Section



## 2.6. Details

Jefferson County or CDOT standard details may be referenced as applicable. Where these standards cannot be used, a separate detail sheet shall be provided with an explanation detailing why these standard details are not being used.

## 2.7. Standard Notes

The following general notes shall appear on the cover sheet or the first sheet of the plans for all street/road construction plan packages.

1. A Construction Permit from Transportation and Engineering is required prior to commencing work within County Right-of-Way.
2. Any work within State Right-of-Way will require a State Construction Permit.
3. The contractor shall notify Transportation and Engineering at least 24 hours prior to starting construction within the Right-of-Way.
4. The contractor shall provide all signs, barricades, flagmen, lights, or other devices necessary for safe construction traffic control in accordance with the current edition of the MUTCD and as modified by the Colorado Supplement to the MUTCD. A construction traffic control plan shall be submitted to and approved by Transportation and Engineering prior to the issuance of any construction permit for work within County Right-of-Way.
5. The contractor shall contact the Utility Notification Center of Colorado at least 48 hours prior to construction.
6. Construction specification: Current edition of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, special provisions and revisions thereto, and as amended by Chapter 5 of this MANUAL.
7. The subgrade material shall be scarified or removed to a depth required by Jefferson County per information obtained from laboratory tests and/or as required in the Pavement Design Report. Additives or approved material may be required if the native material is unsatisfactory. The subgrade shall be compacted to a minimum density and moisture content range of 2 percent below optimum to 2 percent above as determined in accordance with AASHTO designation T180 or T99 and in accordance with the Standard Specifications Section 203.07.
8. Class 6 aggregate base course for shoulders shall be placed and compacted 95 percent modified Proctor Test (AASHTO T180) after placement of asphalt.
9. Existing asphalt pavement shall be straight sawcut or blade-cut when adjoining with new asphalt pavement. SS-1 tack coat shall be applied to all surfaces.
10. Structural section, including subbase and asphalt, shall be constructed according to the Final Pavement design that has been prepared by the developer's engineer, and approved by Transportation and Engineering according to Chapter 4 of this MANUAL. Existing structural section at the match point shall comply with the minimum Full Depth Asphalt thickness identified in Table 4.3 "Minimum Pavement Sections" of this MANUAL for the respective road classification, regardless of the original thickness of asphalt and / or sub-base.

The following notes shall appear in addition to the above for all street construction, as applicable:

1. Concrete may be placed by machine methods if all finish lines are within 1/8" + tolerance of the lines shown on the plans. The flowline must be free draining and comply with this MANUAL.
2. One half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.
3. The contractor is advised to first obtain inspection of forms by Transportation and Engineering before placing concrete curb, gutter, sidewalk, inlets, and/or other concrete drainage structures.

### *Chapter 3*

## **Design and Technical Criteria**

### **3.1. General**

This section sets forth the minimum design and technical criteria to be used in the preparation of all street/road construction plans. All street/road design shall be in accordance with the current edition of AASHTO Geometric Design of Highways and Streets, unless modified herein.

For this regulation, streets shall be used in the Plains and roads shall be used in the Mountains, except as indicated below:

3.1.1 Roads may be allowed in the Plains in locations with slopes greater than 15%, subject to approval by Planning and Zoning.

3.1.2 Streets may be required in the following Mountains locations as directed by Planning and Zoning: 1) Areas where urban development is projected based on Community Plans designations, 2) Areas where curb and gutter would be needed to mitigate drainage impacts.

### **3.2. Street/Road Types**

3.2.1 Public Streets/Roads: Streets or roads that are owned and maintained by the City, County or State for public use.

3.2.2 Private Streets/Roads: Streets or roads that are owned, maintained, or restricted for the use by a person, group of people, or non-governmental entity.

3.2.3 Non-Maintained Streets/Roads in County ROW: Streets or roads that are owned by the County for public use, but are not constructed to a County public standard and are not County maintained.

### **3.3. Functional Classification**

Jefferson County has adopted a Major Thoroughfare Plan based on traffic volumes, existing and/or zoned land use, and anticipated growth. The Major Thoroughfare Plan designates streets/roads as freeway, parkway, principal arterial, minor arterial, major collector, or collector.

3.3.1. Freeway: A freeway serves major regional traffic movements and carries the highest traffic volume of all classifications. A freeway is planned to have four to six through lanes and may have frontage roads. The movement of traffic takes precedence over access. Access is fully controlled and is allowed only to other freeways or to arterials by grade separated interchanges. Opposing movements on a freeway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes. A freeway may be developed as a parkway with at-grade intersections as a first phase. Freeways are typically in State jurisdiction.

Design Speed: Special Design Required

3.3.2. Parkway: A parkway serves major regional traffic movements and carries high traffic volumes. A parkway is planned to have four to six through lanes. The movement of traffic takes precedence over access. Access is fully controlled and allowed only to major collector classifications or higher. Grade separation at major intersections is preferred over traffic signals. Opposing movements on a parkway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 40 - 50 MPH

3.3.3. Arterial.

3.3.3.1. Principal Arterial: A principal arterial serves major regional traffic movements and carries high traffic volumes. A principal

Transportation Design and Construction Manual – Amended ~~12-17-19~~~~XX-XX-XX~~

arterial is planned to have four to six through lanes in the Plains and four through lanes in the Mountains. The movement of traffic takes precedence over access. Access is controlled and allowed to collectors and higher class facilities is preferred, but some restricted access to major developments may be allowed. Opposing movements are usually separated by a raised, depressed, or painted median. Pedestrians and bicycle traffic may be carried on detached walks and trails unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 35 - 45 MPH

3.3.3.2. Minor Arterial: A minor arterial serves intracommunity traffic and carries moderate traffic volumes. Minor arterials are planned to have four lanes in the Plains. In the Mountains, minor arterials are planned to have two lanes, plus turn lanes and passing or climbing lanes where warranted. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally separated by a median/turn lane. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Is this true? Indian just south of HWY 128 is posted 50mph but your GIS shows it as a Minor Arterial.

Design Speed: 30 - 40 MPH

3.3.4. Major Collector: A major collector serves intracommunity traffic and carries moderate traffic volumes. Major collectors are planned to have two lanes, plus turn lanes where warranted, in the Plains and the Mountains. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally separated by a median/turn lane. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40MPH

3.3.5. Collector: A collector serves neighborhood traffic movements over short distances, generally accessing arterials and major collectors. A collector has two lanes, plus turn lanes where warranted, in the Plains and two lanes in the Mountains. Access takes precedence over the movement of traffic. Reasonable access is allowed except for private residential driveways. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 25 - 30 MPH

3.3.5. Local: A local street or road serves neighborhood traffic over very short distances to higher class roadways. A local street or road has two travel lanes. It is always paved in the Plains and usually paved in the Mountains. Access to adjacent land is its primary purpose. All types of access are allowed. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 15 - 25 MPH

3.4. Standard Templates

The following templates reflect the minimum section for each street/road classification and for cul-de-sacs. Any additional requirements including, but not limited to, acceleration/deceleration lanes and left turn lanes are not shown.

Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
1	Principal Arterial Street	Greater than 25,000	109-127'
2	Minor Arterial Street	15,000 to 25,000	87-101'



3	Major Collector Street	8,000 to 15,000	<del>78'-77'-91'</del>
4	Collector Street (36' FL to FL) with Attached Sidewalks	1,000 to 8,000	<del>60'-46'-54'</del>
5	Collector Street (36' FL to FL) with Detached Sidewalks	1,000 to 8,000	<del>37'-32'-40'</del> + 20' easement for sidewalks, maintenance and traffic signs
6	Local Street (34' FL to FL) with Attached Sidewalks	Less than 1,000	50'
7	Local Street (34' FL to FL) with Detached Sidewalks	Less than 1,000	35' + 20' easement for sidewalks, maintenance and traffic signs
8	Local Street (28' FL to FL) with Attached Sidewalks	Less than 350	45'
9	Local Street (28' FL to FL) with Detached Sidewalks	Less than 350	30' + 18' easement for sidewalks, maintenance and traffic signs
Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
10	Minor Arterial Road	Greater than 8,000	70'
11	Major Collector Road	2,000 to 8,000	50', 60' for turn lanes
12	Collector Road	1,000 to 2,000	50'
13	Local Road	Less than 1,000	50'
14	Street Cul-de-sac – Option 1 Street Cul-de-sac – Option 2 Street Cul-de-sac – Option 3	See LDR, Section 15	90' 100' 112'
15	Partial Cul-de-sac for Local Streets	See LDR, Section 15	45'R
16	Offset Cul-de-sac for Local Streets	See LDR, Section 15	90'
17	Cul-de-sac for Local Roads	See LDR, Section 15	90'
Private street/road templates and Non-maintained streets/roads in County ROW templates *			
<del>18</del>	<del>Driveway/Private Street/Road &amp; Non-maintained Street/Road in County ROW (No Parking)</del>	See LDR, Section 15	20' minimum
19	Pull Out for Private Road	N/A	n/a
20	Hammerhead Turnaround for Driveway/Private Road	See LDR, Section 15	varies
21	Hammerhead Turnaround for Private Street	See LDR, Section 15	varies

\* The "non-maintained streets/roads in County ROW" templates can only be used if the following provisions apply:

1. The County is not holding a guarantee a previous development process that would require the construction of a County public standard street/road in the ROW.
2. The County does not wish to have the street/road constructed to a County public standard.
3. The street/road is not identified on the Jefferson County Major Thoroughfare Plan.

**Commented [LW1]:** To split out and create separate templates for driveway, private street, and private road

3.5. Horizontal Alignment

3.5.1. Horizontal Curves: Minimum curve radii for a normal crown section based on design speed are summarized in the table below.

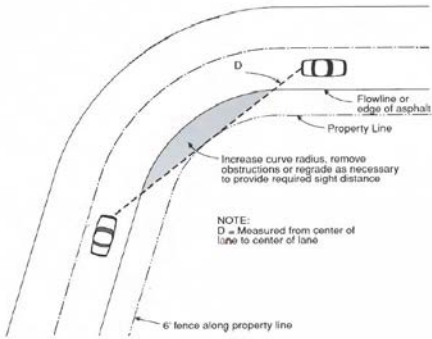
Design Speed (mph)	Minimum Curve Radius (feet)
15	50
20	107
25	198
30	333
35	510
40	762
45	1039
50	Special Design

3.5.1.1. For collector roads, the centerline line radius may be reduced to a minimum of one hundred (100) feet, provided, however, that on a curve with a centerline radius less than four hundred (400) feet, the maximum grade shall be reduced by one (1) percent for each one hundred (100) feet or fraction thereof the radius is reduced.

3.5.2. Super Elevation: Super elevation is required for curves on all principal and minor arterial streets/roads and selected collector streets/roads. Minimum horizontal curve radius, rate of super elevation, and lengths of tangent runout and super elevation runoff shall be in accordance with the recommendations of the current edition of AASHTO Geometric Design of Highways and Streets.

Super elevation shall not be used on local streets, but may be used on local roads.

3.5.3. Sight Distance: Horizontal alignment must provide at least the minimum stopping sight distance for the design speed at all points. This includes visibility at intersections, as well as around curves and roadside encroachments. Where an object off the traveled surface restricts sight distance, the minimum radius of curvature is determined by the stopping sight distance. A likely obstruction may be a bridge abutment, retaining wall, cut slope, landscaping, or side or corner of a building. In considering sight distance, it shall be assumed a 6'-0" fence (as measured from finished grade) exists along all property lines except in the sight distance triangles required at all intersections. Minimum stopping sight distance (measured from the centerline of the inside lane) shall be as follows for centerline grades equal or less than 3%:



Design Speed (mph)	Stopping Sight Distance (d) (feet)
15	80
20	115
25	150
30	200
35	250
40	325
45	400
50	475

For grades greater than 3%, stopping distance shall be in accordance with the recommendations of the current edition of AASHTO Geometric Design of Highways and Streets.

### 3.6. Vertical Alignment

3.6.1. Grades: The minimum grade for all new streets and roads is 2%, except within a sag. A minimum flowline grade of 1.5% shall be maintained around all full and partial cul-de-sac bulbs, except within a sag. Planning and Zoning may approve grades as low as 1% if existing conditions make it infeasible to construct a minimum of 1.5%. The maximum grade for all public streets is 6.0% and for public roads is 8.0%. The maximum grade for public roads may be increased to 10% where the dip of the natural terrain bears between South 60° East and South 45° West.

3.6.2. Intersection Grades: The maximum grade at intersections shall be in accordance with the following figure and table. Grades and lengths apply to the street/road controlled by a stop sign. At signalized and uncontrolled intersections, grades and lengths apply to all legs of the intersection.

	Through Street / Road		
Intersection Street/Road	Local	Collector	Major Collector/Arterial
Local	50' @ 4%	100' @ 4%	100' @ 4%
Collector	-	100' @ 3%	200' @ 2%
Major Collector/Arterial	-	-	200' @ 2%

3.6.3. Changing Grades. Continuous grade changes shall not be permitted. The use of grade breaks in lieu of vertical curves is discouraged; however, if a grade break is necessary and the algebraic difference in grade (A) does not exceed four-tenths (0.40) of a percent along the street/road, the grade break will be permitted.

The maximum grade break allowed at the point of tangency at a curb return for local and collector streets shall be two (2) percent and a maximum of one (1) percent for arterial streets.

3.6.4. Vertical Curves. All vertical curves shall be symmetrical. A vertical curve shall be used when the algebraic difference in grade (A)

Where did these come from? They don't seem to match Green Book

Table 3-35. Design Controls for Crest Vertical Curves

Design Speed (mph)	Stopping Sight Distance (ft)	U.S. Customary	
		Rate of Vertical Curvature, $K_a$	Design
15	80	3.0	3
20	115	6.1	7
25	155	11.1	12
30	200	18.5	19
35	250	29.0	29
40	305	43.1	44
45	360	60.1	61
50	425	83.7	84
55	495	113.5	114
60	570	150.6	151
65	645	192.8	193
70	730	246.9	247
75	820	311.6	312
80	910	383.7	384

Table 3-37. Design Controls for Sag Vertical Curves

Design Speed (mph)	Stopping Sight Distance (ft)	U.S. Customary	
		Rate of Vertical Curvature, $K_s$	Design
15	80	9.4	10
20	115	16.5	17
25	155	25.5	26
30	200	36.4	37
35	250	49.0	49
40	305	63.4	64
45	360	78.1	79
50	425	95.7	96
55	495	114.9	115
60	570	135.7	136
65	645	156.5	157
70	730	180.3	181
75	820	205.6	206
80	910	231.0	231

equals or is greater than four-tenths (0.40) of a percent. The minimum grade within a vertical curve shall be no less than 0.25 percent. All vertical curves shall be labeled, in the profile with curve length (L) and K value. Crest and sag vertical curves shall be in accordance with the following table:

Design Speed (mph)	Minimum K Value	
	Crest	Sag
30	30	40
35	50	50
40	80	70
45	120	90
50	160	110

### 3.6.5. Connection with Existing Streets/Roads

3.6.5.1. Connection with existing roadways shall be smooth transitions conforming to minimum standards (see Table 3-35 and Table 3-37) if the algebraic difference in grade (A) between the existing and proposed grades is 0.40 percent or greater. When a vertical curve is used to make this transition, it shall be fully accomplished within the existing roadway, and comply with the grade requirements at intersection approaches.

3.6.5.2. Existing grade shall be shown for at least three hundred (300) feet with field verified as-builts showing stations and elevations at twenty-five (25) foot intervals. In the case of connection with an existing intersection, these as-builts are to be shown within a three hundred (300) foot radius of the intersection. This information will be included in the plan and profile that show the proposed roadway.

3.6.5.3. Previously approved designs for the existing improvement are not an acceptable means of establishing existing grades; however, they are to be referenced on the construction plan where they occur.

3.6.5.4. The basis of the as-built elevations shall be the same as the design elevations (both flowline or top of curb, etc.) unless otherwise approved by Planning and Zoning.

## 3.7. Intersection Spacing, Vision Clearance Triangle, and Sight Distance, Driveways and Private Streets/Roads

3.7.1. Intersection Spacing: Spacing of intersections (measured centerline to centerline) shall be in accordance with the following table:

Proposed Street/Road: Existing Street/Road	Minimum Separation (feet)
Local: Local or Collector	175
Local: Arterial or Major Collector	500
Collector: Collector	230
Collector: Major Collector or higher	1000
Major Collector: Major Collector	660
Major Collector: Arterial or higher	1320
Arterial: Arterial or higher	5,280'

3.7.2. Vision Clearance Triangle: The table below shows where a vision clearance triangle must be provided.

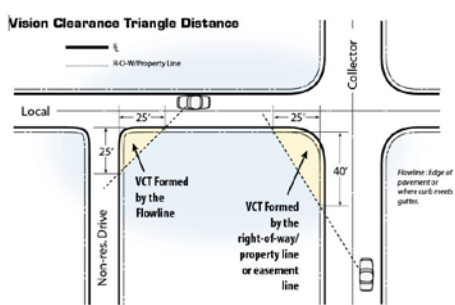
Required	Not Required
Street/Road Intersections	Intersection of internal drive isles in non-residential*
Intersections of non-residential driveways with streets/roads	Multi-family and townhome developments*
Intersections of multifamily and/or townhome residential drive isles with streets/roads	
Intersections of street/roads and railroad Right-of-Way	

\* Layout of these types of developments should not impede a driver's ability to see on-coming vehicles and pedestrians at intersections

As illustrated below, the vision clearance triangle must provide an unobstructed view across the triangle formed by the Right-of-Way/property line or easement line adjacent to a street or road as illustrated. The vision clearance triangle may also be formed by the flowline adjacent to a street or road as illustrated below subject to approval by Planning and Zoning. The approval of the vision clearance triangle formed by a flowline is predicated on a fully built-out street or road and existing Right-of-Way that exceeds the Right-of-Way requirements in the Land Development Regulation. Within the area of the triangle, there shall be no fence, wall, landscaping, structure or other obstruction to view more than ~~forty-two~~thirty-six (4236) inches in height, ~~or trees with foliage or signs lower than eight (8) feet in height~~ (measured from the flowline or edge of pavement on the street/road surface). The allowable height of ~~forty-two~~thirty-six (4236) inches is determined by measuring from the flowline or edge of pavement, as applicable. For example, the grade on a lot within the triangle is 12" higher than the flow line of a gutter, the allowable height of landscaping would be 30" on the property.

Note that if there is any conflict between this provision (3.7.2) and the Sight Distance provision (3.7.2.1) of this MANUAL, the Sight Distance provision shall take precedence. Note that if a physical median exists or is proposed at an access point restricting or eliminating a conflict point, the Vision Clearance Triangle requirements will not apply where no conflict points exist.

Why are you removing this? We have this in our specs and I am interested in reason for change to know if we should include this in our next update.



Street/Road Classification	Required Distance from Intersection
Non-residential drive	25'
Local	25'
Collector	40'
Major Collector/Arterial/Parkway	55'
Railroad Right-of-Way	55'

3.7.2.1. Sight Distance: At any street/road intersections or multifamily residential, commercial and industrial site driveways, an unobstructed view as defined above must be provided across the area formed by the flowline or edge of pavement on one street/road and the flowline or edge of pavement of the intersecting street/road (or edge of driveway) and lines (labeled d1 or d2 on the Sight Distance figure) connecting them at ten (10) feet from their point of intersection. This area will be used to ensure that drivers of vehicles exiting from the stopped approach have the minimum required sight distance available. The minimum required sight distance shall be in accordance with the Minimum Sight Distance Requirements table for two lane streets/roads.

How did you get these numbers? They don't match Green Book or CDOT?

#### Minimum Sight Distance Requirements

(in feet) for vehicles entering onto two-lane streets/roads:

Operating Speed (mph)	Left Sight Distance d1 *	Right Sight Distance d2 **
20	220	130
25	260	170
30	350	260
35	430	350
40	530	440
45	610	570
50	740	700

\* Measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the outside lane.

\*\* Measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the median lane.

Table 9-7. Design Intersection Sight Distance—Case B1, Left Turn

Design Speed (mph)	Stopping Sight Distance (ft)	Intersection Sight Distance for Passenger Cars		Design Speed (km/h)	Stopping Sight Distance (m)
		Calculated (ft)	Design (ft)		
15	80	165.4	170	20	20
20	115	220.5	225	30	35
25	155	275.6	280	40	50
30	200	330.8	335	50	65
35	250	385.9	390	60	85
40	305	441.0	445	70	105
45	360	496.1	500	80	130
50	425	551.3	555	90	160
55	495	606.4	610	100	185
60	570	661.5	665	110	220
65	645	716.6	720	120	250
70	730	771.8	775	130	285
75	820	826.9	830		
80	910	882.0	885		

Table 9-9. Design Intersection Sight Distance—Case B2, Right Turn

Design Speed (mph)	Stopping Sight Distance (ft)	Intersection Sight Distance for Passenger Cars		Design Speed (km/h)	Stopping Sight Distance (m)
		Calculated (ft)	Design (ft)		
15	80	143.3	145	20	20
20	115	191.1	195	30	35
25	155	238.9	240	40	50
30	200	286.7	290	50	65
35	250	334.4	335	60	85
40	305	382.2	385	70	105
45	360	430.0	430	80	130
50	425	477.8	480	90	160
55	495	525.5	530	100	185
60	570	573.3	575	110	220
65	645	621.1	625	120	250
70	730	668.9	670	130	285
75	820	716.6	720		
80	910	764.4	765		

Note: Intersection sight distance shown is for a stopped passenger car to turn right onto a two-lane roadway with no median and with grades of 3 percent or less.

et/road or driveway.

5-foot height of the approaching vehicle.

3. The operating speed of the approaching vehicle is assumed to be the posted speed limit.

4. Sight distance requirements as shown in the Minimum Sight Distance Requirements table are designed to enable vehicles entering the street/road to accelerate to the operating speed of approaching vehicles without causing the approaching vehicles to reduce speed by more than 10 mph.

5. Truck traffic (WB30 or larger) entering onto streets/roads requires longer sight distances than shown in Table. Any proposed public or private street/road or driveway regularly used by truck traffic may require an individual analysis.

6. When the criteria for sight distances cannot be met, the County may deny the access, prohibit left turns by vehicles entering the street/road or require speed change lanes.

#### 3.7.3. Right Turn Lanes

3.7.3.1. Right Turn Acceleration Lanes: Right turn acceleration lanes may be required based on an approved transportation study. Right turn acceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, Transportation Design and Construction Manual – Amended 12-17-19XX-XX-XX

What is your Warrants for needing turn lanes? CDOT? Harmelink?

as determined by Planning and Zoning.

3.7.3.2. Right Turn Deceleration Lanes: Right turn deceleration lanes are required at arterial ations and at driveways on arterial streets/ roads as needed based on required transportation study/analysis. Transportation study/analysis shall address storage, as applicable. Right turn deceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning.

3.7.3.3. If the proposed street/road intersection or driveway is within two different speed zones, the criteria for the higher speed zone apply.

3.7.3.4. Where there are three or more through lanes in the direction of travel, right turn acceleration and deceleration lanes will be required only when determined necessary by Planning and Zoning due to high traffic volume or other site specific safety considerations.

3.7.3.5. Taper and lane lengths shall be in accordance with the following criteria.

Deceleration Right Turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length* (Taper Length + Lane Length)
25	80'	120'	200'
30	100'	150'	250'
35	120'	190'	310'
40	140'	230'	370'
45	160'	280'	440'
50	180'	320'	500'

*\*At signalized intersections, where storage is needed for right-turning vehicles, additional length shall be provided to accommodate the average number of vehicles anticipated.*

Acceleration Right turn Lanes

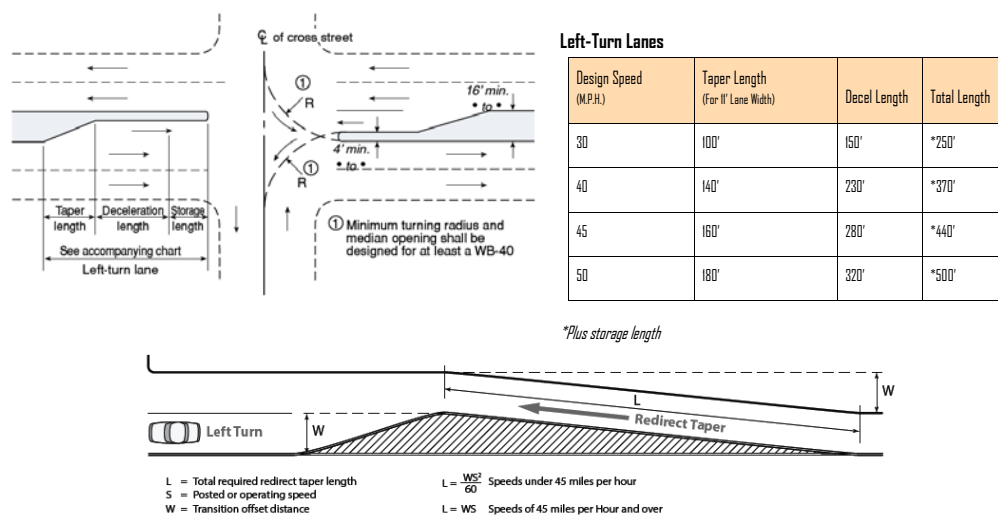
Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length (Taper Length + Lane Length)
30	120'	190'	310'
35	120'	270'	390'
40	180'	380'	560'
45	180'	550'	730'
50	240'	760'	1000'

3.7.3.6. A continuous accel/decel lane may be required if the acceleration lane for one access and the deceleration lane for another access overlap or are in close proximity to each other.

3.7.3.7. The minimum pavement width for acceleration and deceleration lanes shall be eleven (11) feet, excluding gutter pan or shoulder.

3.7.3.8. Grade correction factors are required where street/road grades are steeper than three (3) percent.

3.7.4. Left-Turn Lanes: Left-turn lanes are required at all arterial and major collector street/road intersections and at driveways on major collector/arterial streets/roads. Design of left-turn lanes shall be in accordance with the following criteria.



3.7.4.1. Storage Lengths: Storage lengths for signalized and unsignalized intersections shall be determined by an approved transportation analysis or transportation study, as applicable.

3.7.4.2. Median Design: Other left-turn median designs such as reverse curve taper, offset approach nose and double left-turn lanes must be approved by Planning and Zoning and shall conform to AASHTO standards.

3.7.5. Curb Returns

3.7.5.1. The table below provides the minimum street/road intersection radii measured to flowline or edge of pavement where no curb and gutter is required.

Intersecting Street	Principal Arterial	Minor Arterial	Major Collector	Collector	Local
Principal Arterial	Special Design*	Special Design*	40'	40'	30'
Minor Arterial	Special Design*	Special Design*	30'	30'	25'
Major Collector	40'	30'	30'	30'	25'
Collector	40'	30'	30'	25'	20'
Local	30'	25'	25'	20'	20' /15'

\*Special Design should provide consideration for right turn channelization.

3.7.5.1.1. At driveway locations where curb returns are used, the minimum radii allowed on arterials and major collectors shall be twenty-five (25) feet.



3.7.5.1.2. At driveway or private access locations where there is no curb and gutter, the minimum radii (measured to edge of pavement) allowed on arterials and major collectors shall be twenty-five (25).

3.7.5.2. The minimum elevation difference (fall) around curb returns (PCR to PCR) for flow along the curb line shall be as follows:

Radius	Minimum Fall
15'	0.3'
20'	0.4'
25'	0.5'
All Others	1.27% of length from PCR to PCR

3.7.5.3. The maximum fall around curb returns shall be equal to the steepest grade coming into or out of the return multiplied by the return length, + 0.2 feet.

3.7.5.4. Curb Return Profiles: Curb return profiles are required for radii equal to or greater than thirty (30) feet within the public Right-of-Way. A midpoint elevation along the arc length of the curb return shall be shown in plan view for radii equal to or greater than twenty-five (25) feet. Curb return design shall be set in accordance with the following design procedure. General standards for flowline control and profiles within the curb returns shall be as follows:

3.7.5.4.1. The point of tangency at each curb return shall be determined by the projected tangent grade beginning at the point of intersection (P.I.) of the flowlines.

3.7.5.4.2. The arc length and external distance of the curb return shall be computed and indicated on the drawing.

3.7.5.4.3. Show the corresponding flowline (or top of curb) grade for each roadway beyond the P.C.R.

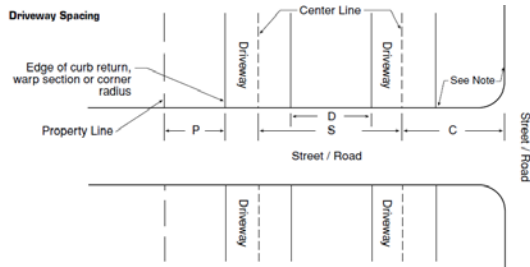
3.7.5.4.4. Design of the curb return flowline shall be such that the maximum cross slope between the midpoint of the curve and the PICR (external distance) does not exceed +5 percent. Grade breaks at the PCR's will not exceed two (2) percent for local and collector streets and one (1) percent for arterials. The flowline design of the curb return will be accomplished within the return without affecting street grades beyond the PCR. Maximum vertical curves will equal the arc length of the curb return. The elevation and location of the high or low point within the return, if applicable, is to be called out in the profile.

3.7.5.4.5. Scale for the curb return profile is 1" = 10' horizontally and 1" = 1' vertically. See Section 2.4.6.

3.7.6. Driveway Spacing

Opposing and adjacent driveway locations shall be in accordance with the following figure and table. The minimum spacing shall be increased as necessary to accommodate left turn storage bays. Offset of opposing driveway locations is not required if driveways are physically constrained to right-in, right-out.

NOTE: Flowline of curb/gutter or edge of asphalt if curb/gutter does not exist or edge of shoulder if asphalt does not exist.



I really like this. How did you get these numbers? Broomfield may look at stealing some of this info in our next specs update.

	Figure Reference	Distance
<b>Residential Driveways</b>		
From property lines	P	0'
From streets/roads	C	30'
Between driveways	N/A	0'
On local streets/roads	D	10'
On collector streets/roads	S	80'***
On major collector/arterial streets/roads	S	325'
<b>Non-Residential Driveways on Locals/Collectors</b>		
From property lines	P	0'
From major collectors/arterial streets/roads	C	300' *
From collector streets/roads	C	200' *
From local streets/roads	C	125'
Between driveways		
30 MPH design speed	S	180'
35 MPH design speed	S	200'
<b>Non-Residential Driveways on Major Collectors/Arterials/Parkways</b>		
From property lines	P	0'
From streets/roads	C	500' **
Between driveways		
40 MPH design speed	S	275'

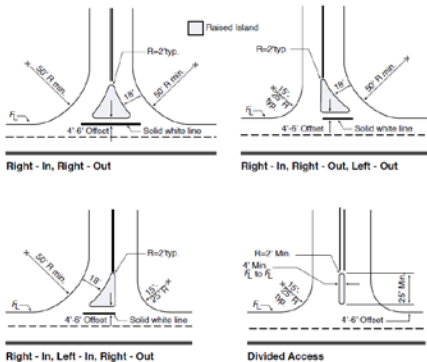
45 MPH design speed	S	325'
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*\*The C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. The minimum distance shall be no less than 150 feet.*

*\*\* If the proposed driveway is restricted to right turn movements or if it is not aligned with an existing or planned left turn lane, the C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. If signalization is proposed, the minimum C distance shall be increased to 660 feet.*

*\*\*\*May be reduced for circular driveways or driveways with a standard hammerhead turnaround If approved by Planning and Zoning.*

3.7.7. Channelizing Islands The following figures illustrate the minimum design for channelizing islands for site accesses with various turn movement restrictions.



- 3.7.7.1. Non-rigid post mounted delineators are required on raised islands.
- 3.7.7.2. Curb ramps four (4) feet wide, with a maximum slope of 12:1, are required and shall be shown on the plans.
- 3.7.8. ~~Non-Maintained Roads in County Right-of-Way, Driveways, and Private Street/Roads, and Non-Maintained Roads in County Right-of-Way~~ Standards. \_\_\_\_\_
- 3.7.8.1. Driveways serving one dwelling unit shall meet the following standards (Template 18):\_
- Exception: If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.4. do not apply.
- 3.7.8.1.1. Curve Radius: Minimum horizontal curve radius of 30 feet at centerline.
- 3.7.8.1.2. Width: A total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side in accordance with Template 18.
- ~~or if the length of the driveway in the Mountains exceeds 150-500 feet in length, and is a total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side, then pullouts shall be required at 200-foot intervals in accordance with Template 19. Due to site constraints, this 200-foot interval could be modified by 50 feet in either direction. Alternatively, if pullouts are not desired, a total width of 16 ft, including a 12-foot all-weather travel surface and two-foot shoulders on either side is required in accordance with Template 18 allowed.~~
- 3.7.8.1.3. Grade: Maximum grade of ten (10) percent on straight sections and twelve (12) percent ~~grade~~ where the dip of the natural terrain bears between South 60° East and South 45° West. Maximum grade of eight (8) percent for curves with radius of less than or equal to 50 feet at centerline.\_
- Exceptions: ~~In the Mountains, a maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100)~~

feet is allowed provided the appropriate fire sprinkler systems are installed per [the National Fire Protection Association \(NFPA\) 13D - Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes](#). There may be more than one section up to 15% provided [if it is separated they are separated by a distance of 1000 feet.](#)

~~3.7.8.1.4. If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.34. do not apply.~~

3.7.8.1.54. Turnaround: If the length of the driveway exceeds 150 feet, a hammerhead turnaround shall be provided in accordance with Template 20. ~~and the The location of the turnarounds shall be approved by the appropriate fire protection district.~~

**Commented [NS2]:** I don't think we want this included any longer.

3.7.8.2. Private streets/roads serving more than one dwelling unit and non-maintained streets/roads in county Right of Way shall meet the following standards:

3.7.8.2.1. [Curve Radius](#): Minimum horizontal curve radius of 30 feet at centerline.

3.7.8.2.2. [Width \(For a street/road serving up to 15 dwelling units\)](#): A total width of 20 feet, including a 16-foot all-weather travel surface and two-foot shoulders on either side in accordance with Template 18 ~~for roads serving up to 15 dwelling units~~. Alternatively, ~~for a private road~~ a total width of 14 feet, including a 10-foot traveled surface, two-foot shoulders on either side, and pullouts at ~~±50-200~~ foot intervals in accordance with Template 19. [Due to site constraints, this 200 foot interval could be modified by 50 feet in either direction.](#)

3.7.8.2.2.13. [Width \(For a street/road serving 16 or more dwelling units or one or more non-residential units\)](#): A total width of 24 feet, including an 18-foot paved surface and three-foot shoulders on either side in accordance with Template 18. ~~for roads serving 16 or more dwelling units or one or more non-residential units.~~

3.7.8.2.34. [Grade](#): Maximum grade of ten percent on straight sections; Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West. Maximum grade of eight percent for curves with radius of less than or equal to 50 feet at centerline.

[Exceptions: In the Mountains, 3.7.8.2.5 a m](#)Maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100) feet is allowed provided the appropriate fire sprinkler systems are installed per NFPA 13D, [for all new dwellings the street/road serves](#). There may be more than one section up to 15% provided it is separated by a distance of 1000 feet.

3.7.8.3. ~~The appropriate fire protection district may approve alternative standards for driveways and private roads. Plans shall be submitted that bear the written approval of the appropriate fire protection district. The off-site driveway or private road shall meet the requirements as described in this section. If the off-site driveway or private road does not cannot meet the requirements of this section, the following shall be submitted to Planning and Zoning:~~

~~1) A letter with a written description of the existing conditions and documentation of why the off-site driveway or private road cannot meet the requirements,~~

~~2) Plans showing the existing conditions of the off-site driveway or private road and/or proposed design,~~

~~3) A certified statement by a qualified Colorado-registered professional engineer indicating that the off-site driveway or private road will be able to serve the residents effectively and safely. This statement shall include a detailed explanation of how an emergency apparatus within the appropriate Fire Protection District will be able to serve a residence safely and effectively, and will be safe for fire apparatus. Such statement shall bear the professional engineer's seal, signature and date, and~~

~~4) A written statement from the property owner that a fire sprinkler system will be installed per NFPA 13D at the time of Building Permit. These submittal documents will be required to be reviewed and approved by Planning and Zoning prior to issuance of a building permit. Planning and Zoning may consult directly with the appropriate Fire District when evaluating offsite driveways or private roads which cannot meet the requirements of this section.-~~

3.7.8.4. Driveway approaches and private road intersections with public roads must comply with Standard 8 - Driveway and Private Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

**Commented [NS3]:** Should this include evidence that apparatus can make it up the road. Either with autoturn or turning radius templates.

Road Approaches onto Roads.

3.7.8.5. Cattle guards shall conform to the current edition of the CDOT M&S Standard Plans and approved by the appropriate fire protection district.

3.7.8.6. All gates and entry-way structures shall be approved by the appropriate fire protection district.

3.7.8.7. All streets in the Plains are required to be paved.

### 3.8. Drainage

All storm drainage systems shall be designed in accordance with Jefferson County Storm Drainage Design and Technical Criteria (JCSDDTC). Safe and efficient conveyance of traffic is the primary function of streets/roads; therefore, design of the storm drainage function shall not exceed the limits (such as gutter capacity and street overtopping) set forth in the JCSDDTC. All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T", in accordance with Jefferson County Land Development Regulation Section 33.

3.8.1. Crosspans: Crosspans are not permitted across collector or arterial streets, nor are they allowed on streets with existing storm sewer systems. Crosspans may be used parallel to collector or arterial streets to convey storm runoff across local streets.

3.8.2. Inlets: Inlets shall be located to intercept gutter flow at the point gutter capacity is exceeded by the storm runoff (see Chapter 9 of the JCSDDTC for gutter capacity). Inlets shall also be installed to intercept cross-pavement flows at points of transition in superelevation. Due to the presence of curb ramps at intersections, inlets are not allowed within the curb return, but shall be located at the tangent points of the curb return.

3.8.3. Cross Slope: Except at intersections, or where superelevation is required, streets/roads shall be level from top of curb to top of curb (or flowline to flowline) and shall have a two (2) percent crown. At or within 150' of an intersection, the maximum elevation difference between flowlines is that dictated by the intersection grade (Section 3.5.2.) and the actual distance between flowlines.

3.8.3.1. Parabolic or curved crowns are not allowed. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street.

3.8.3.2. Carrying the crown at a side street into the through street is permitted only when drainage considerations warrant such a design.

3.8.3.3. The rate of change in pavement cross slope, when warping side streets at intersections, shall not exceed one (1) percent every twenty-five (25) feet horizontally on local streets/roads, one (1) percent every thirty-seven and one-half (37.5) feet horizontally on collector streets/roads, or one (1) percent every fifty-six and one-half (56.5) feet horizontally on arterial streets/roads.

3.8.4. Temporary Erosion Control: Temporary erosion control is required along and at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc., in accordance with the Jefferson County Zoning Resolution, Section 15.

3.8.5. Cross Culverts: Cross culverts shall be installed at locations where roads cross natural drainageways and/or where changes in road grade are greater than two (2) percent. The culvert slope shall match as nearly as possible that of the existing topography, but shall in no case be less than one (1.0) percent. Cross culverts for roads shall be spaced a maximum of five hundred (500) feet apart.

### 3.9. Traffic Control

3.9.1. Construction Traffic Control: Traffic safety in construction zones should be an integral element of every project from planning through design and construction. Pedestrian, as well as vehicular traffic, should be considered in the design of a traffic control plan. A traffic control plan shall be submitted to and approved by Transportation and Engineering prior to issuance of a construction permit.

Design of all traffic control plans shall be in accordance with Part VI of the Manual on Uniform Traffic Control Devices, Standards for Work Zone Traffic Control. All necessary signs, pavement markings, barricades, etc. shall be shown on the plan.

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Do you have any time constants on Traffic Control? For example Broomfield does not allow TC on arterials between 7-9a and 4-6p. We also have restrictions around schools during school drop off pick up times.

3.9.2. Traffic Signals: Traffic signals shall be installed at street/road intersections or site accesses identified as meeting warrants in the traffic study submitted for a proposed development. If the proposed signal location is within twelve hundred (1,200) feet of any adjacent signal, a two-way progression analysis shall be included in the traffic study.

Design of all traffic signals shall be in accordance with the Manual on Uniform Traffic Control Devices and the Colorado Department of Transportation Standards and Specifications. Traffic signal plans shall be submitted to and approved by Planning and Zoning.

Traffic signal poles shall not be installed within sidewalks or curb ramps.

3.9.3. Signing and Striping: Plans are required for signing/ striping of new streets/roads and re-signing/stripping of existing streets/roads necessitated by development. All signing/stripping plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and shall be submitted as part of the construction plans.

3.9.3.1. The signing plan shall:

1. Show the general longitudinal location of each existing and proposed sign (by side of street/road and station).
2. Specify the sign legend and sign type (from the MUTCD).
3. Specify the sign size.
4. Include a typical detail of installation dimensions (height, distance from curb or edge of pavement).
5. Include a detail of post and base dimensions and installation plan (showing any wedges or sleeves, depth below surface, any materials used).
6. Specify the blank gauge and material of the sign(s).
7. Note the reflectorization provided.

3.9.3.2. The striping plan shall show:

1. Striping material (paint, thermoplastic, preformed tape, etc.).
2. Color designation and line width.
3. Lane width.
4. Proposed and existing lane striping including skip interval.
5. Typical treatments for accel/decel lanes, turning lanes, bike lanes and crosswalks.

3.9.3.1. Stop signs shall be placed at intersections in accordance with the MUTCD, unless otherwise approved by the Director of Planning and Zoning.

3.9.3.2. All street/road name signs shall be in accordance with the current edition of DRCOG "Guidelines for the Design and Placement of Street Signs in the Denver Region".

### **3.10. Miscellaneous**

3.10.1. Guardrail: In locations where guardrail is required, as determined by Planning and Zoning, design shall be in accordance with the Colorado Department of Transportation Standards and Specifications. Determination of guardrail requirements shall be based on Colorado Department of Transportation Roadway Design Manual, Section 702. Guardrail locations shall be shown on the construction plans.

3.10.2. Noise Attenuation: In locations where arterial streets/roads are adjacent to existing or planned residential areas, fencing and/or other noise attenuation measures are required. These measures may include, but are not limited to, earth beams, landscaping, walls, or a combination.

3.10.3. Street Lighting: Street lights shall be provided at all parkway/arterial/major collector street/road intersections. In addition, street lights shall be provided at all locations where multifamily residential, commercial or industrial site driveways intersect Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

parkway/arterial/major collector streets/roads. Street lights shall be designed in accordance with the most recent ANTI/ICES Roadway Lighting Standards and installed in accordance with Public Service Company of Colorado standards. Light poles shall not be installed within sidewalks or curb ramps.

3.10.4. Roundabouts: Roundabouts may be constructed subject to an approved traffic study. Roundabouts shall be designed in accordance with the current edition of the Federal Highways Administration Publication, Roundabouts: An Informational Guide, and approved by Transportation and Engineering and the appropriate fire protection district.

3.10.5. Bridges: Bridges shall be designed in accordance with CDOT Bridge Manuals and approved by Transportation and Engineering and the appropriate fire protection district.

3.10.6. Curb Extensions (mid-block and corner) and Pedestrian Refuge Islands: Curb extensions and pedestrian refuge islands shall be designed in accordance with the current version of the Federal Highway Administration Bicycle and Pedestrian Report and approved by Transportation and Engineering and the appropriate fire protection district.

#### *Chapter 4*

## **Pavement Design and Technical Criteria**

### **4.1. General**

This section sets forth the minimum criteria and design procedures for public and private roadway pavements. Recommended design methodologies for asphalt are addressed and essentially follow the Colorado Department of Transportation (CDOT) and the Asphalt Institute methodology. Some standardization of criteria has been made in design procedures. Other design methodologies may be presented for comparison to the current County design method.

### **4.2. Pavement Design Report Submittal**

4.2.1 Preliminary Pavement Design: A Preliminary Pavement Design shall be used for estimating purposes only to determine the financial security "Exhibit A" associated with development projects. Three standardized Preliminary Pavement Designs corresponding to three zones of unique geotechnical characteristics within Jefferson County are presented in Construction Standard 16-18. Construction Standard 19 shows each of the three zones. Zone 1 corresponds with materials associated with decomposing granite in the higher elevation foothills and mountains. Zone 2 addresses highly expansive clay and claystone material within the Designated Dipping Bedrock Area with edge drains. Zone 3 involves non-cohesive soil and weathered bedrock along the Front Range. The Preliminary Pavement Design shall be replaced with the Final Pavement Design, and the associated "Exhibit A" financial security costs recalculated, after County approval of the Final Pavement Design Report.

#### 4.2.2 Final Pavement Design:

The final pavement design shall be completed and submitted after or in conjunction with County approval of the associated construction plans. All soil samples must be taken after overlot grading, or represent the "as-constructed" soil conditions after construction has been completed. Pavement design approval is required prior to placement of any concrete flatwork and/or paving within County Right-of-Way.

The report shall be prepared by or under the supervision of and signed by a Professional Engineer registered in the State of Colorado and shall include the following information:

A. Vicinity map to locate the investigated area.

- B. Scaled drawings showing the location of borings, and required information stated in 4.3.2.
- C. Scaled drawings showing the estimated extent of subgrade soil types and Equivalent Daily Load Application (EDLA) for each street.
- D. Pavement design alternatives for each street on a scaled drawing.
- E. Tabular listing of Sample Designation, Sample Depth, Composite Group Number, Liquid Limit, Plasticity Index, Percent Passing the No. 200 sieve, American Association of State Highway and Transportation Officials (AASHTO) Classification, Group Index, Percent Swell from Swell Consolidation tests, and Soil Description.
- F. California Bearing Ratio (CBR) or R-value test results and calculations for each soil type used in the design. Include natural moisture content and natural density.
- G. Pavement design nomographs supplied by Jefferson County properly drawn to show Soil Support, EDLA and Structural Number (SN).
- H. Design calculations for pavement thickness.
- I. Percentage water soluble sulfates, sampled at a minimum of every other boring.
- J. A discussion regarding potential subgrade soil problems including, but not limited to:
  - 1. heave or settlement prone soils
  - 2. frost susceptible soils
  - 3. ground water
  - 4. drainage considerations (surface and subsurface)
  - 5. cold weather construction (if appropriate)
  - 6. other factors or properties which could affect the design or performance of the pavement system
- K. Recommendations to alleviate or mitigate the impact of problems discussed in Item J above.

#### **4.3. Subgrade Investigation**

4.3.1 Field Investigation: The field investigation shall consist of boring soils to a depth of at least five feet below the bottom of the proposed asphalt pavement layer elevation for roads classified as Local or Collector. Borings shall extend 10 feet below the bottom of the proposed asphalt pavement layer elevation on Major Collector / Minor Arterial and Major Arterial roadways. In all cases borings shall be spaced no more than 250 feet apart, or a minimum of one boring for each section of street, unless otherwise required by Transportation and Engineering. The borings shall be checked for ground water at the time of drilling, and then 24-hours after the borings are completed. Samples shall be taken after overlot grading is completed and the subgrade is "rough cut" (1 to 2 feet of proposed elevation). Soil classifications shall be verified after installation of utilities.

Geological features within five feet of the existing ground surface, and all new roadways proposed in the Dipping Bedrock Area, require more detailed investigation including drilling and/or trenching. Every third bore hole shall be a minimum of 10 feet deep, regardless of the road classification.

California Drive samples shall be obtained from each boring within 12-18 inches of the final subgrade elevation.

4.3.2. Boring Profiles: Boring logs shall include the following:

- a. Date, Strata Elevations, Depth of Boring.
- b. Natural moisture content, Blow Count and Dry Density of each undisturbed sample.
- c. Water table elevation.

4.3.3. Classification Testing: Each soil sample shall be tested according to AASHTO and/or the American Society for Testing Materials (ASTM) criteria to determine: Liquid Limit, Plastic Limit, Plasticity Index, and Percentage passing the U.S. Standard No. 200 sieve. Samples of sands and gravels shall require gradation analysis for classification determination.



These data shall be determined using the following methods:

- a. Liquid Limit - AASHTO T 89 (ASTM D 4318)
- b. Plastic Limit - AASHTO T 90 (ASTM D 4318)
- c. Passing No. 200 - AASHTO T 11 (ASTM C 117)
- d. Gradation - AASHTO T 27 (ASTM D 422)

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

4.3.4. Soil Grouping: Soil samples collected in the field investigation can be combined to form soil groups. These groups shall be based upon the AASHTO Classification, Group Index and location within the area investigated. Groupings shall not consist of samples with different AASHTO Classifications (Note: There may be more than one group index within a given classification). Composite samples can be manufactured by combining representative, equal portions of each sample contained within the group and mixing to provide a uniform composite sample of the soil group. This shall be limited to group indices within the range of 7. Composite samples shall be subjected to Classification Testing as outlined in Section 4.3.3. Moisture-Density curves must be included for groups used in the design.

4.3.5. Subbase Support Testing: Individual subbase or composite samples shall be tested to determine the support value using either CBR (California Bearing Ratio) or Hveem Stabilometer (R-value) testing. These values shall be used in the design of pavement sections in accordance with the procedures outlined in Section 4.5. Tests shall be conducted in accordance with the following procedures:

4.3.5.1. CBR Tests: California Bearing Ratio tests shall be conducted in accordance with AASHTO T 193 with the following modifications:

- a. Note 4 of AASHTO T 193 shall not apply. A 3- point CBR evaluation is required.
- b. The compaction method used for the CBR test shall be determined by the soil classification.
- c. Surcharge shall be calculated using a unit weight of 140 pcf for bituminous pavement and 135 pcf for untreated aggregate base course.
- d. The design CBR value shall be determined from the CBR - Dry Density Curve and shall be the CBR value at 95 percent compaction.
- e. In addition to the values requested in AASHTO T 193, Stress-Penetration curves for each sample, a CBR - Dry Density curve and Proctor Compaction test results shall be reported.

4.3.5.2. R-Value Tests: Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

- a. Dry density and moisture content for each sample.
- b. Expansion pressure for each sample.
- c. Exudation Pressure - corrected R-value curve showing the 300 psi design R-value.

#### **4.4. Pavement Design Criteria**

This section sets forth the parametric input data to be used for the design of pavements of various roadway classifications. If cohesive soil mitigation is required, the soil treatment shall extend from back of sidewalk to back of sidewalk.

4.4.1. Equivalent (18 Kip) Daily Load Applications (EDLA): The pavement design procedure in this chapter is intended to provide for a 20-year service life of pavement, given that normal maintenance is provided to keep roadway surface in an acceptable condition. EDLA and Design Traffic Number (DTN) are considered equivalent units based on 20-year design criteria and an 18 kip axle loading. All data and design nomographs in this chapter use EDLA units for pavement loading repetitions. Calculations shall be included, where applicable.

EDLA criteria for each Jefferson County roadway classification are given in Table 4.1.

Table 4.1 Recommended Equivalent (18 Kip) - Daily Load Applications (EDLA)

Classification	Class Modifier	EDLA Values
Local	Serving <50 D.U.	8
	Serving >50 D.U.	10
Collector	Residential	30
	Other	100
Major Collector/Minor Arterial	All	200
Principal Arterial	All	200

NOTE: Alternative EDLA values may be considered with justification provided by the Transportation Study, proposed land uses, and traffic analysis that defines proportion of truck vehicles, including construction truck traffic.

4.4.2. Design Serviceability: The following criteria shall be used for all Jefferson County roadways to be dedicated for public use:

Table 4.2 Serviceability Index

Roadway Classification	SI
Arterials	2.5
Collectors	2.5
Local	2.0

4.4.3. Minimum Pavement Layers: This paragraph provides the minimum acceptable pavement layers for public roadways in Jefferson County. These pavement layer thicknesses may be used for preliminary planning purposes. Final pavement designs must be based on actual subbase support test results. Table 4.3 lists these minimum thicknesses for each roadway classification.

Table 4.3 Minimum Pavement Sections

Road Classification	EDLA	Composite Section (inches)			Full Depth Asphalt (inches)
		Asphalt	Subbase		
			Base Course	Stabilized	
<50 D.U.	8	4	6	12	5
=>50 D.U.	10	4	6	12	5
Residential	30	4	6	12	5
Other	100	5	6	12	6
Major Collec- tor	200	5	6	12	7
Minor Arterial	200	5	6	12	7
Major Arterial	200	5	6	12	8

Regardless of the pavement layer design, all soils with an R-value less than 10, or PI greater than 15, shall be stabilized to a minimum of 12 inches below the bottom of the asphalt pavement layer, and shall be included in the depth of treatment.

Cohesive soil subbases shall be overexcavated and replaced with moisture conditioned fill. Minimum requirements for overexcavation are listed below in Table 4.3a.

Table 4.3a Minimum Overexcavation Requirement for Cohesive Soils

Plasticity Index	Depth of Overburden/Fill Treatment	
	Locals/Collectors	Major Collectors/Arterials
15-20	1 foot	2 feet
21-30	2 feet	3 feet
31-40	3 feet	4 feet

- NOTES:
1. Road segments with isolated soil types may be designed separately for that individual segment.
  2. Soil with (PI) over 40 shall be removed and wasted to a depth of five feet for any type of street.
  3. In the Designated Dipping Bedrock Area, all bedrock shall be overexcavated to a depth of at least five (5) feet below the bottom of the proposed pavement layer. Where the bedrock is claystone, the top of the weathered claystone shall be considered as the top of bedrock. Should soil other than bedrock be found throughout the five (5) foot zone, it shall be overexcavated as shown in Table 4.3a.
  4. The overexcavation areas shall be recompact to 95% of maximum Standard Proctor Density (ASTM D-698) at U to +4% above optimum moisture content. There shall be a minimum of 12 inches of soil stabilization below the bottom of the asphalt layer that is included in the total depth of overexcavation.
  5. Overexcavation of overburden/fill below the stabilization section may be waived by Transportation and Engineering in areas where either previous overexcavation work during overlot grading has been validated or in cases where a thorough geotechnical investigation determines overexcavation is not warranted. Previous overexcavation work must be validated by compaction reports provided by the developer's geotechnical firm and in accordance with the Land Development Regulation (LDR).

4.4.4. Flexible Pavement Strength Coefficients: Table 4.4. contains standard design coefficients for various pavement materials. Non-standard design coefficients may be used only if approved in advance by Transportation and Engineering. In addition, design values must be verified by predesign mix test data and supported by daily construction tests; or, redesign values will be required.

Table 4.4 Strength Coefficients

Pavement Structure Component*	Strength Coefficients	(Limiting Test Criteria)
Conventional Materials		
Hot Mix Asphalt	0.40	1800 Lbs. Marshall Or R 90+)
Exist. Asphalt Pavement	0.30	(9-15 Yr)
	0.24	(>15 Yr)
Aggregate Base Course	0.12	(Cbr 80+ Or R 78+)
Exist. Aggregate Base Course	0.10	(Cbr 50+ Or R 69+)
Granular Subbase Course	0.07	(Cbr 15 Or R 50+)
Treated Materials		
Cement Treated Aggregate Base	0.23	(7 day, 650-1000 psi)
Lime Stabilized Subbase	0.14	(PI.<6, net swell <.5%, PH >12.3) Compressive Strength >/200 psi, per ASTM 5102-04, Procedure B
All Stabilized Subbase	0.14	Compressive Strength >/200 psi, per ASTM 5102-04, Procedure B

\* The combination of one or more of the following courses placed on a subgrade to support the traffic load and distribute it to the roadbed.

Structural Layers of a conventional flexible pavement design are defined below.

- a) Surface Course: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists
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skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course.”.

- b) Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course. The use of base course is not accepted in areas that base course does not adequately drain from roadway system.
- c) Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course, surface course or both.
- d) Subgrade: Prepared and compacted soil extending to such a depth as to affect the structural design.

#### 4.5. Pavement Design Procedure

4.5.1. Flexible Pavements: The following procedure should be used in determining the Structural Number (SN) of the pavement being designed:

4.5.1.1. Using the appropriate roadway classification, determine the corresponding EDLA (Table 4.1).

4.5.1.2. Determine the Serviceability Index (SI) of the roadway classification (Table 4.2).

4.5.1.3. Select the proper nomograph:

Example: Figure 4.1 Flexible Pavements with SI = 2.0

Example: Figure 4.2 Flexible Pavements with SI = 2.5

NOTE: Original nomographs required are available from Transportation and Engineering.

4.5.1.4. Using subgrade CBR or R-Value test results and EDLA, determine the SN from the appropriate design nomograph.

4.5.1.5. Once the Structural Number (SN) has been determined, the design thicknesses of the pavement structure can be determined by the general equation:

$$SN = a_1D_1 + a_2D_2 + a_3D_3 + \dots$$

where

$a_1$  = Hot Mix Asphalt (HMA) strength coefficients

$a_2, a_3, a_n$  = strength coefficients of additional pavement components

$D_1$  = thickness of Hot Mix Asphalt (HMA) (inches)

$D_2, D_3, D_n$  = thickness of additional pavement component sections

The strength coefficients for various components of the pavement structure are given in Table 4.4.

The component thickness selected must meet two conditions:

- a. Total HMA thickness selected cannot be less than the minimum specified in Table 4.3. for the roadway classification.
- b. The base course thickness selected cannot exceed 2.5 times the HMA thickness selected, with a maximum thickness of eight (8) inches.

4.5.1.6. The design must reference any mitigative measures required when the subbase and / or subgrade contains cohesive or expansive soils. Design reports recommending permeable layers such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the fine-grained soils. If cohesive or expansive soil mitigation is required, the soil stabilization shall extend from back of sidewalk to back of sidewalk. It is required that soils with R-values less than 10 or Plasticity Index greater than 15 be stabilized. Stabilization is for a minimum of the upper twelve (12) inches below the bottom asphalt pavement layer, and shall be included in the depth of treatment.

4.5.2 Rigid Pavements: This procedure has been deleted.

4.6. Material Specifications

The Specifications presented in this section are performance oriented. The County’s objective in setting forth these Specifications is to achieve an acceptable quality of roadway structures. All sources for the mined or manufactured materials must be annually approved by Transportation and Engineering as having met the appropriate materials performance specifications. This approval is a condition of using those material sources for public improvement construction. For the purpose of these Standards, public improvements are all roadway improvements, sidewalks, curbs and gutters, appurtenant drainage basins or structures, storm sewer and their access ways, other public works within Jefferson County Right-of-Way, and required stormwater detention structures built on private property and maintained by the property owner(s).

4.6.1. Violations of Approval Conditions

4.6.1.1. Random Testing. Transportation and Engineering may order random tests of materials used in County public improvements to verify compliance with material specifications. These tests are in addition to the requirements of the roadway inspection and testing procedures.

4.6.1.2. Any and all material used to construct public improvements that is not from a certified source, or that is from a certified source and fails one or more random material test, may be subject to complete removal as a condition of County acceptance of that public improvement. Additional tests will be required to confirm the existence and extent of the sub-standard material prior to the initiation of remedial action. The extent of the material to be removed will be at the discretion of Transportation and Engineering.

4.6.2. Use of Materials Not Listed in Section 4.6. Materials in this section and provided with a set of specifications are those deemed to be the primary structural materials commonly or typically used in public improvements. Ancillary public improvement materials such as manufactured paints and coatings, bonding agents, sealers, fabrics or gaskets, insulating materials, etc., should be in compliance with CDOT material specifications for the appropriate material employed. Alternative materials for construction may be proposed for use. Decisions on acceptability of alternative materials will be made by Transportation and Engineering.

4.6.3. Material Specifications

4.6.3.1. Hot Mix Asphalt: This shall comply with material specifications for PG Binders and asphalt mixes in accordance with CDOT’s most recent edition of Standard Specifications for Road and Bridge Construction, 702 and 703. This is hereby referred to as "CDOT Standard Specifications".

4.6.3.2. Aggregate Base Course Material. This material shall consist of hard, durable particles or fragments of stone or gravel, crushed to required sizes, containing an appropriate quantity of sand or other finely-divided mineral matter which conforms to the requirements of AASHTO M 147, and to Section 703.03, CDOT Standard Specifications.

Specifications. In addition, the material must have an R-value of 78 or greater, or a CBR of 80+, and must be moisture stabilized. Moisture stability is determined by R-value testing which shows a drop of 12 points or less in R-value between exudation pressures of 300 psi and 100 psi.

Only aggregate from sources approved by the Transportation and Engineering shall be used.

Table 4.5 Aggregate Base Course Materials

Sieve Size	Mass Percent Passing Square Mesh Sieves	
	Class 5	Class 6
2"	100	
1"	95 - 100	100
3/4"	—	95

#4	30 - 70	30 - 65**
#8	—	25 - 55
#200*	03 - 15	03 - 12**
Liquid Limit (LL)	30 Max.	30 Max.

\*ASTM (C117)

\*\*For gravel shoulders, No. 200 shall be 9-12 and No. 4 shall be 30-50.

Base course may be used only where the base can daylight in barrow ditches or where the subgrade consists of material classifying as GM, GW, GP, SM, SW, or SP using the Unified Soil Classification System.

4.6.3.3. Cement Treated Aggregate Base Course. This material shall consist of a mixture of aggregate materials, Portland cement and water as outlined in Section 304 of the CDOT Standard Specifications. Acceptable aggregates include CDOT Classes 5 and 6. Other aggregates may be used, if previously approved by Transportation and Engineering.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering. As a minimum, the mix design report shall contain a description of material sources, gradations and Atterberg limits of aggregates, cement type, Proctor compaction curves and unconfined compressive strength results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO specifications. Minimum in-place thickness for cement treated aggregate base course shall be twelve (12) inches.

To be approved, the mix shall have a seven-day compressive strength of at least 650 psi and no more than 1,000 psi. The minimum acceptable cement content shall be five percent by weight. Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis, or an annual basis for suppliers, prior to issuing construction permits.

4.6.3.4. Lime Treated Subgrade: This Material consists of a mixture of native or imported soils, hydrated or quick lime and water as outlined by ASTM Specification C977, CDOT Standard Specification 307.

The materials to be used in construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five day, 100°F cure unconfined compressive test results for each mix, strength versus lime content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Minimum pH of 12.3 after completion of initial mixing.
2. Plasticity Index less than 6, per ASTM D4318.
3. Minimum hydrated lime of 5.0% dry weight, per ASTM D3.
4. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
5. Sulfate concentrations not to exceed .5%

Note: Field validation shall be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.5. Lime/Fly-Ash Stabilized: This material consists of a mixture of native or imported soils, hydrated or quick lime, Class "C" Fly-Ash, and water as outlined by ASTM Specification C977, CDOT Section 307.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus lime/fly-ash content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

- 1. Plasticity Index less than 6, per ASTM D4318.
- 2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
- 3. Sulfate concentrations not to exceed .5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.6. Cement Stabilized Subgrade. This material consists of a mixture of native or imported soils, Portland cement and water.

The materials to be used on construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

- 1. Minimum Portland cement of 3.0% dry weight per ASTM D3.
- 2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
- 3. Sulfate concentrations not to exceed 0.5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

*Chapter 5*

**Construction Specifications and Standards**

**5.1 Construction Specifications**

The Permittee agrees to adhere to all construction specifications set forth in the latest edition of the Jefferson County Land Development Regulation, the Jefferson County Transportation Design and Construction Manual and the Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction manuals.

5.1.1. Permits: All work performed within County Rights-of-Way and/or easements shall require the issuance of a street/road construction permit. Permits shall be obtained at the Jefferson County Transportation and Engineering office, located at 100 Jefferson County Parkway, Suite 3500, Golden, Colorado.

5.1.1.1. Any permit issued shall pertain only to construction within the County-owned Right-of-Way and is in no way considered a permit to enter on any private property adjacent to such Right-of-Way nor to alter or disturb any facilities or installations existing within the Right-of-Way which may have been installed, and are owned, by others.

5.1.1.2. Permits, when issued, shall be valid for a period of ninety (90) calendar days, and may be renewed for one (1) additional ninety (90) calendar day period, providing the renewal is obtained (renewal may be obtained by telephone) prior to the permit expiration date.

Failure to obtain a renewal as stated herein will require obtaining a new permit and payment of applicable fees.

5.1.1.3. Any permit determined to be without an adequate bond as required in Section 5.1.2. below, shall be subject to immediate revocation by Transportation and Engineering.

5.1.2. Bonds: A non-cancellable permit bond shall be required for Right-of-Way Use and Construction Permits and License Agreements Section of the County Policies and Procedures for Streets and Roads.

5.1.3. General Specifications:

5.1.3.1. Any work done to a street/road or other County property under a permit shall result in the street/road or other property being returned to a condition equal to or better than original, within the limits of careful, diligent workmanship, good planning, and quality materials, with said work being accomplished in the least possible time and with the least disturbance to the normal functioning of the street/road or other property.

5.1.3.2. All backfill material, compaction, and resurfacing of any excavation made in the County property shall be done in accordance with specifications and standards approved by and on file with Transportation and Engineering.

5.1.4. Road Closures: Normally, only one side of a public street/road may be blocked at any given time. Should operating conditions require complete closure, advance approval of the closing of a public street/road must be obtained from Transportation and Engineering or advance approval of the closing of a private road must be obtained from Planning and Zoning. The permittee shall notify the appropriate fire protection district, the Jefferson County Sheriff's Department, and the Colorado State Patrol concerning exact location of barricades and dates traffic will be impeded. Barricades shall be maintained by the responsible contractor.

5.1.5. Utility Installations:

5.1.5.1. Underground: All utility lines, including Cable TV, shall be installed a minimum of two (2) feet below ground surface, or proposed roadway elevation, whichever is lower. This requirement is applicable throughout the Right-of-Way, including ditch lines and/or borrow pits. Exceptions may be granted by Transportation and Engineering where warranted and upon prior written request and approval.

5.1.5.2. Overhead: A minimum ground clearance of 18 feet 0 inches shall be provided where overhead utility lines cross public roads and streets. The clearance shall be measured at the lowest point where the line crosses the traveled portion of the road and/or street.

5.1.6. Base Course: All aggregate base course shall meet CDOT Class 6 Specifications, or an acceptable base course predicated on specific site conditions as approved by Transportation and Engineering. Native material is unacceptable as base course.

5.1.7. All concrete shall be in conformance with the appropriate class as specified in Section 601 of the CDOT Standard Specifications. A combination cure-sealer shall be used for concrete flatwork. Provide adequate texture by means of a moderately heavy broom finish to surfaces prior to applying the cure-sealer. The product shall be Dayton Superior Cure & Seal LV 25% J20 UV or approved equal. Apply two coats per manufacturer's instructions to all exposed surfaces, with the second coat applied at right angles to the first for complete coverage. The temperature range of application is 35 to 90 degrees F. Concrete shall not be left exposed for more than one hour between the time finishing is completed and commencement of curing treatment.

5.1.7.1. Concrete may be placed by machine methods provided that all finish lines are within 1/8" ± tolerance of the lines shown on the plans. The flowline must be free draining.

5.1.7.2. One-half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.

5.1.7.3. Median Cover Material and Median Edging Patterned Concrete: Median cover material and median edging patterned concrete shall be colored concrete that is Davis color #5084 "Harvest Gold" or approved equal. The release agent shall be Concrete Coatings Stamp-TEK™ liquid release or approved equal. The stamp pattern shall be Matcrete "UK Cobblestone" or equivalent. A combination cure-sealer containing silane shall be used for concrete flatwork. The cure-seal product shall be SpecChem Cure Shield EX or approved equal. Control joints are saw cut every 10 feet. Expansion joint material with a zip-strip shall be installed between the patterned concrete and the back of curb. Control joints and expansion joints shall be sealed with Sikaflex-2C or approved equal. Refer to STND-18 and STND-19 for details. Granular pre-emergent herbicide shall be placed in the areas that are to receive median cover.

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5.1.7.4. Detectable Warnings on Concrete Curb Ramps: Detectable Warnings on concrete curb ramps shall be truncated domes of the dimensions shown on the plans. Domes shall be BRICK RED in color. Domes shall be prefabricated by the manufacturer as a pattern on embeddable surface plates. Dome plates shall be set into wet concrete and shall not be glue or spray-on varieties. Detectable warning plates shall not be concrete pavers, masonry pavers, or cast-iron plates. Refer to STND-16 for details.

5.1.7.5. Waterproofing Membranes: Waterproofing membrane shall be placed on concrete bridge deck surfaces, and concrete box culverts per the waterproofing membrane detail. Surfaces to receive waterproofing membrane shall be thoroughly cleaned via sand-blasting or high pressure water. The waterproofing membrane shall be a hot pour asphaltic material, with 55 pound (#55) minimum asphaltic based roll material immediately placed on top. Refer to STND-17 for details.

5.1.8.1 Storm Sewer Pipe: Within County Right-of-Way and/or easements, all storm sewer pipe shall be minimum Class II Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76, C-506 or C-507. Actual depth of cover, live load, and field conditions may require structurally stronger pipe.

5.1.8.2 All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T" in accordance with Jefferson County Land Development Regulation Section 33.

5.1.9. Culverts: Within County Right-of-Way and/or easements, all culverts shall conform to the Storm Drainage Design and Technical Criteria.

#### 5.1.10. Traffic Control Devices

All traffic control devices shall conform to the MUTCD and be approved by Transportation and Engineering prior to installation. Conformance to the following minimum materials specifications or approved equal is required. Traffic signals shall conform to CDOT standards.

5.1.10.1. Signs, Sign Posts, and Anchors: Sign faces, posts and bases-anchors shall conform be in conformance with the following materials specifications. All Nonstandard signs-faces, posts, and anchors bases must be approved by Transportation and Engineering. Nonstandard signs will not be maintained by the County. Post anchors for sign intallation after complete construction require approval by Transportation and Engineering.

5.1.10.1.1. Street Name Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy 0.100 -080 inches thick. Polyethylene plates (Polyplate) is not allowed. (no polyplate allowed). Facing shall be green, electrocut HighHi-Intensity reflective sheeting with white HiHigh-Intensity Prismatic grade retroreflective sheeting letters and numerals. Refer to STND-12 for details.

5.1.10.1.2. Regulatory and Warning Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy -10-0.100 inches thick. High-Intensity prismatic grade retroreflective sheeting shall be used for the background color, and letters and numerals for on all regulatory (i.e. stop, speed limit)-and warning signs. Refer to STND-12 for details.

5.1.10.1.3. Sign Posts: All sign posts shall be two (2) inch by two (2) inch galvanized telespar tube with 120 inch wall thickness, and three eighths (3/8) inch holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length. U posts are not allowed. All sign posts shall be two (2) inch by two (2) inch galvanized TELESPEAR® telespar tube with 12 Gauge (0.105 -120 inch wall thickness), and three eighths (3/8) 7/16 inch pre-punched holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length. U-posts are not allowed.

5.1.10.1.4. Sign Post Bases: All sign post bases shall be twist resistant mounting for telespar type post consisting of a steel angle (1/4" x 2 1/2" x 2 1/2" x 24") with a formed and welded steel plate (1/8" x 10" x 15"), used with a compression fit V lock wedge of 1/8 inch galvanized steel. The wedge must have a one half (1/2) inch hole drilled in one side for removal. All sign post anchors shall be anchored securely in the soil or concrete to create a breakaway system. All sign post anchors shall be 2.25 inch x 2.25 inch perforated

square tubing, galvanized steel, TELES PAR ® (or equivalent), a minimum of 3 feet in length. Each tube section shall be 12 Gauge (0.105 inch wall thickness) with 7/16 inch diameter pre-punched holes on 1-inch centers, all sides over full length. The anchor tubing shall be twist resistant and allow mounting of a one-size smaller TELES PAR ® sign post. The anchor shall be driven into the soil no less than 30 inches. The sign post shall be inserted 8 inches inside the anchor tubing and double bolted in place prior to covering. Each bolt shall be a Hex Head with a Washer and matching Hex Nut. Bolts shall be secured at the exposed top of the anchor base and placed at opposite tube sides, 90 degrees apart. Signs to be placed in concrete medians or islands shall have the anchor driven inside of a 6-inch Schedule 40 PVC sleeve, with the sleeve measuring the thickness of the concrete plus 1-inch, and secured to the post in the same fashion as described in 5.1.10.1.3. The PVC sleeve shall be embedded in the surrounding concrete when the concrete is placed. Sign post anchors driven in soil not within concrete medians or islands shall be anchored in the same fashion without the PVC sleeve. Refer to STND-13 for details.

5.1.10.2. Pavement Marking: ~~Specified~~ Pavement marking materials shall be used as specified for the service life, type, and at locations as identified below.

5.1.10.2.1. Temporary Application, Construction, or Detours: Waterborne paint (High Build) shall be used for short duration striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. The same waterborne paint may be used for crosswalks and stop (bar) lines as deemed necessary. Stencil markings, such as symbols or arrows, shall not be placed for temporary use unless approved by the engineer. ~~3M Stamark 5730 preformed plastic marking material or an approved equivalent shall be used for crosswalks, stop bars, symbols (i.e. turn arrows) and striping for separation of turn and through lanes.~~

5.1.10.2.2. Permanent Application: Epoxy paint shall be used for striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. Preformed Thermoplastic Pavement Markings shall be used for crosswalk and stop (bar) line markings, railroad (RR) crossings, words, symbols, and arrows. The thickness of all Preformed Thermoplastic Pavement Markings shall be 125 mils. Preformed Plastic Marking Tape (Type I), may be used in lieu of Preformed Thermoplastic Pavement Markings, if approved by Transportation and Engineering prior to installation. Preformed Plastic Marking Tape shall be 3M™ Stamark™ 5730 (White), 3M™ Stamark™ A270ES (White), ~~or approved equivalent. Preformed plastic marking material or reflectorized paint shall be used for all other pavement marking. Use of thermoplastic pavement marking is not permitted.~~

5.1.10.3. Curb Ramps: All required curb ramps shall conform to current CDOT M&S Standard Plans and be approved by Transportation and Engineering.

5.1.10.4. Bike Racks: All required bike racks shall conform to Association of Pedestrian and Bicycle Professionals “Essentials of Bike Parking: Selecting and Installing Bike Parking that Works”.

5.2 Construction Standards

All construction within County Right-of-Way and/or easements shall be in conformance with current CDOT M & S Standards and the following County construction standards.

Standard Number	Description
1	Curb and Gutter
2	Combination Curb, Gutter and Sidewalk
3	6" Vertical Curb, Gutter and Attached Sidewalk
4	6" Vertical Curb, Gutter and Detached Sidewalk
5	Typical Intersection Crossspan

6	Driveway Section for 6" Vertical Curb and Gutter
7	Optional Driveway Section for Combination Curb, Gutter and Sidewalk
8	Driveway Approaches for Roads
9	Typical Median Designs
10	Concrete Joint Details
11	Asphalt Street/Road Patchback
12	Road and Street Name Signs
13	Sign Posts and Bases
14	Typical Arterial Street Lighting
15	Street Name Sign and Bracket on Traffic Signal Pole
<a href="#">16</a>	<a href="#">Detectable Warnings on Concrete Curb Ramps</a>
<a href="#">17</a>	<a href="#">Waterproofing Membranes</a>
<a href="#">18</a>	<a href="#">Median Cover Material Patterned Concrete</a>
<a href="#">19</a>	<a href="#">Median Edging Patterned Concrete</a>
<a href="#">20</a> <a href="#">16</a>	Zone 1 Foothills / Mountain Area Preliminary Pavement Design
<a href="#">21</a> <a href="#">17</a>	Zone 2 Dipping Bedrock Area Preliminary Pavement Design
<a href="#">22</a> <a href="#">18</a>	Zone 3 Front Range Area Preliminary Pavement Design
<a href="#">23</a> <a href="#">19</a>	Design Zone Preliminary Pavement Sections

## Definitions

**AASHTO**  
American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, current edition.

**ADT**  
Average Daily Traffic

**Axle Load**  
The total load transmitted by all wheels on a single axle extending across the full width of the vehicle. Tandem axles 40 inches or less apart shall be considered as a single axle.

**California Bearing Ratio**  
A measure of the ability of a soil or aggregate to resist the transmission of a vertical load in a lateral direction.

**CDOT**  
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## Colorado Department of Transportation

### Emulsified Asphalt Treated Base

A base consisting of a mixture of mineral aggregate and emulsified asphalt spread on a prepared surface to support a surface course.

### Equivalent Single Axle Loads (ESAL)

A numerical factor that expresses the relationship of a given axle load to another axle load in terms of their effect on a serviceability of a pavement structure. All axle loads are equated in terms of the equivalent number of repetitions of an 18,000 pound single axle.

### 18k EDLA

18,000 pound single axle Equivalent Daily Load Applications (explained in “Axle Load” and “ESAL” above).

### Flexible Pavement

A pavement structure which maintains contact with and distributes loads to the subgrade and depends upon aggregate interlock, particle friction, and cohesion for stability.

### Flowline

The transition point between the gutter and the face of the curb. For a cross or valley pan, it is the center of the pan. Where no curb exists, the flowline will be considered the edge of the outside traveled lane.

### Grade

Rate or percent of change in slope, either ascending or descending from or along the highway. It is measured along the centerline of the highway or access.

### Lime Treated Subgrade

Subgrade consisting of a mixture of soil, hydrated lime and water, usually mixed in place and placed to support a pavement structure.

### MUTCD

The Manual on Uniform Traffic Control Devices and the Colorado Supplement, current editions.

### Mountains

See “Mountains” definition in the Zoning Resolution.

### Passing Sight Distance

The visibility distance required to allow drivers to execute safe passing maneuvers in the opposing traffic lane of a two-lane, two-way highway.

### Pavement Structure

The combination of subbase, base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

- a. Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course.
- b. Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or subgrade to support a surface course.
- c. Surface Course: The uppermost component of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course”.

### Plains

See “Plains” definition in the Zoning Resolution.

### Plant Mixed Bituminous Base

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A base consisting of mineral aggregate and bituminous material, mixed in a central plant, laid and compacted while hot, on a subbase or a subgrade, to support a surface course.

#### Plant Mixed Bituminous Pavement

A combination of mineral aggregate and bituminous material mixed in a central plant, laid and compacted while hot.

#### Regional Factor

A numerical factor expressed as a summation of the values assigned for precipitation, elevation, and drainage. This factor is used to adjust the structural number.

#### Roads

Public or private Rights-of-Way within the Mountain Area or as otherwise designated within this MANUAL.

#### Serviceability Index

A number indicative of the ability of the pavement to serve traffic at any particular time in its design life.

#### Signal Progression

Progressive movement of traffic at a planned rate of speed through adjacent signalized locations within a traffic control system without stopping.

#### Soil Support Value

A number which expresses the relative ability of a soil or aggregate mixture to support traffic loads through the pavement structure.

#### Speed Change Lane

A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase (acceleration lane) or decrease (deceleration lane) its speed to a rate at which it can more safely merge or diverge with through traffic.

#### Stabilometer "R" Value

A numerical value expressing the ability of a soil or aggregate to resist the transmission of vertical load in a lateral or horizontal direction.

#### Stopping Sight Distance

The minimum sight distance necessary to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

#### Storage Lane

Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during critical periods without interfering with the through lanes.

#### Streets

Public or private Rights-of-Way within the Plains Area or as otherwise designated within this MANUAL.

#### Strength Coefficient

A factor used for expressing the relative strength of each layer in a pavement structure.

#### Structural Number

A number derived from an analysis of roadbed and traffic conditions. A Weighted Structural Number is a Structural Number which has been adjusted for environmental conditions. A Weighted Structural Number may be converted to pavement structure thickness through the use of suitable factors related to the type of material being used in the pavement structure.

#### Traffic Analysis Period

A common analysis period (usually 20 years) used in geometric design.

Untreated Base Course

A layer or layers of base course without treatment of any kind.

## Transportation Studies

### Table of Contents

1. Requirements for Transportation Studies

2. Trip Generation Memoranda

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— Introduction & Summary

— Proposed Development

— Existing Area Conditions

— Projected Traffic

— Transportation Analysis

— Improvement Analysis

— Findings & Recommendations

— Appendix

— Example Report Outline

— Bibliography

Ignore I see this info  
on page 43.

Based on the latest  
version of the Trip gen?

### 1. Requirements for Transportation Studies (TS)

General: In considering the transportation aspects of land development, it is important to determine early in the process if and when a Transportation Study (TS) will be required. The trip generation from a proposed development is the main quantitative threshold; however, existing transportation issues such as a high crash location, complex intersection geometries or other specific problems or deficiencies may also necessitate a TS. A TS shall be required in accordance with the Submittal Requirements Section of the Land Development Regulation.

The TS categories are as follows:

**Trip Generation Memorandum:** A Trip Generation Memorandum (TGM) is required when the land uses proposed with a development are expected to generate between 150 and 800 vehicle-trips per day. The TGM should show a computation of trips generated from the proposed use(s). The TGM for a proposed rezoning should also include a computational comparison of the maximum possible number of trips generated from the proposed uses and the maximum possible trips generated from existing and allowed uses. Include a table summarizing trip generation estimates.

Can this be used on any type of road class? What about location to a signalized intersection. Does it need to look at requirements for turn lanes? Take a look at Broomfield Basic TIS in Broomfield Standard and Specs 162.02.03.

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**Transportation Analysis:** A Transportation Analysis (TA) ~~may be~~ required ~~by Planning and Zoning~~ during a Rezoning to determine the amount and/or distribution of traffic generated from a proposed development ~~that is expected to generate 800 average daily vehicle-trips or more. The TA should show a computational comparison of the maximum possible trips generated from the proposed use(s) compared to the number of maximum possible trips generated from existing zoning. It should also include a percentage change in the average daily traffic (ADT) and peak hour traffic of adjacent roadways. A transportation analysis is a computation of the traffic that is generated from a proposed development that is expected to generate less than 1000 average daily trips. The analysis should conceptually address any potential onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development, including improvements that may already be required by County regulations. Required improvements may include the addition of turning lanes and bicycle/pedestrian facilities, including any other improvements which may be suggested by the analysis.~~

**Minor Transportation Study:** A Minor Transportation Study is required when a proposed development is expected to generate 1000 average daily trips per day or more, and the traffic impacts are localized as determined by Planning and Zoning. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

**Major Transportation Study:** A Major Transportation Study is required when a proposed development is expected to generate 1000 average daily trips or more, and the traffic impacts are regional as determined by Planning and Zoning. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the widening or realigning of existing streets; the addition of new intersections or interchanges; the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

**Transportation Impact Study:** A Transportation Impact Study (TIS) is required during a Site Development Plan (SDP) or Plat process when a proposed development is expected to generate 800 average daily vehicle-trips or more. While the trip generation from a proposed development is the main quantitative threshold, existing transportation issues such as a high crash location, complex intersection geometrics or other specific problems or deficiencies may also necessitate a TIS. The scope of the TIS should be agreed upon by the County and the applicant during the Preliminary Application process. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

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**Letter of Conformance with an Approved TIS:** If a development in the Site Development Plan process is expected to generate more than 800 new vehicle trips, and there is an approved TIS on file from the last 3 years for the overall or regional development, a letter of conformance describing that the uses proposed in the development match those assumed in the overall TIS and a copy of that TIS are required.

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## **2. Trip Generation Memoranda**

### **A. Responsibility**

**General:** The applicant is responsible for providing trip generation computation when proposing a development generating between 150 and 800 vehicle trips.

**Review Process:** The TGM for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the TGM with each re-submittal.

**Certification:** The TGM shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

### **B. Format**

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The TGM data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review.

Introduction and Summary

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The purpose of the TGM should be clearly stated. This section should concisely summarize findings and conclusions.

Proposed Development

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Provide a description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, and access roadways.

Existing Conditions

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Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected.

Trip Generation Comparison Table

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Provide a trip generation comparison table showing the traffic generated from existing land use(s) compared to the maximum potential trip generation for land uses associated with the proposed development. The latest edition of ITE’s Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE’s Trip Generation Handbook, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar uses are available, an analysis of the proposed use based on the site’s capacity may be considered.

Findings

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Provide a summary of findings, including the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed.

C. Example Outline

Trip Generation Memo

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[Development Title]

Case Number: XX-XXXXXX XX

Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

Report Author

[Name]

[Address]

[Phone Number]

[Email]



Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

Purpose of Analysis

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Introduction

The purpose of this Trip Generation Memo is to evaluate the potential impacts of the proposed development to the surrounding transportation network.

Project Overview

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[[Description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, access roadways, and proposed development phasing. Site plan should not be included in this analysis.]]

Existing Roadway System

Road classification and speed??

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[Include a description of the study area roadways and intersections including current traffic

Projected Transportation Impact

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Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable]

Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											
Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
Comparison Table											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

Findings

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[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the transportation network]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

Appendix

[Insert any data used in analysis:]

Trip Generation Calculations

Traffic Counts

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## 2. Responsibility for Transportation Studies

*General:* The impacts from a proposed development as assessed in the TS are the primary responsibility of the applicant and their engineer.

*Review Process:* The TS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study, if applicable.

*Certification:* The TS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TS shall be signed and sealed by a registered professional engineer in the State of Colorado.

## 3. Transportation ~~Study Format~~Analyses

### A. Responsibility

General: The applicant is responsible to demonstrate how transportation systems can accommodate the traffic generated by a proposed development or how the system can be improved to accommodate the traffic generated by the development.

Review Process: The TA for a proposed rezone will undergo an iterative review process in accordance with the Zoning Resolution. The applicant shall provide a letter identifying changes to the TA with each re-submittal.

Certification: The TA shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

### B. Format

Throughout the TA, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review.

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### Introduction and Summary

The purpose of the ~~TS~~TA should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, ~~conclusions~~conclusions, and recommendations of the ~~TS~~TA.

### Proposed Development

Provide a description of the land, parcel size, ~~general terrain features~~ and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site specific development should be described. This includes a discussion of location, proposed zoning, land use and intensity. A site plan is not necessary within a TA, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

How did you determine?  
Broomfield was using 2yr.

### Existing Area Conditions

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County. Roadways that provide access to the site ~~as well as future roadways included in the study area~~ are included in this section. ~~Existing intersections within the study area as well as geometrics and traffic signals should be identified. The existing and proposed uses of the site should be identified in terms of various zoning categories of the County. The land use generating the most trips should be used for the analysis.~~ Current traffic volume counts should be collected to determine existing traffic conditions in the study area. ~~If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected.~~ These counts ~~may should~~ include ~~those for street-average daily traffic and for intersection peak hour turning movements within the study area.~~

### Projected Traffic

~~The main component of the TA~~One of the most critical elements of the TS is estimating the amount of traffic being generated ~~from a proposed development. A trip generation comparison table showing computational comparison of the maximum possible trips generated from the proposed uses and the maximum possible trips generated from existing and allowed uses shall be provided. The latest addition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar uses are available, an analysis of the proposed use based on the site's capacity may be considered.~~ Include a table summarizing trip generation estimates. Calculate the percentage increase in average daily traffic with the proposed development over the existing traffic.

~~Computer Software:~~ A number of computer software packages are available that are designed to either produce trip generation data or accept trip generation data for further analysis.

~~Trip Distribution:~~ The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

~~Trip Assignment:~~ The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3-year projected and 20-year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

~~Internal Trips:~~ Trips captured internally by a proposed development may be applicable depending on the use. The internal capture rates used should be based on the current version of the ITE's *Trip Generation Handbook*.

~~Pass-by trips:~~ Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass-by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway. Findings and Recommendations

Summarize the proposed development, its impacts, and the possible mitigation strategies.

C. Example Outline

### Rezoning Transportation Analysis

[Development Title]

Case Number: XX-XXXXXX RZ

Applicant Information

[Name]  
[Address]  
[Phone Number]  
[Email]

Report Author

[Name]  
[Address]  
[Phone Number]  
[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

[Cert Number/Seal and Signature of Certified Transportation Professional (PE, AICP-CTP, ITE-PTP) (If applicable)]

Purpose of Analysis

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Introduction

The purpose of this Transportation Analysis is to evaluate the potential impacts of the proposed zoning to the surrounding transportation network. If the proposed zoning is approved, the Applicant will be required to submit a Transportation Impact Study to determine specific mitigation measures and must satisfy County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates at the time of Site Development Plan (SDP) and/or Preliminary and Final Plat (PF).

Project Overview

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[Description of the project site including size, location, current land use, intensity, existing zoning, and proposed zoning. Site plan should not be included in this analysis.]

Study Area

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[Description of the study area and impacted roadways and intersections. The study area limits should be described and mutually agreed to between the applicant and the county. The study area should not include roadways proposed interior to the development.]

Existing Roadway System

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[Include a description of the study area roadways and intersections including existing traffic counts, lane geometry, posted speed limits, current traffic control at intersections, presence of pedestrian and bicycle infrastructure, availability of on-street parking, and whether a roadway is private or public.]

Projected Transportation Impact

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Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable during rezoning]

**Trip Generation Summary Table**

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Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											
Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
Comparison Table											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

**Analysis**

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[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the transportation network. Provide the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed. Level of Service (LOS) calculations are not required with a TA.]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

**Recommendations**

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[Summarize the anticipated public improvements and strategies and/or recommendations to mitigate potential negative impacts to the transportation network in the study area]

**Table 2: Anticipated Public Improvements**

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Summary of the anticipated public improvements per County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates (shoulders, sidewalks, curb and gutter, bicycle infrastructure, etc.) if the zoning is approved and the applicant proceeds to subsequent development processes.

Location	Improvements

**Table 3: Potential Mitigation Strategies**

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Summary of potential strategies and/or recommendations that show an ability to mitigate traffic impacts from the proposed rezoning to the study area.

[List strategies that can address potential impacts of increased trip generation from the proposed zoning. Impacts should be those that are common for the location type and the level of trip generation increase. Recommendations should generally indicate if strategy is feasible at the location indicated.]

<u>Location</u>	<u>Strategy</u>	<u>Recommendation</u>

- G. Appendices should include the following:
1. Site plan.
  2. Aerial showing the location of proposed access and adjacent accesses (include measurements between access).
  3. Directional and access distribution diagram.
  4. Peak hour turning movement diagram.
  5. If Auxiliary lanes are required include a sketch of improvements (length of taper, decel, storage).

Broomfield requires this info in the appendix for our basic study. The aerial for drive spacing and the direction distribution have been very helpful.

Appendix

[Insert any data used in analysis]

Trip Generation Calculations

Traffic Counts

4. Transportation Impact Studies

A. Responsibility

General: The applicant and their engineer are responsible for mitigating the impacts from a proposed development as assessed in the TIS.

Review Process: The TIS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study with each re-submittal of the TIS.

Certification: The TIS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TIS shall be signed and sealed by a registered Professional Engineer in the State of Colorado.

B. Format

Throughout the TIS, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review.

Introduction and Summary

The purpose of the TIS should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions, and recommendations of the TIS.

Proposed Development

Provide a description of the land parcel size, general terrain features and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site-specific development should be described. This includes a discussion of land use and intensity, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

Existing Area Conditions

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County.  
Transportation Design and Construction Manual – Amended 12-17-19XX-XX-XX

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during the Preliminary Application process. Roadways that provide access to the site as well as future roadways included in the study area are included in this section. Existing intersections within the study area as well as geometrics and traffic signals should be identified. The existing and proposed uses of the site should be identified. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts should include average daily traffic and intersection peak hour turning movements within the study area.

#### Background Traffic

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Background traffic growth estimates should be based on the most recent regional Travel Demand Model available. Overly conservative projections of background growth will not be accepted. If a growth model is not available for the study area, a reasonable growth rate considering area development potential shall be agreed upon by the applicant and the County during the Preliminary Application process. Growth rates above 2% per year will not be considered.

Trips generated by other approved developments within the study area, that were not included in the traffic counts collected, may be added to the background growth and referenced in the TIS. However, the combined background growth rate from area development and growth modelling shall not exceed an average of 2% per year.

#### Projected Traffic

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One of the most critical elements of the TIS is estimating the amount of traffic being generated. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar uses are available, an analysis of the proposed use based on the site's capacity may be considered. Include a table summarizing trip generation estimates.

Trip Distribution: The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

Trip Assignment: The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3-year projected and 20-year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

Internal Trips: Trips captured internally by a proposed development may be applicable depending on the use. The internal capture rates used should be based on the current version of the ITE's Trip Generation Handbook.

Pass-by trips: Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway. Pass-by trips shall still be applied to the site's driveways and any local roadways between the site and the roadway from which the trips are diverted. Pass-by trip reductions should not be made to the overall trip generation prior to trip assignment.

#### Transportation Analysis

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Capacity analysis is required for each of the major street and site access locations (signalized and un-signalized) within the ~~TS-study~~ area. A clearer understanding of both the transportation related implications of the project and the necessary improvements to ensure acceptable operating conditions should result from this section of the TS. In addition, the following County ~~Plans-plans~~ and ~~Program~~ program and ~~Factors-factors~~ shall be considered in the transportation analysis: ~~County Plans and Program~~, Major Thoroughfare Plan, Bicycle ~~and Pedestrian~~ Plan and Traffic Impact Fee Program.

Factors:

- Safety
- Neighborhood Impacts
- School Zone Traffic Control
- Traffic Control Needs
- Transit Needs or Impacts
- Transportation Demand Management
- Circulation Patterns
- On-site Parking Adequacy and Off-site Parking Facilities
- Pedestrian and Bicycle Movements/Continuity of Facilities
- Service and Delivery Vehicle Access
- Emergency and Fire Apparatus Access

*Transportation Safety:* The initial review of existing conditions within the TIS area ~~should-shall~~ include analysis of crash data from the 3 most recent years available. Any intersection experiencing Level of Service of Safety (LOSS) III or IV, or above average crashes on the state-specific Safety Performance Functions, a crash rate of over 1 per million entering vehicles will need additional analysis. The proposed site plan should ensure that the internal circulation system and external access points improve pedestrian and bicyclists safety and minimize vehicle/pedestrian and vehicle/bicyclists conflict points.

*Transportation Operations:* Impacts on transportation operations shall be measured based on the definitions contained in the current version of the *Highway Capacity Manual (Transportation Research Board)*. For each analysis period studied (typically 3 and 20 year periods) and for each phase of the project a projected total traffic volume must be estimated for each critical intersection and roadway segment being analyzed. The projected total traffic volumes (consisting of the summation of existing traffic, background growth traffic, background development traffic and site traffic) will be used in the next step-capacity analysis of future conditions.

*Signalized Intersections:* Level of Service (LOS) is based on roadway system characteristics that include:

- traffic volume
- lane geometry
- percentage of trucks
- peak hour factor
- number of lanes
- signal progression
- ratio of green time to cycle time (G/C)
- roadway grades
- parking conditions
- bicycle and pedestrian flows

The LOS categories are established in the *Highway Capacity Manual*. In general, LOS ratings of A to D are acceptable while E & F ratings must be mitigated. There are a number of software programs that can determine highway capacity.

*Unsignalized Intersections:* LOS for multi-way stop controlled intersections and driveway intersections must be determined by computing or measuring control delay. Where capacity analysis shows a LOS of D or worse, an analysis should be completed to determine if a signal, roundabout, or turn restriction might be needed. Any proposed all-way stop intersection must be justified using MUTCD's guidance on multi-way stop applications. Any newly signalized intersections must be justified using MUTCD Warrant 2 (Four-Hour Vehicular Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX



Volume). Alternatively, Warrant 3 (Peak Hour Volume) may be evaluated only if the unusual cases as defined in the MUTCD apply.

*Roundabouts:* In cases where LOS analysis indicates that an unsignalized intersection is expected to be LOS D or worse, a roundabout will be assessed before consideration will be given to a proposed signalized or multiway stop intersection. Factors for consideration of a roundabout include:

- availability of right-of-way
- crash history or potential
- traffic volume
- lane geometry
- number of lanes
- roadway grades
- parking conditions
- bicycle and pedestrian flows
- level of service

Each proposed location for a roundabout will be evaluated on a case by case basis. The capacity of a roundabout must be evaluated, and appropriate analytical software programs shall be utilized.

Parking: Utilizing ITE's Parking Generation Manual as a starting point, provide an estimate of how much parking the proposed development will generate. Parking utilization rates from similar sites may aid in this analysis.

Queueing: Provide an analysis of projected 95th percentile queues to determine adequacy of existing and proposed turn lane storage lengths, and whether any through-queues block adjacent intersections.

#### **Improvement Analysis**

The improvements required to accommodate existing, background and site generated traffic are summarized in this section. Intersections serving the development should be analyzed first. The analysis should include the following steps:

- Identification of critical movements and corresponding intersection approaches.
- Determine if the intersection needs new types of traffic control such as roundabout, signalization or multi-way stop control. ~~The Transportation Study indicates that an intersection internal, adjacent or within 500 feet of the development will satisfy the MUTCD Peak Hour Warrant or Four-Hour Warrant within 20 years.~~
- Evaluation of each critical movement under potential scenarios of adding lanes, altering signal phasing, signal timing or lane use.
- Evaluation of signal locations, phasing and timing, with particular emphasis on corridor signal progression.
- Evaluation of queue lengths for both turn and through lanes to ensure adequate storage space.
- Identification of potential improvements within the contexts of Right-of-Way availability, intersection spacing, signal progression, County design standards and practical feasibility.

#### **Findings & Recommendations**

~~Summarize the proposed development, its impacts, and the proposed mitigation measures. Throughout the TS, data should be presented in tables, graphs, maps and diagrams in lieu of a narrative, for clarity and ease of review. The examples contained in ITE's current version of Publication No. RP-020C Transportation Impact Analysis of Site Development is an excellent source of information.~~

#### C. Example Transportation Impact Study Outline

#### Transportation Study

Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

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[Development Title]

Case Number: XX-XXXXX SD/PF

-

Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

-

Report Author

[Name]

[Address]

[Phone Number]

[Email]

-

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

-

[Seal and Signature of Colorado Professional Engineer]

Page Break

**Executive Summary**

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**Table of Contents**

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List of Figures

List of Tables

**Purpose of Analysis**

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-

**Proposed Development**

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Project Location

[Insert vicinity map showing the location of the project site in relation to the surrounding transportation network]

Project Overview

[Description of the site including size, location, land use, intensity, existing zoning, proposed zoning, access locations and proposed development phasing.]

**Existing Area Conditions**

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[Include diagrams and narrative of traffic counts collected]

**Background Traffic**

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[Include reference to source Travel Demand Model, any nearby developments considered, and diagrams of 3-year and 20-year projections]

**Projected Traffic**

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Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development including any trip reduction considerations, internal trip capture rates and pass-by trips as applicable]

Trip Generation Summary

[Table including land use, intensity, ITE Code, daily traffic volume, peak hour: in, out and total traffic volumes.]

Trip Distribution

Pass-by Trips (if applicable)

Trip Assignment

3-Year Horizon

20-Year Horizon

**Transportation Analysis**

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Level of Service

[LOS diagrams at all study area intersections]

Safety

[LOSS Analysis]

Intersection Controls

[Roundabout analysis, signal- or all-way-stop-warrant analysis]

Parking

[Include parking generation and availability]

Queueing

[Queueing analysis at study area intersections]

**Improvement Analysis**

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[Describe any improvements needed to mitigate impacts]

–

**Conclusion and Recommendations**

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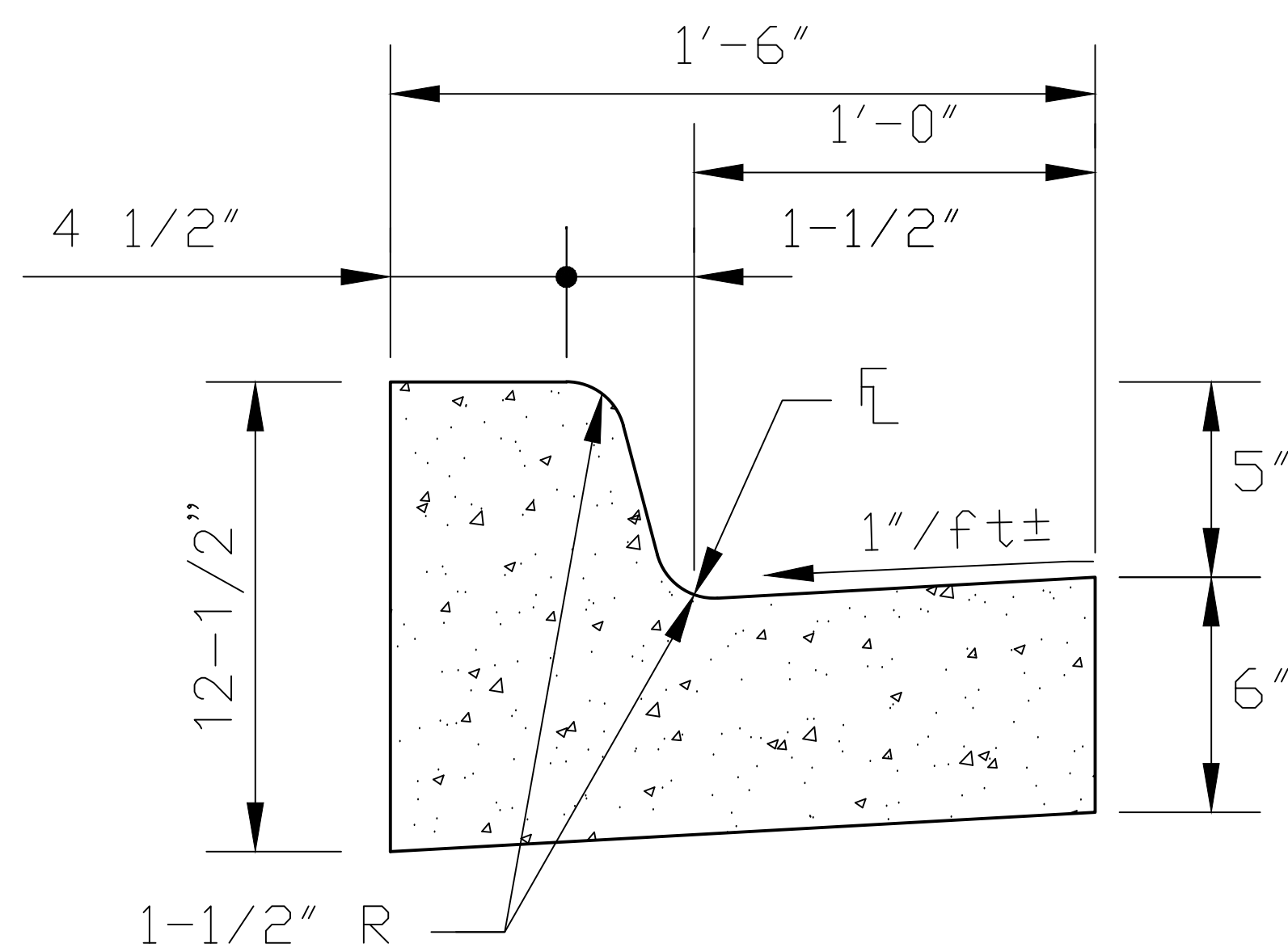
[Summarize the proposed development including site location, proposed accesses, and trip generation.]

**Appendices**

- Site Plan
- Traffic Counts
- Growth Calculations
- Nearby Development Trip Estimates\*
- Trip Generation Sheets
- LOS Worksheets (Synchro or equivalent)
- Roundabout Analysis\*
- Signal and/or All-Way Stop Warrants\*
- LOSS Worksheets
- Parking Generation Sheets
- Queueing Analysis Worksheets
- Signal Progression Analysis\*

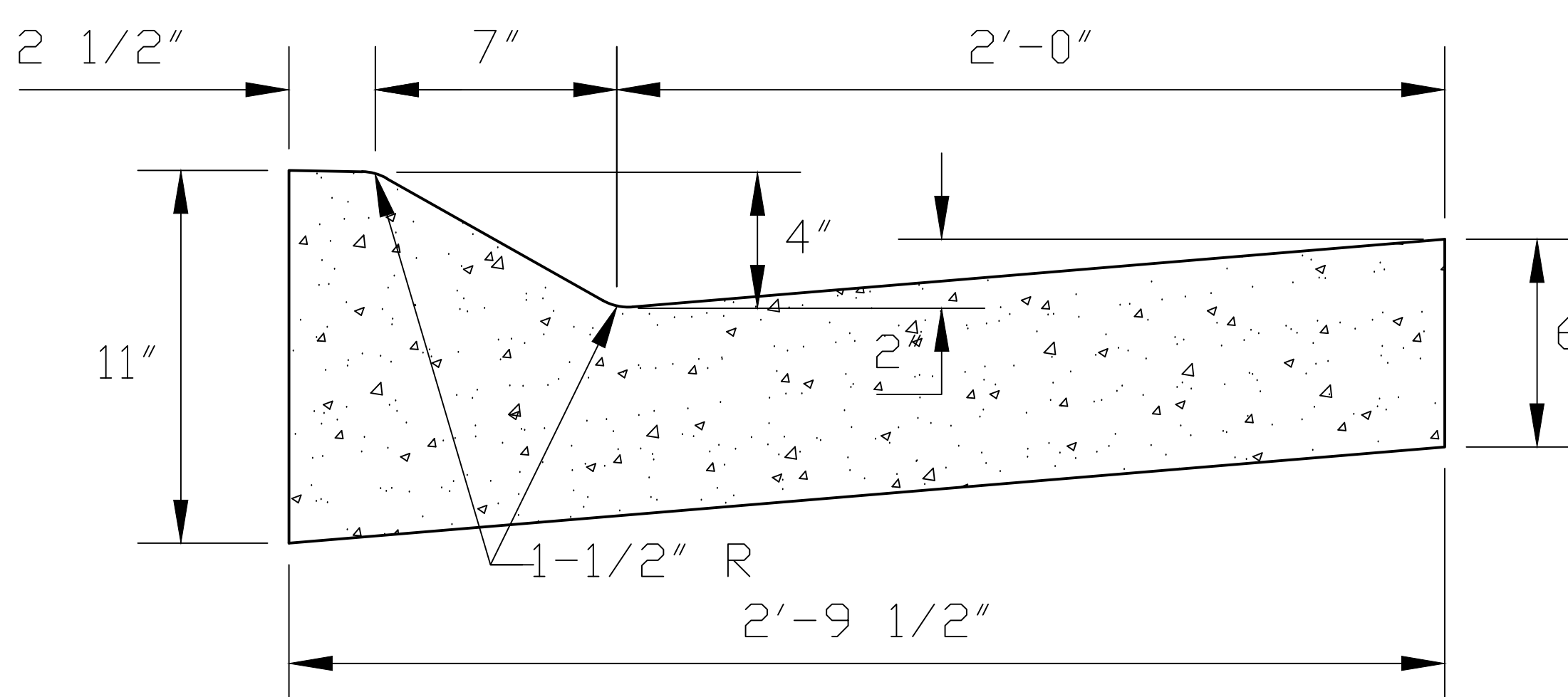
\*as applicable

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\* 6" VERTICAL CURB WITH  
1' GUTTER IS REQUIRED FOR  
ALL RAISED MEDIANS.

6" VERTICAL CURB  
WITH 1' GUTTER

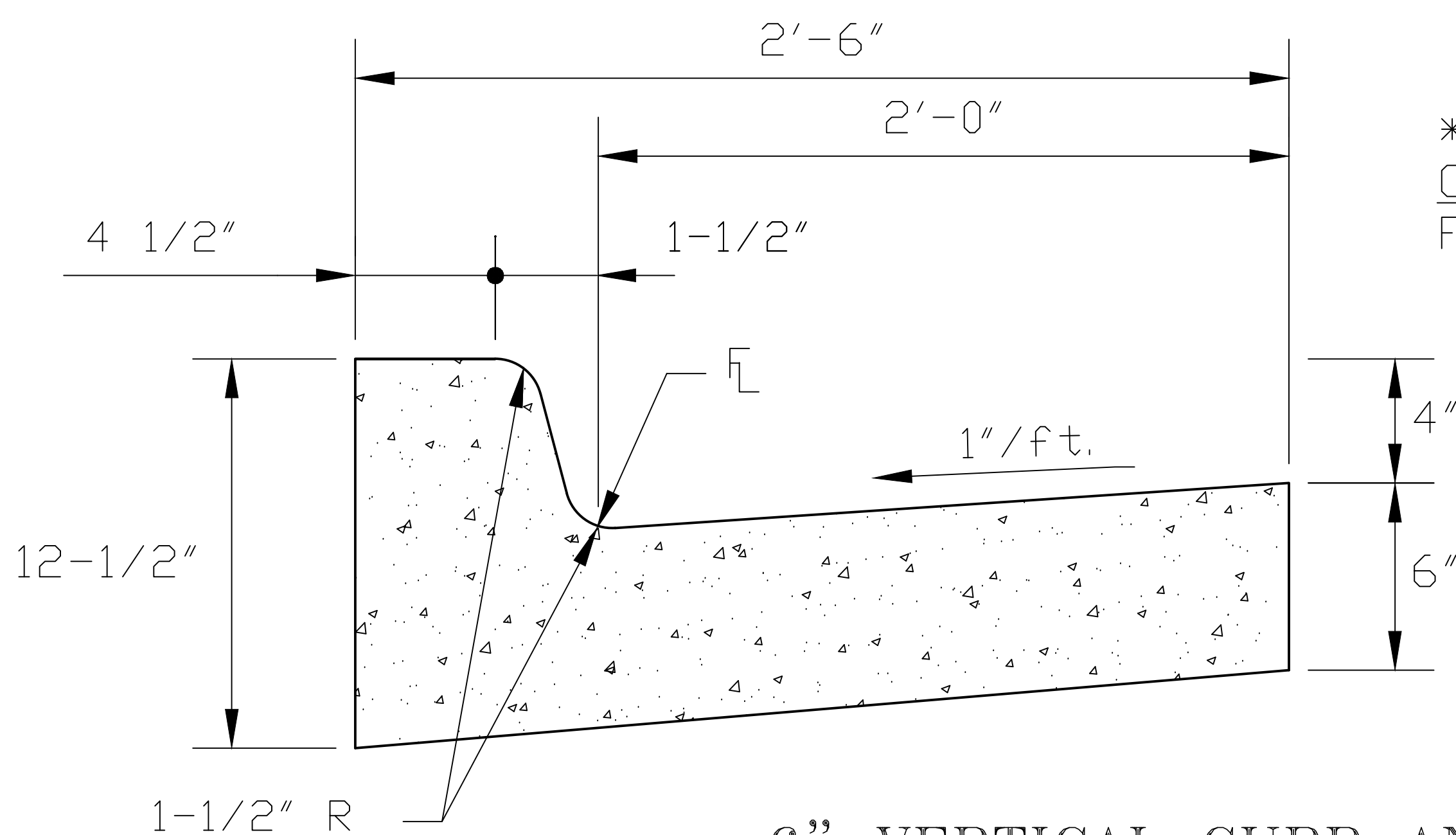


\* SEE STANDARD NO. 10 FOR  
CONCRETE JOINT DETAILS

\* ANY CURB TRANSITION FROM COMBINATION CURB, GUTTER AND SIDEWALK TO 6" VERTICAL CURB AND GUTTER SHALL TAKE PLACE IN A MINIMUM OF 12 FEET.

\* COMBINATION CURB, GUTTER,  
AND SIDEWALK IS REQUIRED  
FOR LOCAL STREETS.

## MOUNTABLE CURB & GUTTER



\* SEE STANDARD NO. 10 FOR  
CONCRETE JOINT DETAILS  
FOR ALL CURB AND GUTTER.

6" VERTICAL CURB AND GUTTER

DATE: 01/04/2016	<div>JEFFERSON COUNTY</div> <div>DIVISION. of TRANSPORTATION &amp; ENGINEERING</div> <div>100 JEFFERSON CNTY. PKWY., SUITE 3500</div> <div>GOLDEN, CO. 80419 (303) 271-8419</div>
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	
SCALE:	
FILE: STND-1	

CURB & GUTTER

JEFFERSON COUNTY  
DIVISION of TRANSPORTATION & ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8419

CURB &amp; GUTTER



- COMBINATION CURB, GUTTER AND SIDEWALK

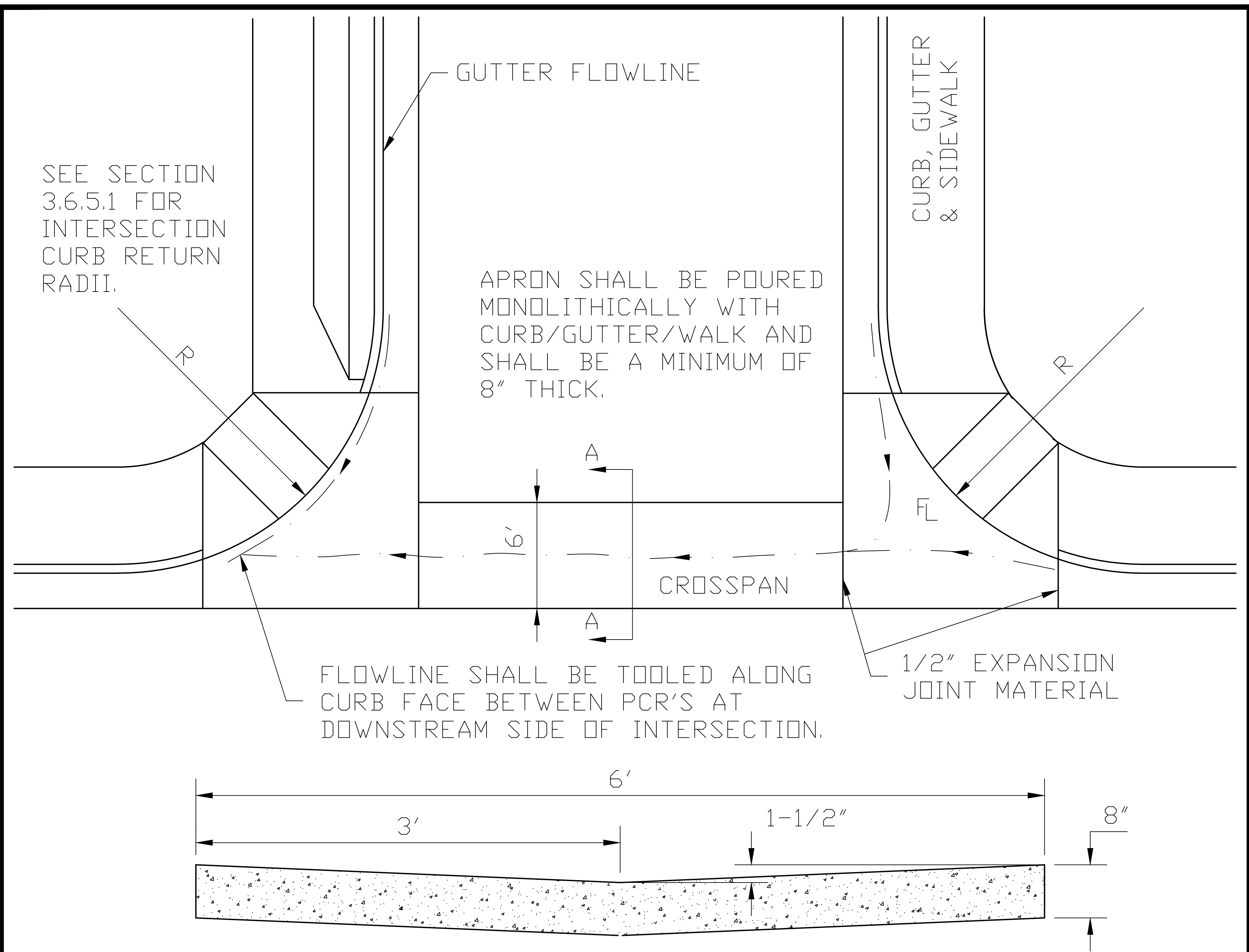


- ## 6" VERTICAL CURB, GUTTER AND ATTACHED SIDEWALK



- ## 6" VERTICAL CURB, GUTTER AND DETACHED SIDEWALK

DATE: 07/15/2019	JEFFERSON COUNTY DIVISION. of TRANSPORTATION & ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8419
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	STANDARDS 2, 3 & 4
SCALE:	
FILE: STND-2-3-4	

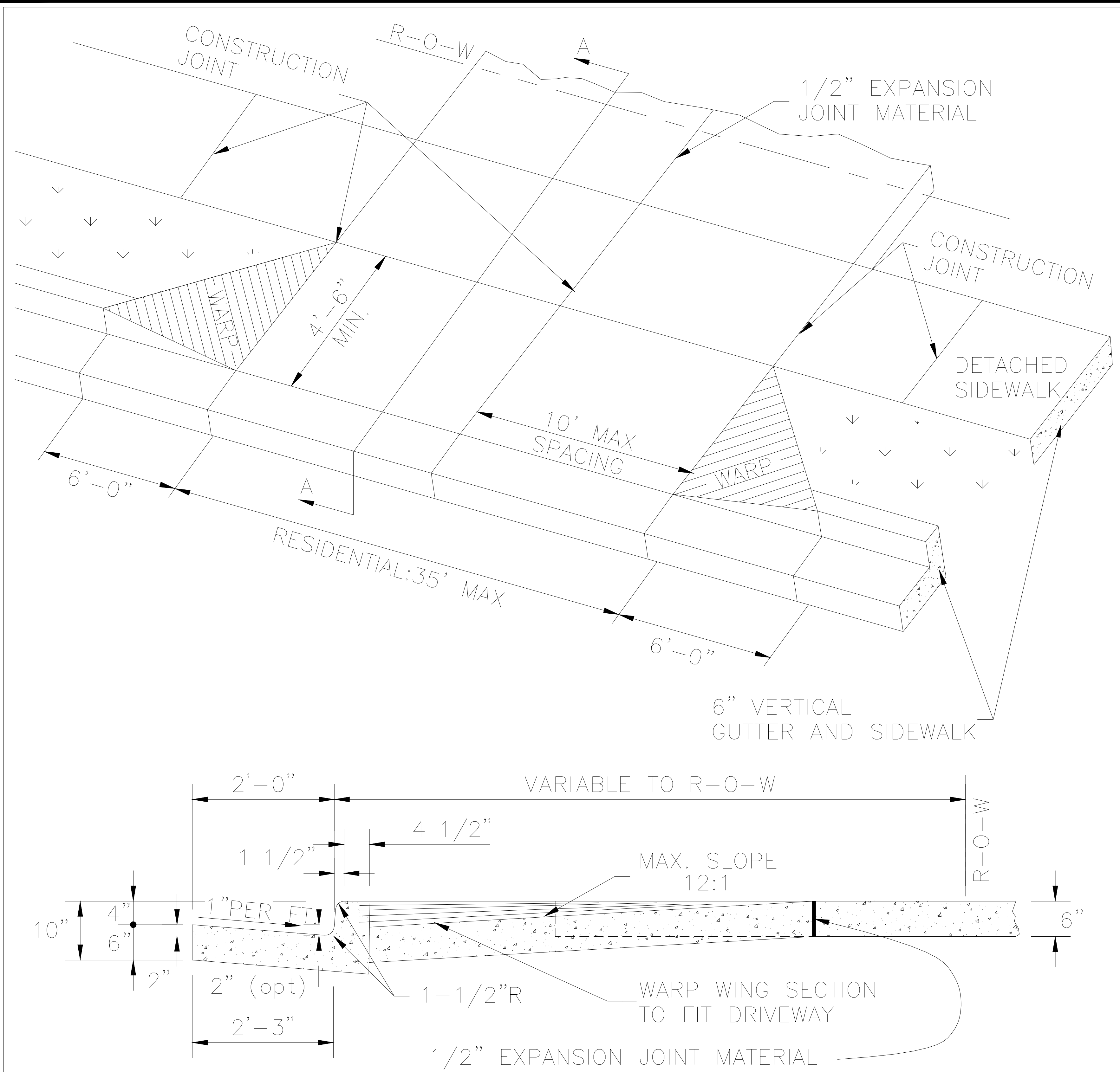


**SECTION A - A**  
**6 FOOT CROSSPAN**

**NOTE:**

- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS.
- \* EXPANSION JOINTS ARE REQUIRED AT P.C.R.'S.
- \* CROSSPANS ARE NOT PERMITTED ACROSS ARTERIAL/COLLECTOR STREETS.

DATE: 7/30/2018	JEFFERSON COUNTY DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	TYPICAL INTERSECTION CROSSPAN
SCALE:	
FILE: STND-5	



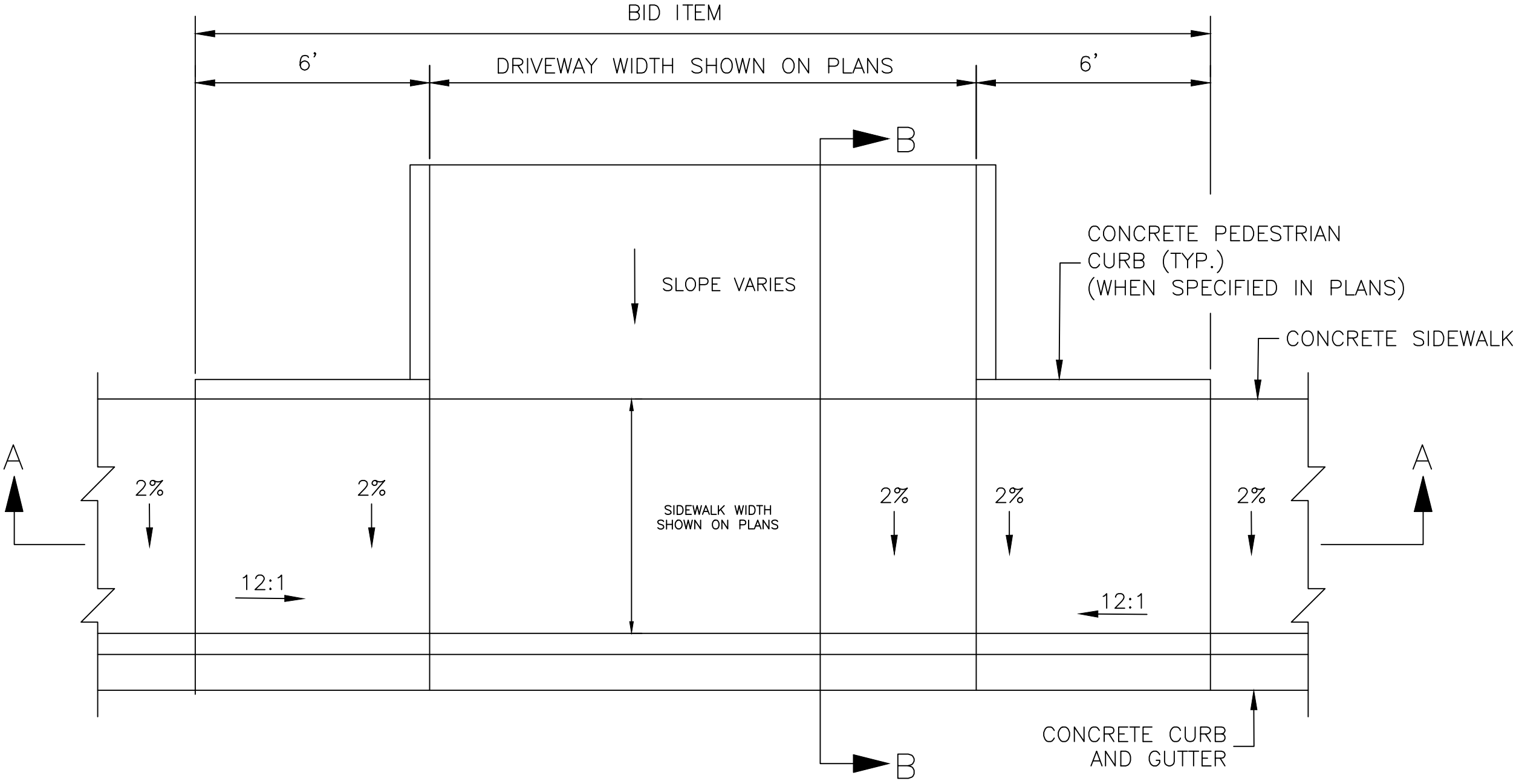
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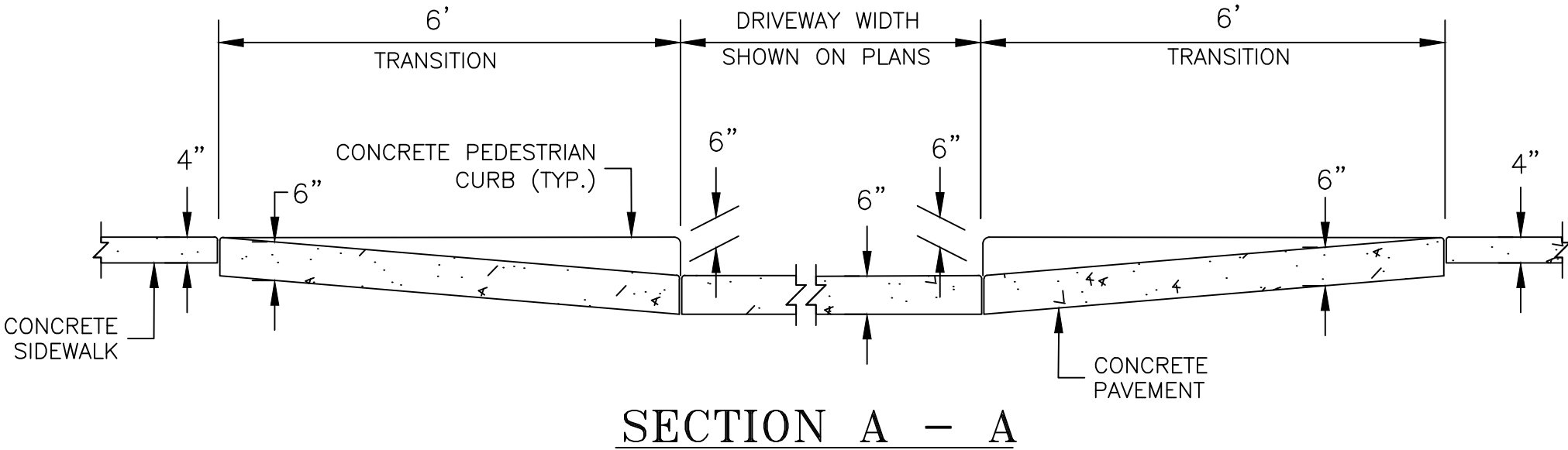
### SECTION A - A

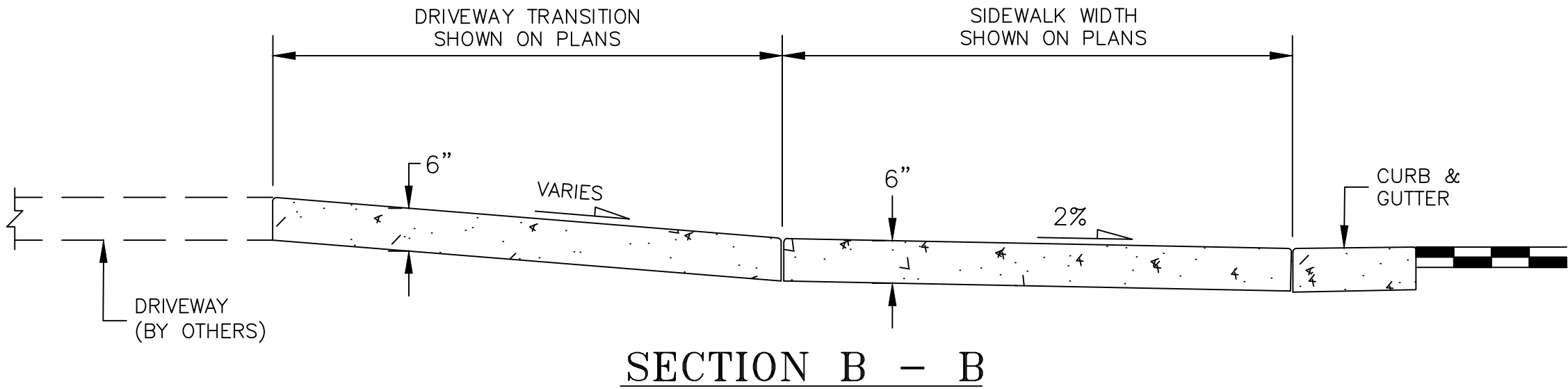
- \* THIS STANDARD IS NOT ALLOWED ON ARTERIAL STREETS.
- \* REFER TO DRIVEWAY INTERSECTION SPACING REQUIREMENTS IN THIS MANUAL.
- \* SEE STANDARD NO. 10 FOR CONCRETE JOINT DETAILS.

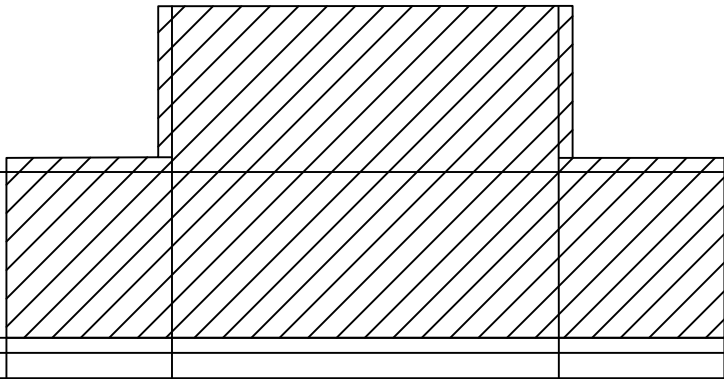
DATE: 12/8/2015	<div>JEFFERSON COUNTY</div> <div>DIVISION of TRANSPORTATION AND ENGINEERING</div> <div>100 JEFFERSON CNTY. PKWY., SUITE 3500</div> <div>GOLDEN, CO. 80419 (303) 271-8495</div>
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	
SCALE:	
FILE: STND-6	<div>DRIVEWAY SECTION FOR</div> <div>6" VERTICAL CURB &amp; GUTTER</div>



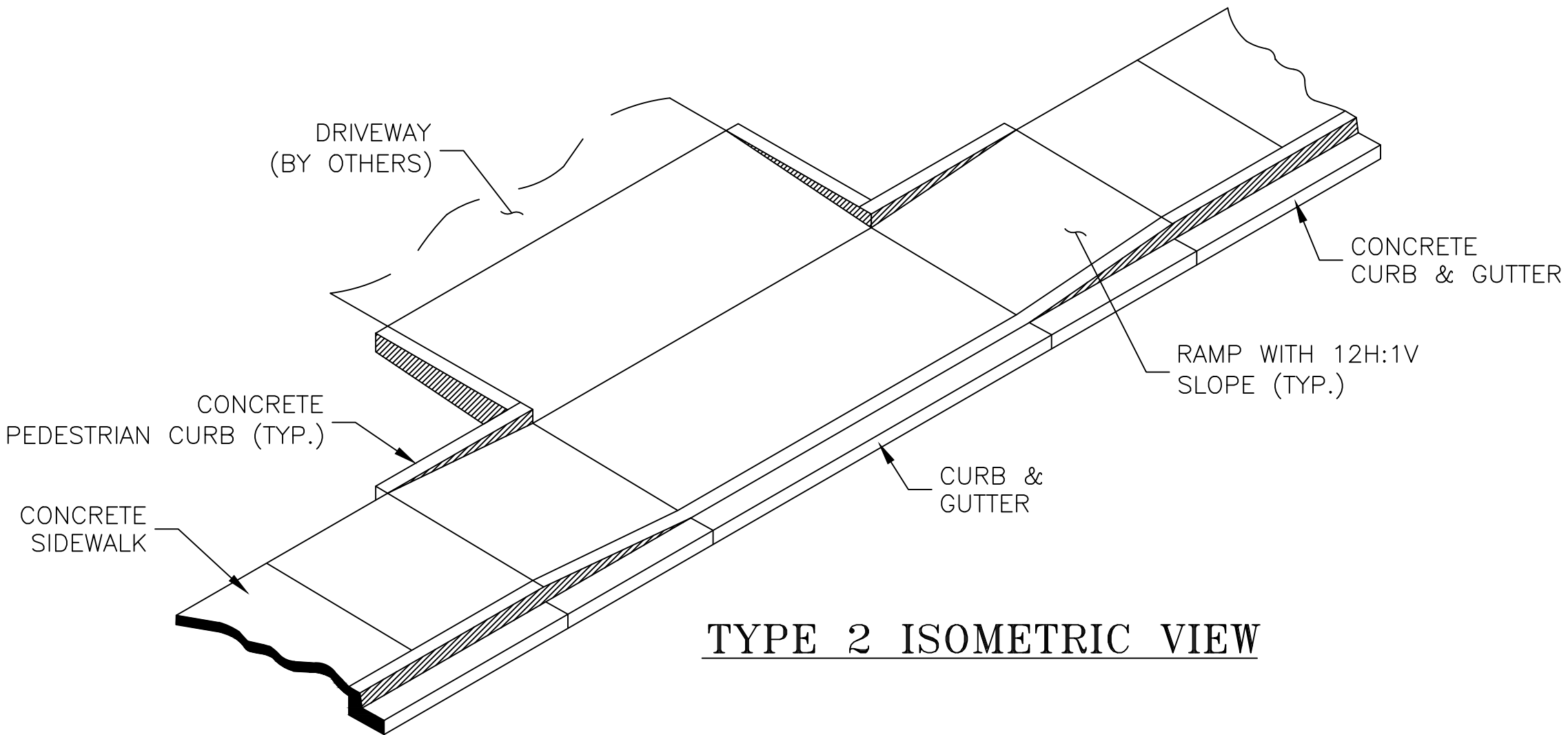






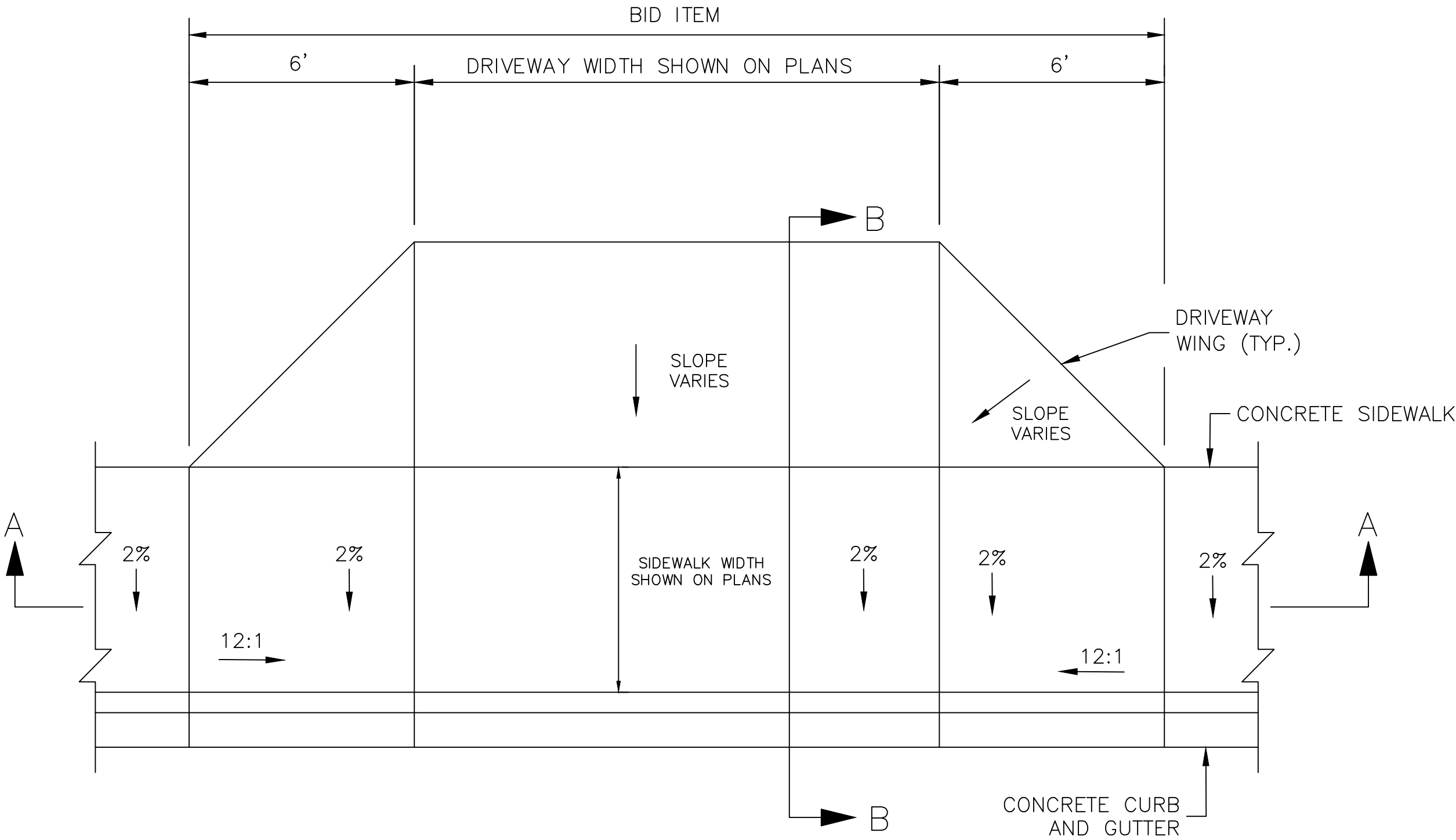


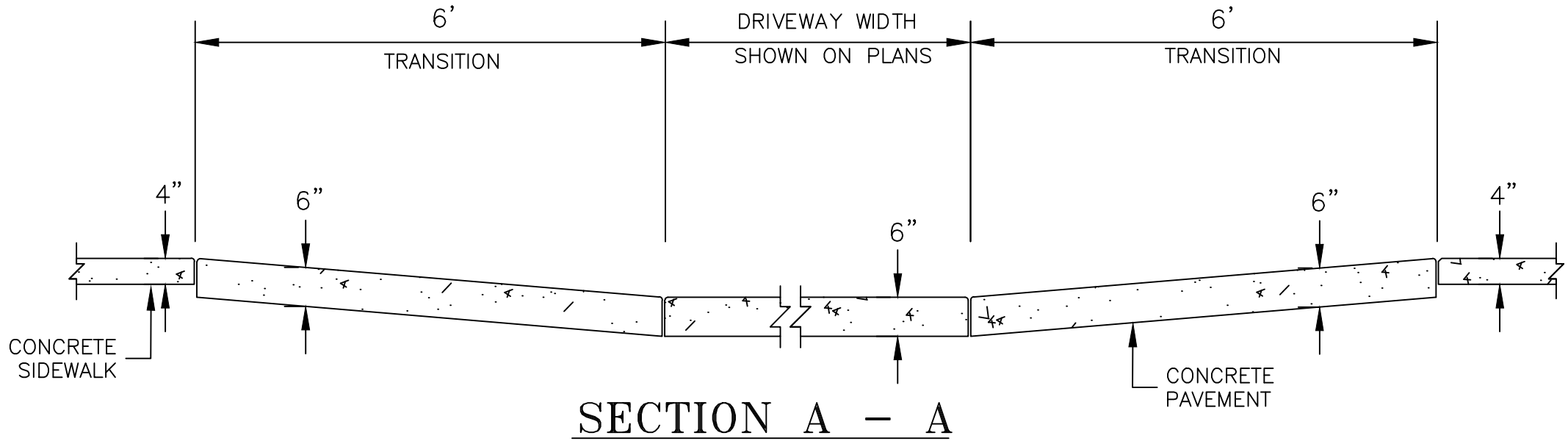
CONCRETE PAVEMENT PAY AREA



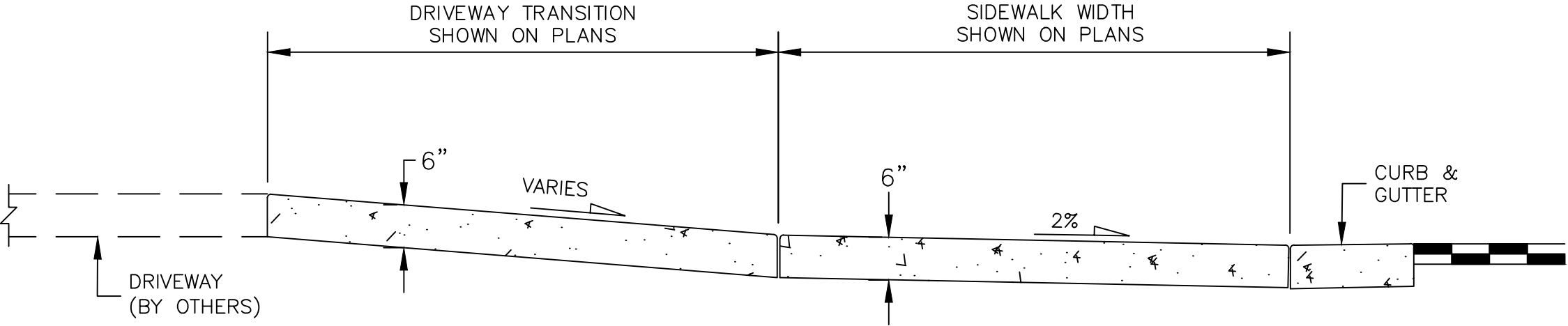
# NOTE:

1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.
2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.
4. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE PAVEMENT.

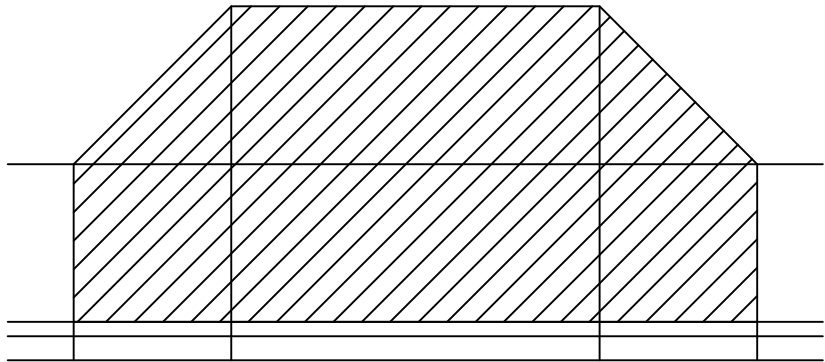




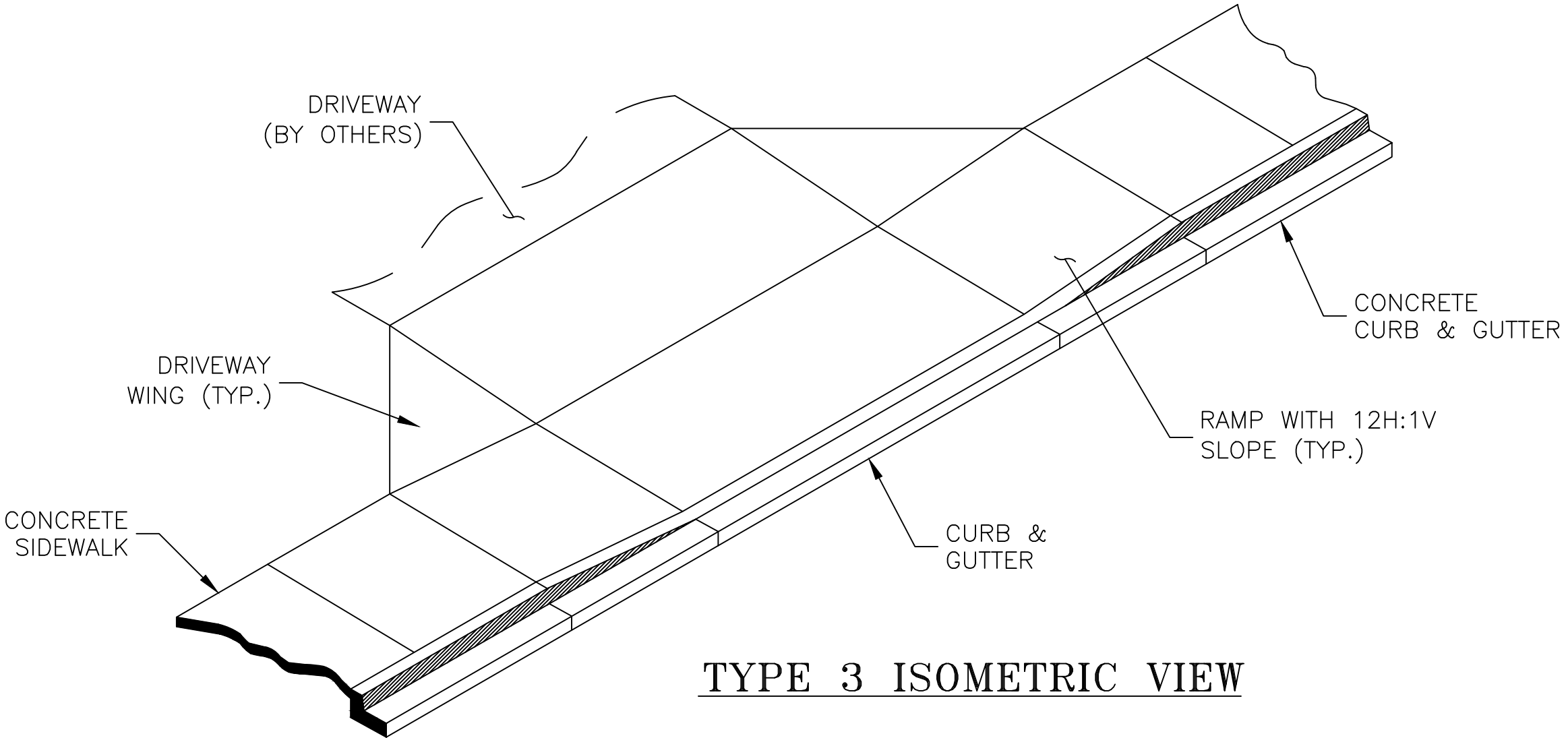




SECTION B - B

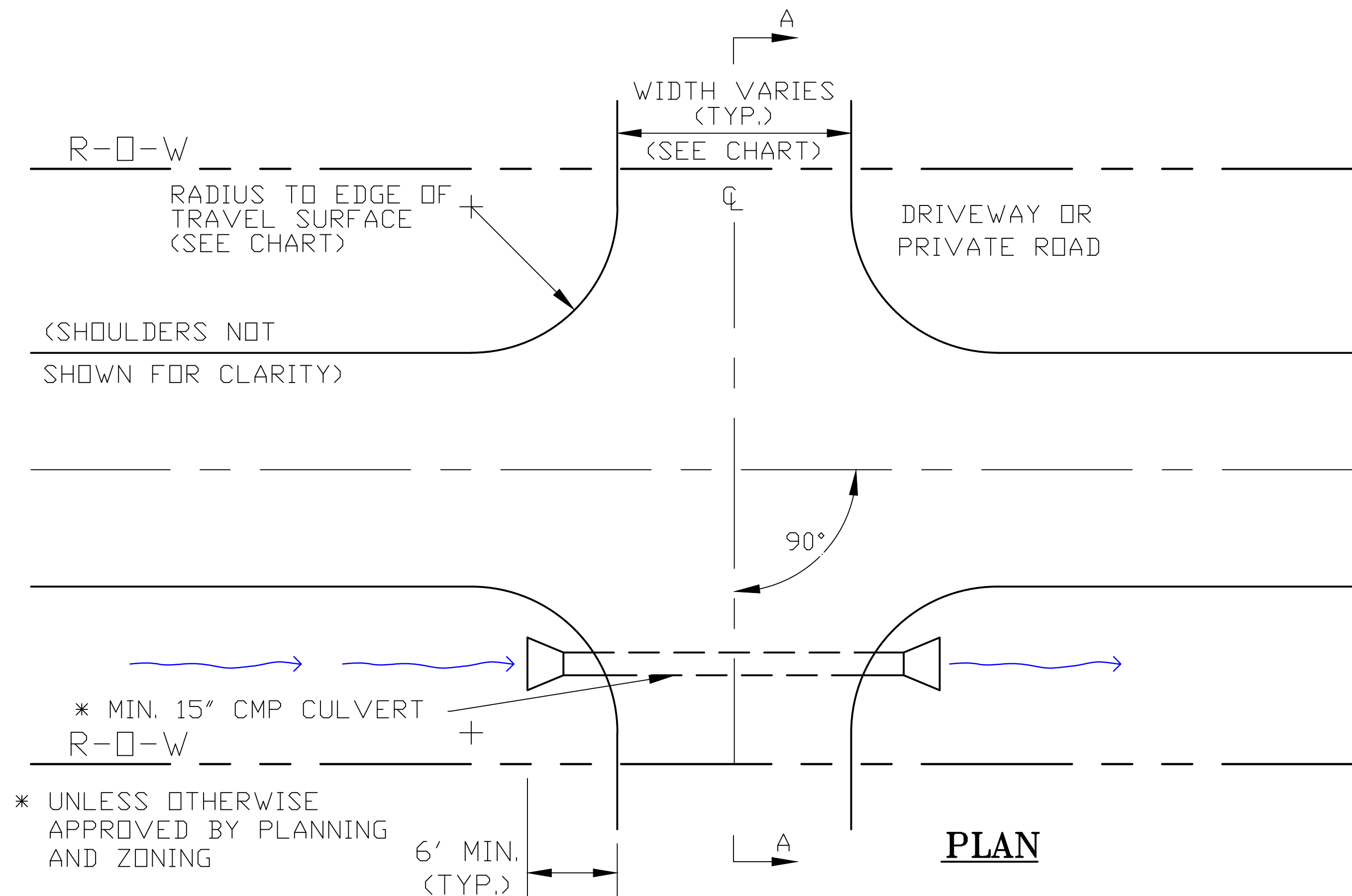


CONCRETE PAVEMENT PAY AREA



# NOTE:

1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.
2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.

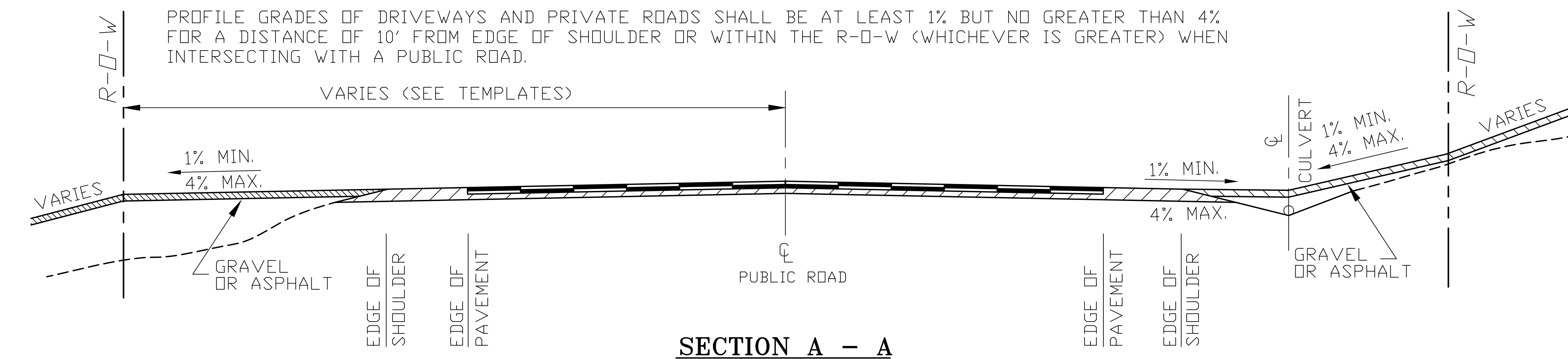


DRIVEWAYS AND PRIVATE ROADS SHALL INTERSECT WITH PUBLIC ROADS AT RIGHT (90°) ANGLES OR AS NEARLY AT RIGHT ANGLES AS POSSIBLE FOR A DISTANCE OF:

- 25' FROM THE TRAVEL SURFACE OR WITHIN THE R-O-W (WHICHEVER IS GREATER) WHEN INTERSECTING WITH A MAJOR COLLECTOR OR ARTERIAL ROAD, OR
- 15' FROM THE TRAVEL SURFACE OR WITHIN THE R-O-W (WHICHEVER IS GREATER) WHEN INTERSECTING WITH A COLLECTOR OR LOCAL ROAD.

	TRAVEL SURFACE	
	WIDTH (FEET)	RADIUS (FEET)
DRIVEWAY	10	10
PRIVATE ROAD	16-18	15

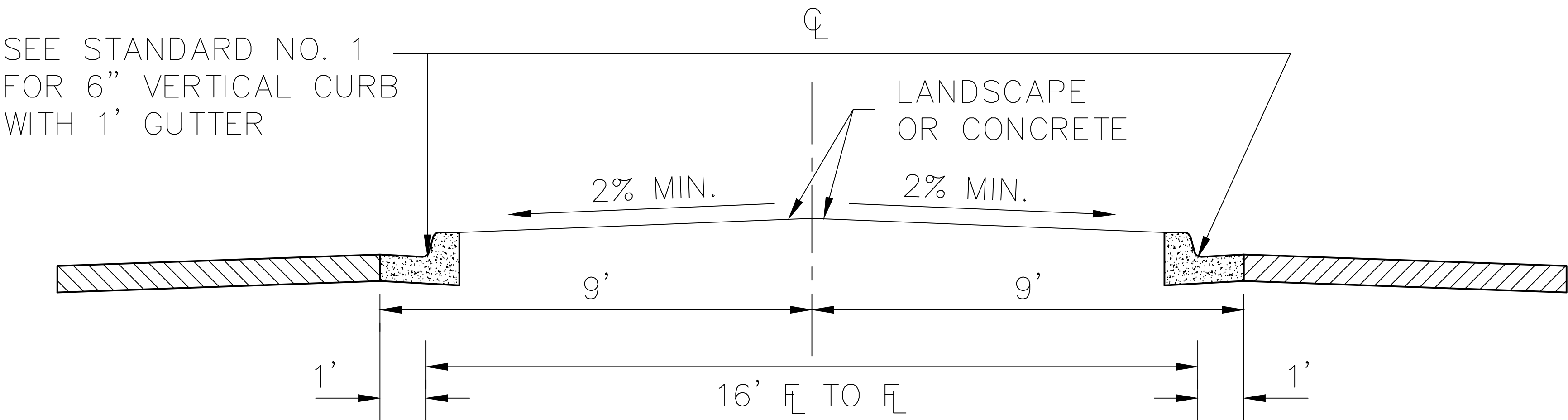
\* AN ACCESS PERMIT FROM THE JEFFERSON COUNTY PLANNING & ZONING IS REQUIRED FOR A NEW OR MODIFICATION TO AN EXISTING DRIVEWAY OR PRIVATE ROAD ACCESSING A COUNTY ROAD.



DATE: 12/9/2015  
 SCALE:  
 Drawn By: D.A.M.  
 Designed By: STAFF  
 FILE: STND-8

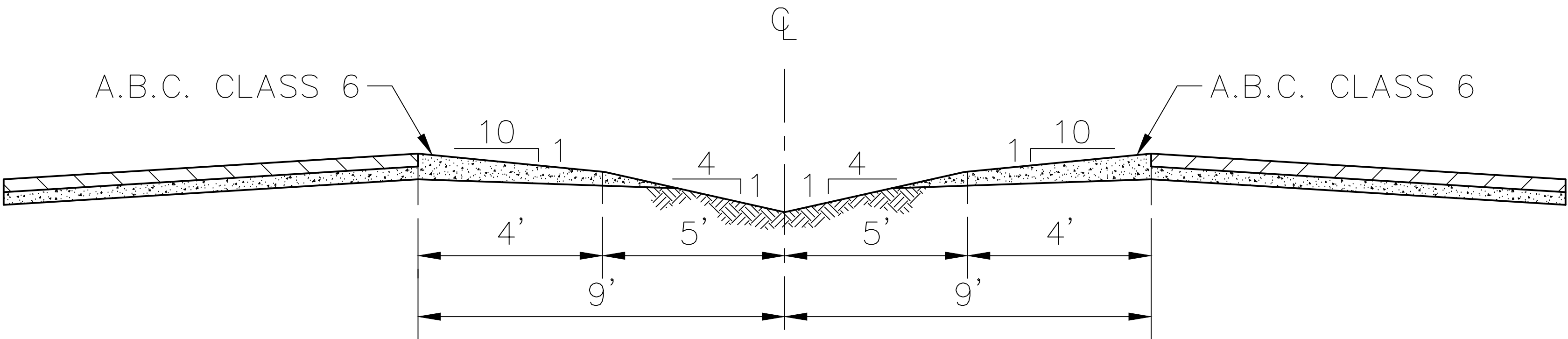
## DRIVEWAY/PRIVATE ROAD APPROACHES FOR ROADS

JEFFERSON COUNTY  
 DIVISION of  
 TRANSPORTATION AND ENGINEERING  
 100 JEFFERSON CNTY. PKWY., SUITE 3500  
 GOLDEN, CO. 80419 (303) 271-8460



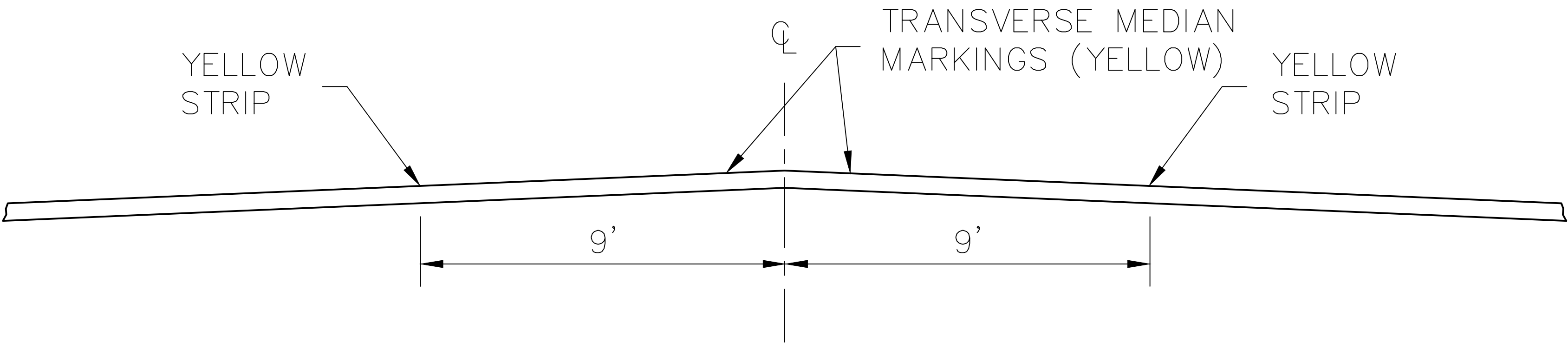
### RAISED MEDIAN

- \* MEDIAN TREATMENT SHALL BE APPROVED BY PLANNING AND ZONING.
- \* SOIL SHALL BE STERILIZED BENEATH RAISED MEDIANS WITH CONCRETE TREATMENTS.
- \* CURB INLETS AND STORM SEWER SHALL BE PROVIDED TO DRAIN ALL RAISED MEDIANS.



### DEPRESSED MEDIAN

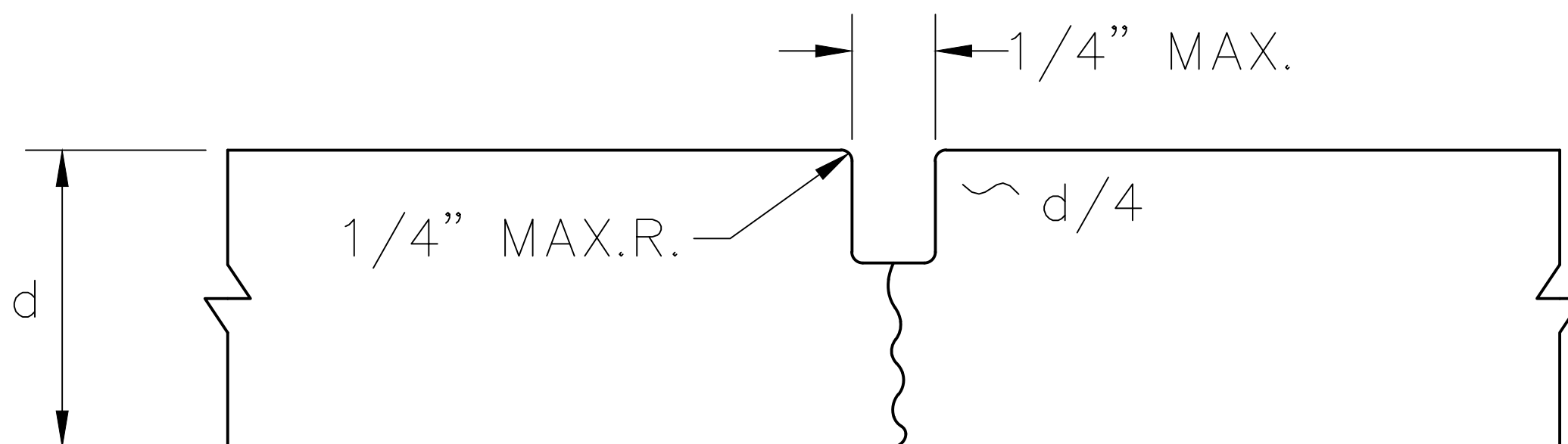
- \* MEDIAN TREATMENT SHALL BE APPROVED BY PLANNING AND ZONING.
- \* DRAINAGE SYSTEMS SHALL BE PROVIDED FOR IRRIGATED MEDIANS.



### PAVED, FLUSH MEDIAN

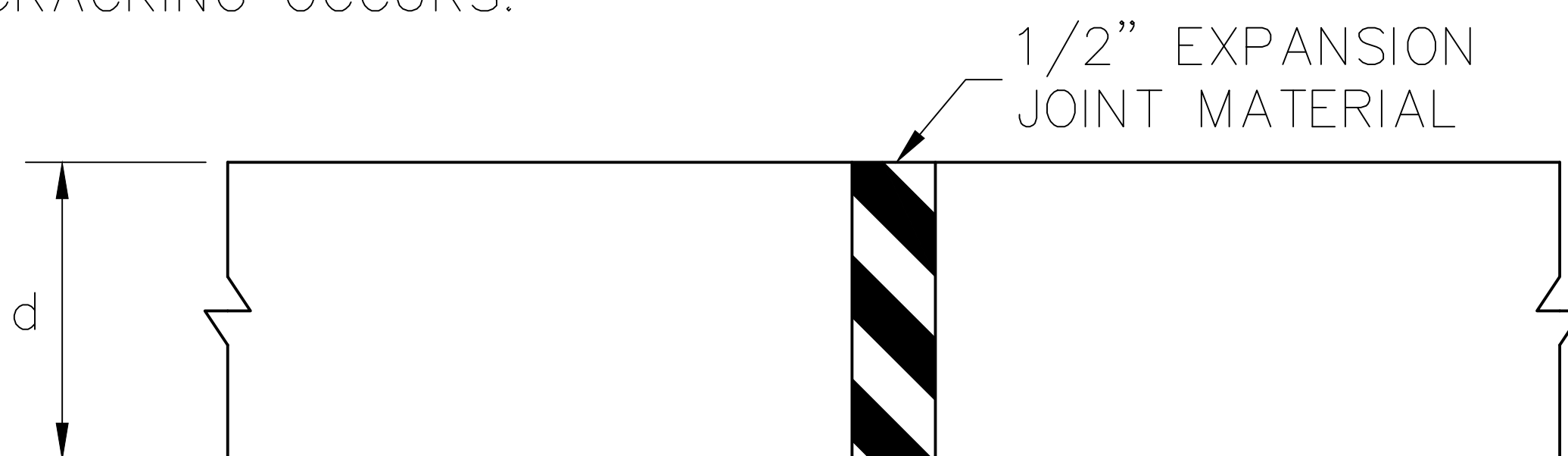
- \* REFER TO CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR ADDITIONAL STRIPING INFORMATION.

DATE: 12/9/2015	JEFFERSON COUNTY DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	TYPICAL MEDIAN DESIGNS
SCALE:	
FILE: STND-9	



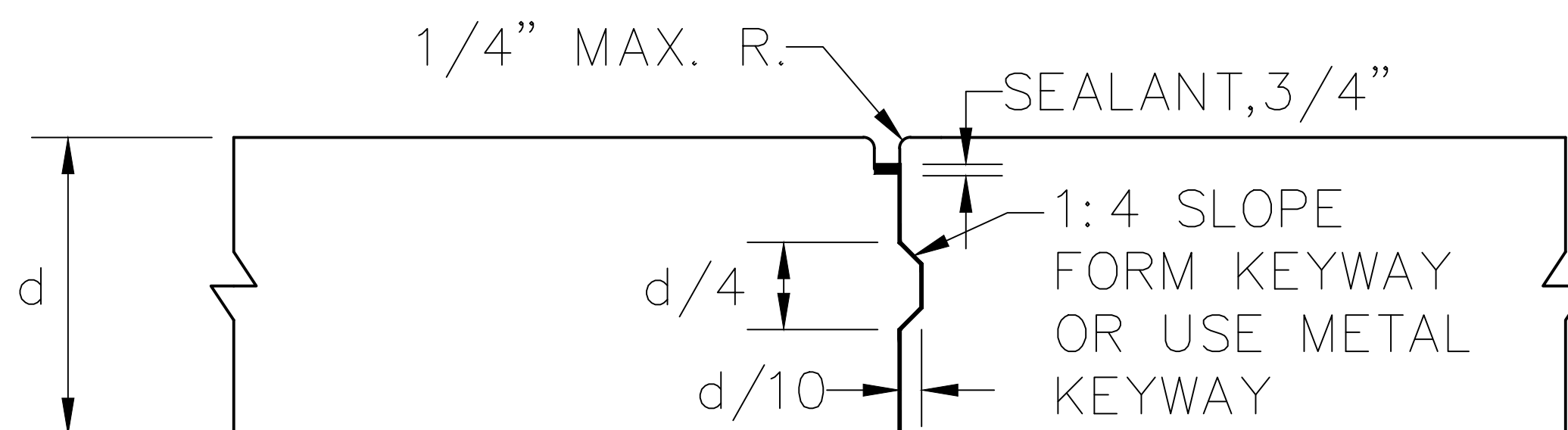
## **CONTRACTION JOINT**

- \* MAXIMUM CONTRACTION JOINT SPACING FOR CURB,GUTTER AND SIDEWALKS IS 10 FEET.
- \* SAWCUT JOINTS (IF USED) SHALL BE AFTER CONCRETE HAS SUFFICIENTLY HARDENED, BUT BEFORE UNCONTROLLED CRACKING OCCURS.



## **DEPRESSED MEDIAN**

- \* 1/2" EXPANSION JOINT MATERIAL SHALL BE PLACED AS REQUIRED AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE
- \* EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR A FIXED STRUCTURE.

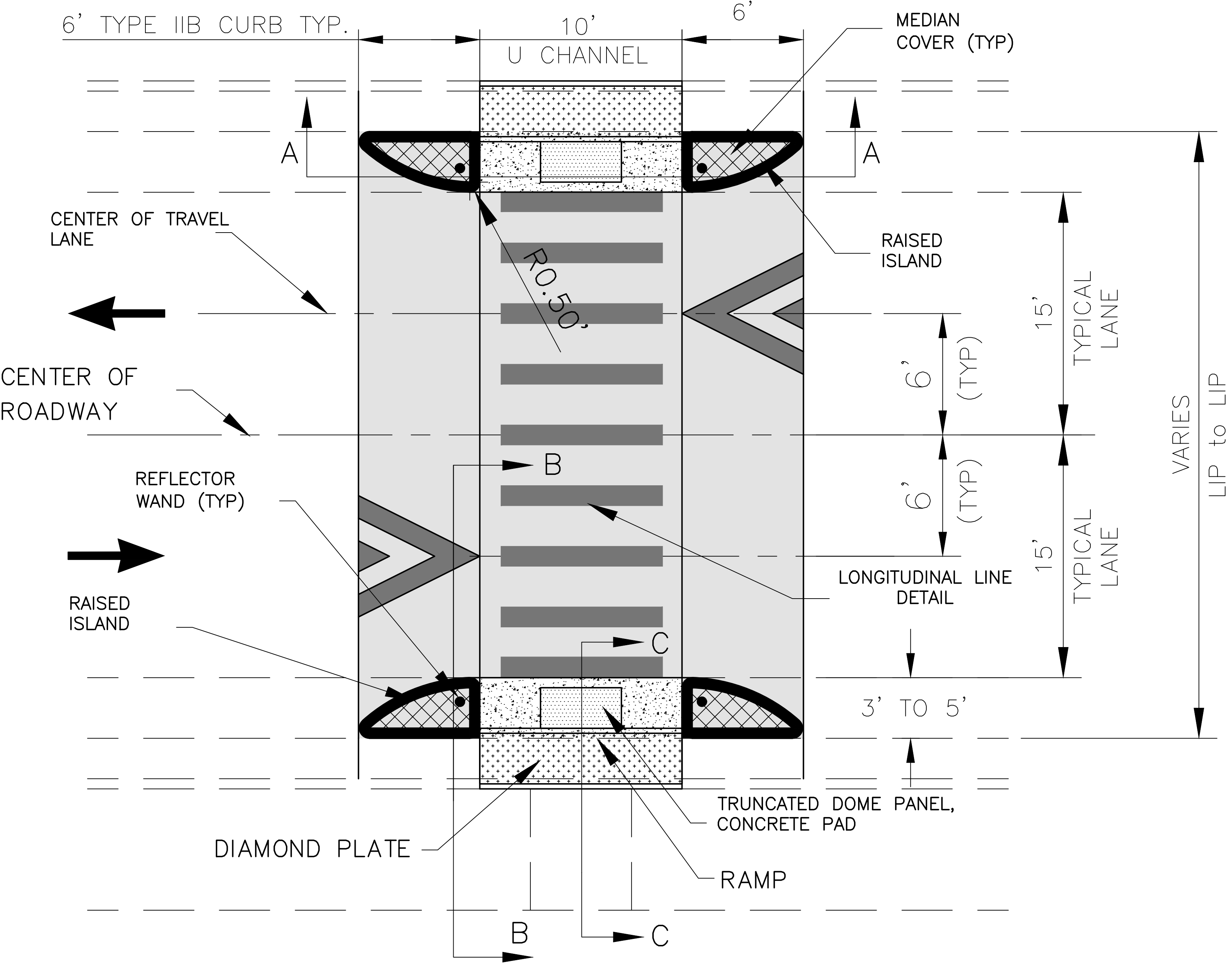


## **LONGITUDINAL OR TRANSVERSE CONSTRUCTION JOINT**

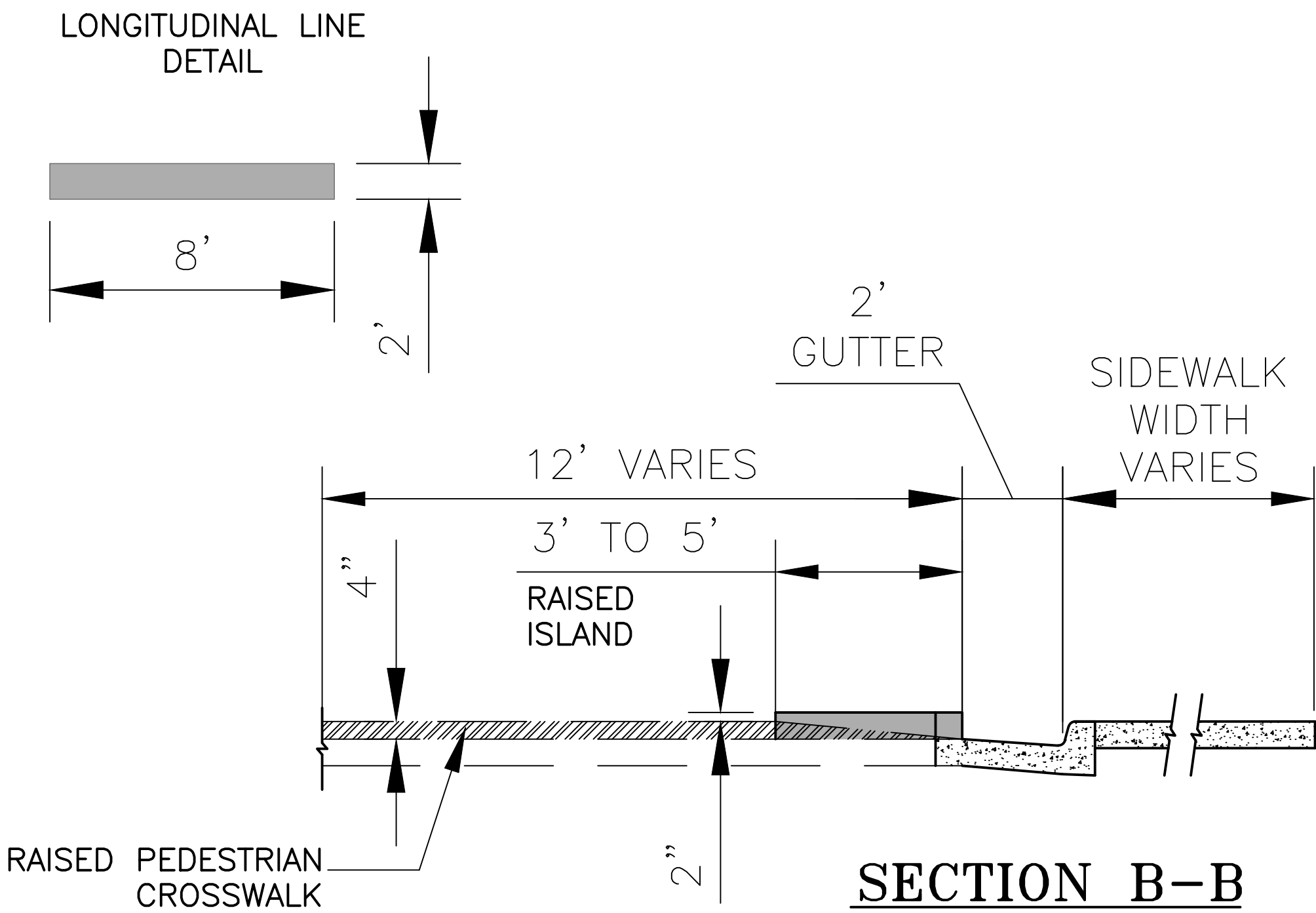
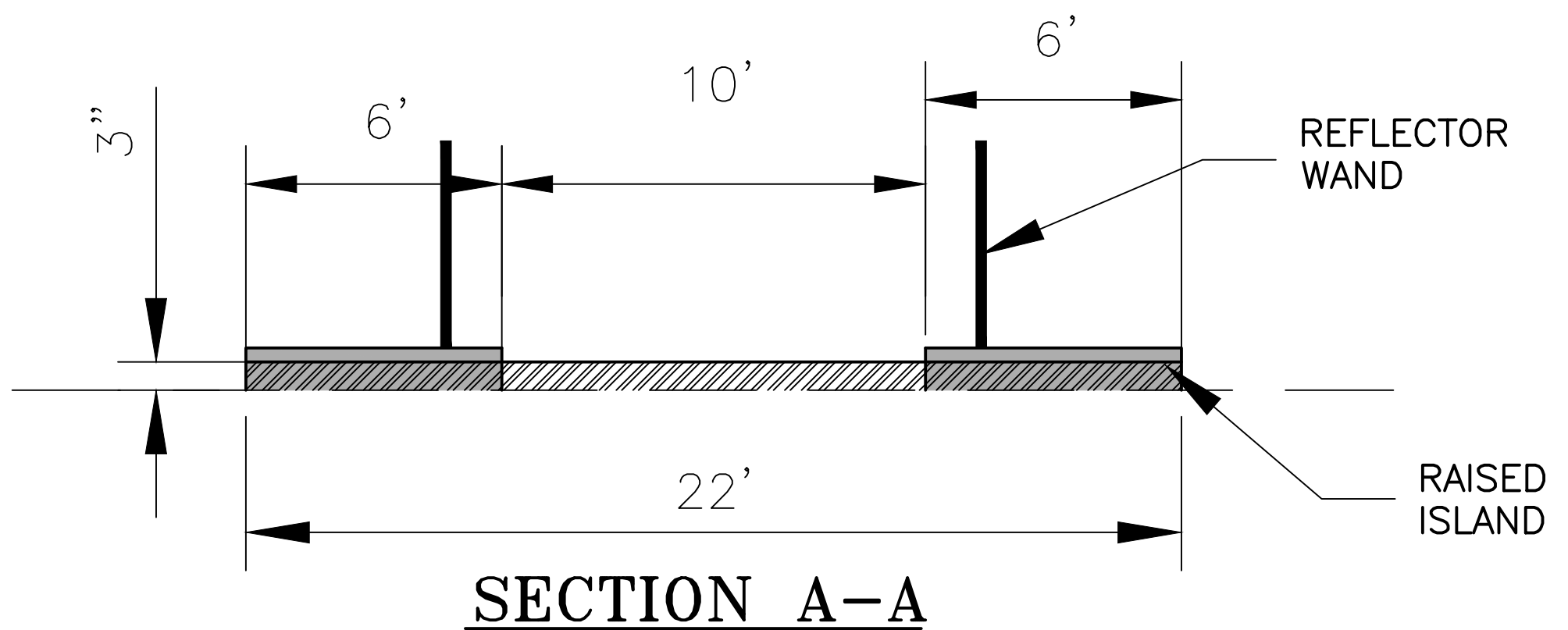
- \* TRANSVERSE CONSTRUCTION JOINTS REQUIRED AT THE END OF EACH DAY'S POUR AND WHEN THE POUR HAS BEEN SUSPENDED FOR 30 MINUTES OR MORE.

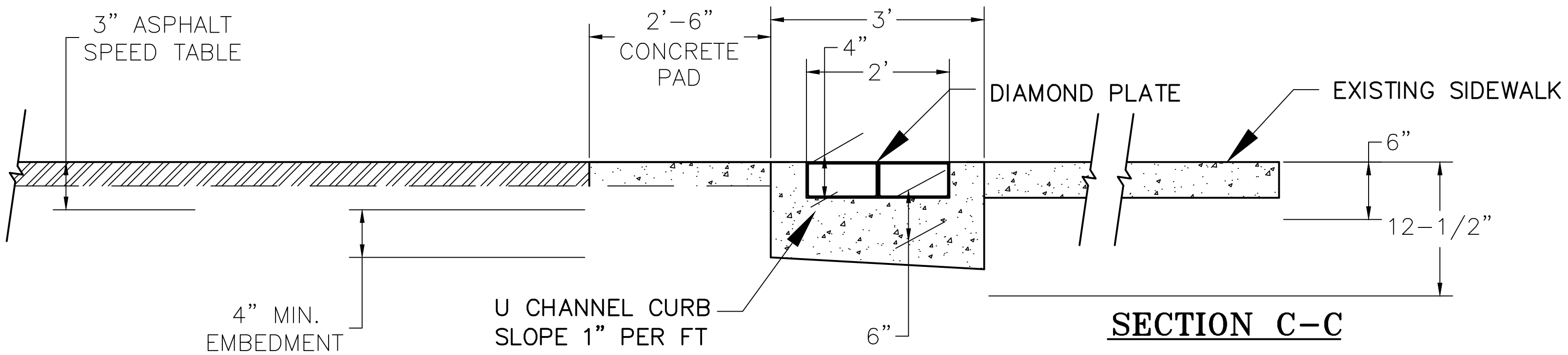
NOTE: JOINT LAYOUT AND JOINT DETAILS FOR CONCRETE STREETS SHALL BE SUBMITTED TO TRANSPORTATION AND ENGINEERING FOR APPROVAL.

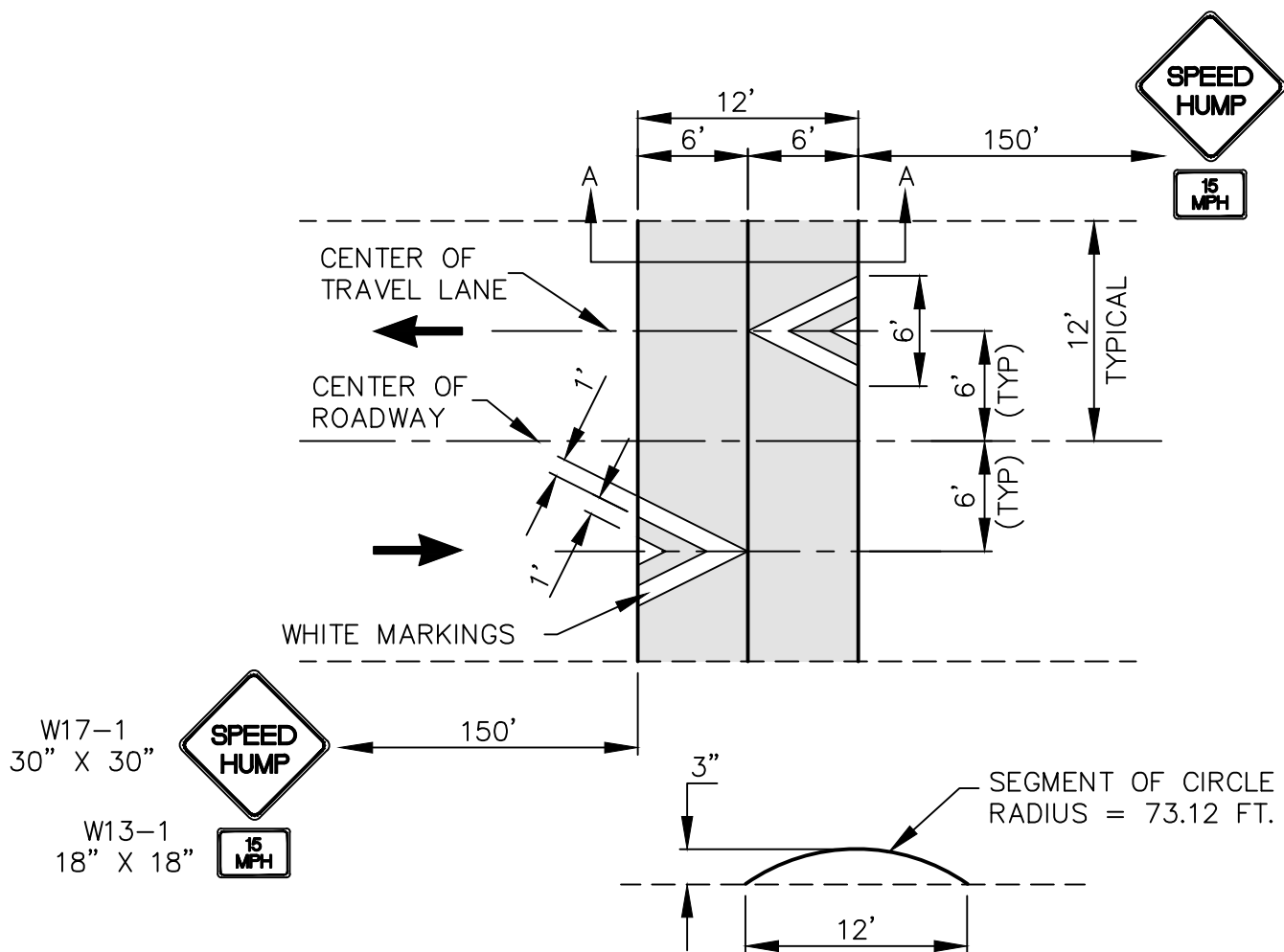
DATE: 12/9/2015	JEFFERSON COUNTY DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	
SCALE:	CONCRETE JOINT DETAILS
FILE: STND-10	











## NOTES:

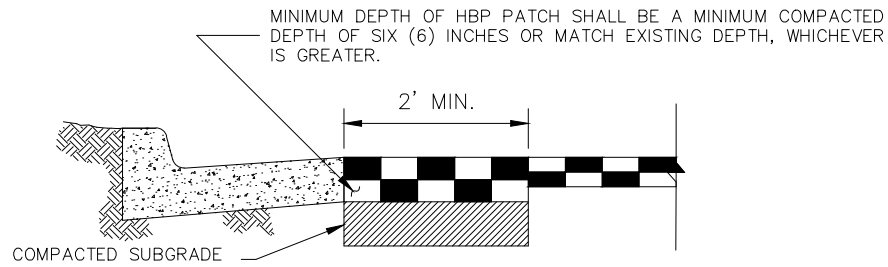
PAVEMENT MARKINGS SHALL BE PERMANENT MARKINGS (THERMOPLASTIC, STAMARK, ETC.)

ADVISORY SPEED LIMIT MAY BE LOWER DUE TO STREET GEOMETRICS.

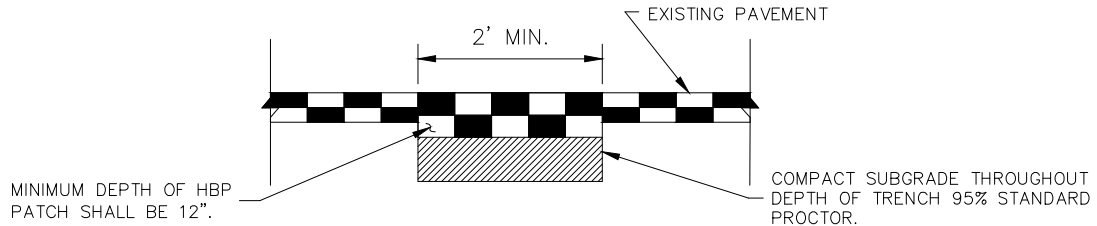
THE EXACT LOCATION OF SPEED HUMP, MARKINGS AND SIGNS WILL BE DETERMINED IN THE FIELD BY THE ENGINEER. (JEFFERSON COUNTY STAFF)

## SPEED HUMP INSTALLATION

DATE: 08/23/2022	<b>JEFFERSON COUNTY</b> DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495
DRAWN BY: S.A.K.	
CHECKED BY: STAFF	
SCALE:	SPEED HUMP INSTALLATION
FILE: STND-12	

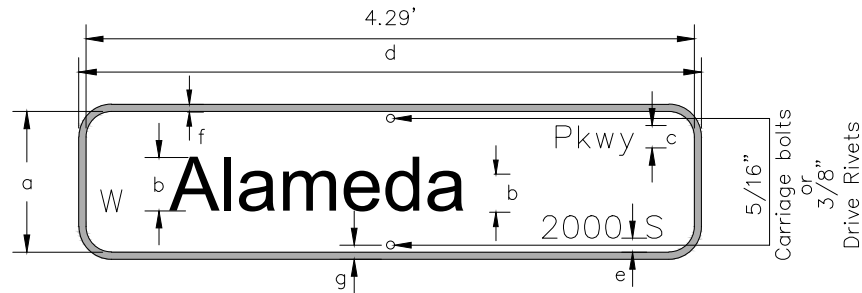


### PATCHBACK ADJACENT TO CURB



### NOTE: PATCHBACK FOR UTILITY AND SERVICE TRENCHES

- \* STRAIGHT SAWCUT OR BLADECUT THE EXISTING ASPHALT PAVEMENT WHEN JOINING WITH NEW ASPHALT PAVEMENT.
- \* PATCH SHALL BE PLACED AND COMPACTED IN LIFTS A MAXIMUM OF 3" IN DEPTH.
- \* APPLY SS-I TACK COAT TO EXISTING ASPHALT AND/OR CONCRETE SURFACES.
- \* TRENCHES LESS THAN 2' IN WIDTH MUST RECEIVE PRIOR APPROVAL FROM THE DEPARTMENT OF HIGHWAYS & TRANSPORTATION AND SHALL BE FLOW-FILLED



### NOTE:

- \* SIGN BLANKS SHALL BE 6061 OR 5052-H38 ALUMINUM ALLOY .100"
- \* FACING SHALL BE 3M GREEN ELECTRO CUT FILM OR EQUIVALENT. \* LETTERS AND NUMBERS SHALL BE 3M HIGH INTENSITY GRADE PRISMATIC WHITE OR EQUIVALENT.
- \* ROAD TYPE (AVE, PKWY, ETC.) TO BE CENTERED IF POSSIBLE OVER GAP BETWEEN BLOCK # AND DIRECTION.
- \* FONT TYPE SHALL BE HIGHWAY GOTHIC B FED KERN REV, HELVETICA MED COMP ACCT AK REV, OR EQUIVALENT.
- \*\* POST MOUNTED OVER 40mph: 8" UPPER AND 6" LOWER.
- \*\* POST MOUNTED 40mph & UNDER: 6" UPPER AND 4.5" LOWER.

### ROAD AND STREET NAME SIGNS

No.	Description	Dimensions (inches)		
		Overhead	Post-mounted, multi-lane, more than 40 mph	Post-mounted, other (multi-lane, 40 mph or less OR two-lane, all speeds)
a	sign height	18	9	9
b	initial capital letter height for street name	12	8	6
	lower case letter height for street name	9	6	4.5
c	initial capital letter height for street type indicator	5	3	3
	lower case letter height for street type indicator	4.5	2.25	2.25
d	length of sign	varies	varies	varies
e	edge of street type and block number to inside edge of border	0.5	0.5	0.5
f	border thickness	1	0.5	0.5
g	bolt hole center to edge of sign	n/a	1	1

DATE: 08/23/2022

DRAWN BY: S.A.K.

CHECKED BY: STAFF

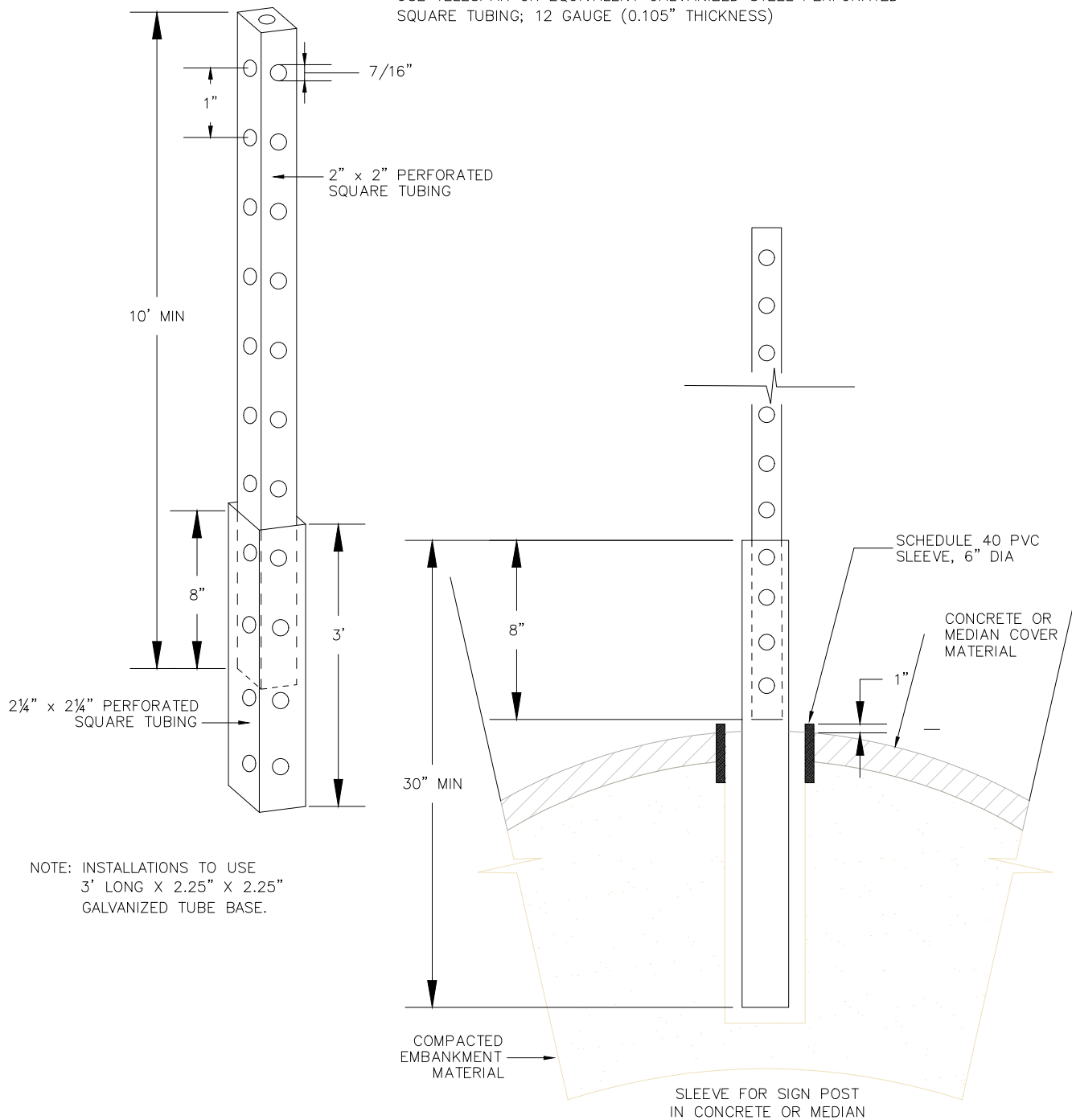
SCALE:

FILE: STND-13-14

JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

STANDARDS 13 & 14

USE TELESAR OR EQUIVALENT GALVANIZED STEEL PERFORATED SQUARE TUBING; 12 GAUGE (0.105" THICKNESS)



## SIGN POST AND BASE

DATE: 08/23/2022

DRAWN BY: S.A.K.

CHECKED BY: STAFF

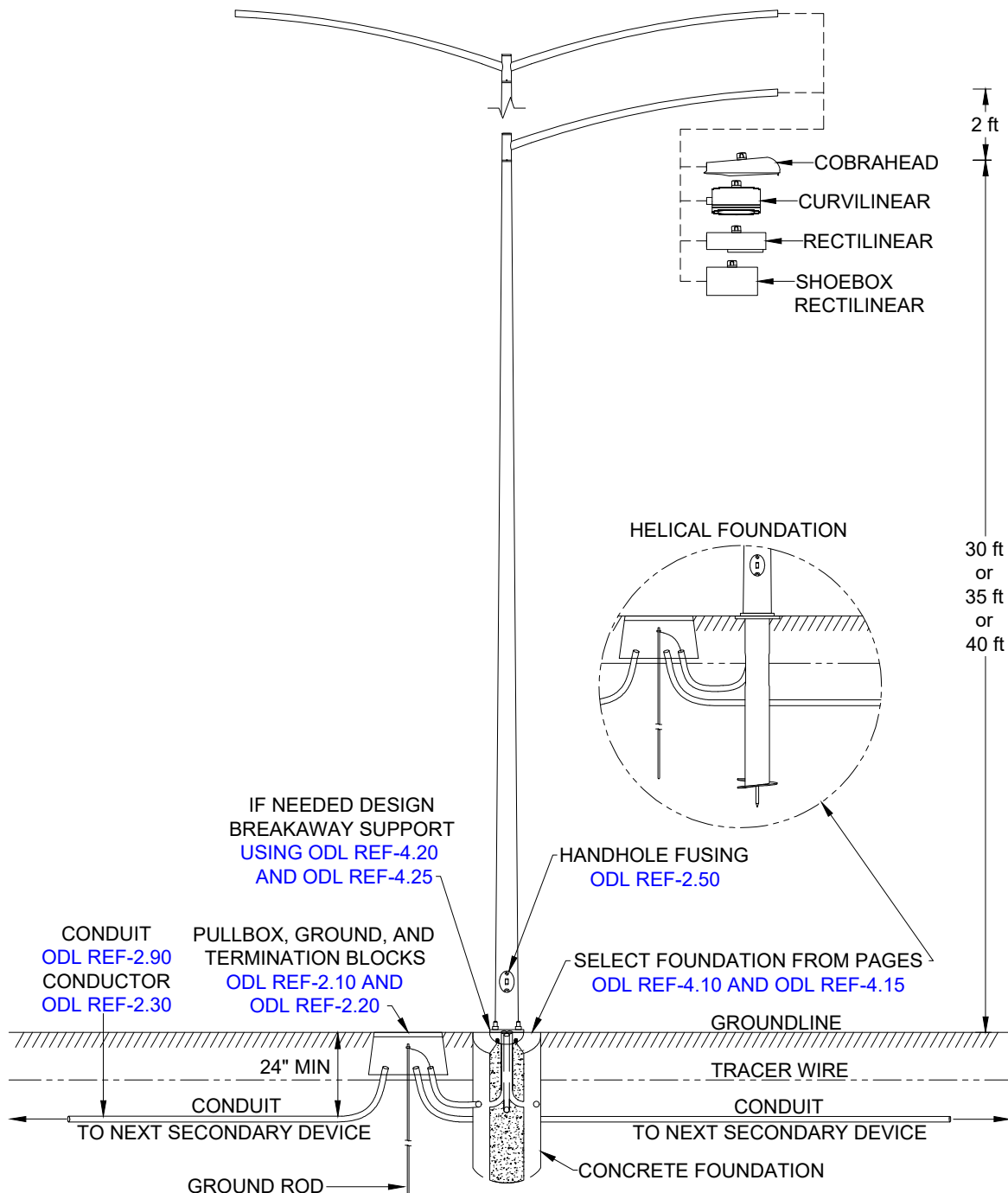
SCALE:

FILE: STND-15

JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

## SIGN POST AND BASE

# STEEL POLE - TENON TOP SIDE MOUNT LUMINAIRES



DATE: 08/23/2022

DRAWN BY: S.A.K.

CHECKED BY: STAFF

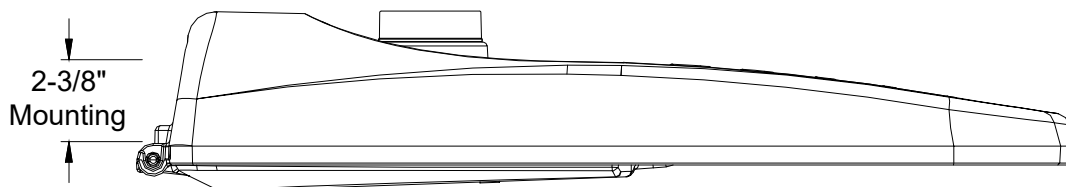
SCALE:

FILE: STND-16

JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

TYPICAL ARTERIAL / MAJOR COLLECTOR  
STREET LIGHTING 1 of 2

## SIDE MOUNT LUMINAIRE COBRAHEAD - LED



Description: For use on 2-3/8" OD arm	C/U	Luminaire Cat ID	Color
<b>LED</b>			
Cobrahead - 14000 lm LED - type D	<b>ESLC25LY</b>	219752	Grey8

### Notes:

1. C/Us include the luminaire, and the Long Life photo control.
2. Design type B, type C, type D and type E for LED luminaires. Types B, C, D and E are functional equivalents to 100, 150, 250 and 400-Watt HPS luminaires respectively. The lumens (lm) shown are the delivered lumens. Please contact EDS or the latest specification for wattage rating.
3. Design poles, mast arms, foundations etc. using sections PL-INDEX, AM-INDEX and ODL REF-INDEX.
4. Cobrahead luminaires are slip fit mounted on 2-3/8" Outside Diameter (OD) pipe mast arms.
5. Check for proper illumination levels according to type of application.
6. All standard LED Cobrahead luminaires have multi-voltage drivers rated for 120- 277 V. LED lights can be designed for 120 V, 208 V, 240 V, and 277 V systems.

DATE: 08/23/2022

DRAWN BY: S.A.K.

CHECKED BY: STAFF

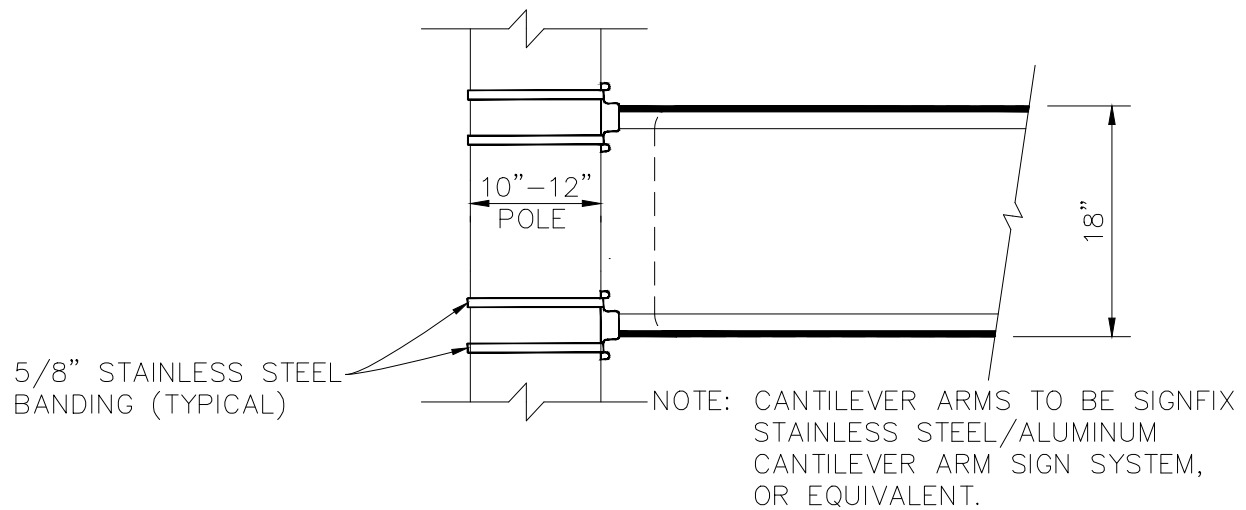
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FILE: STND-16

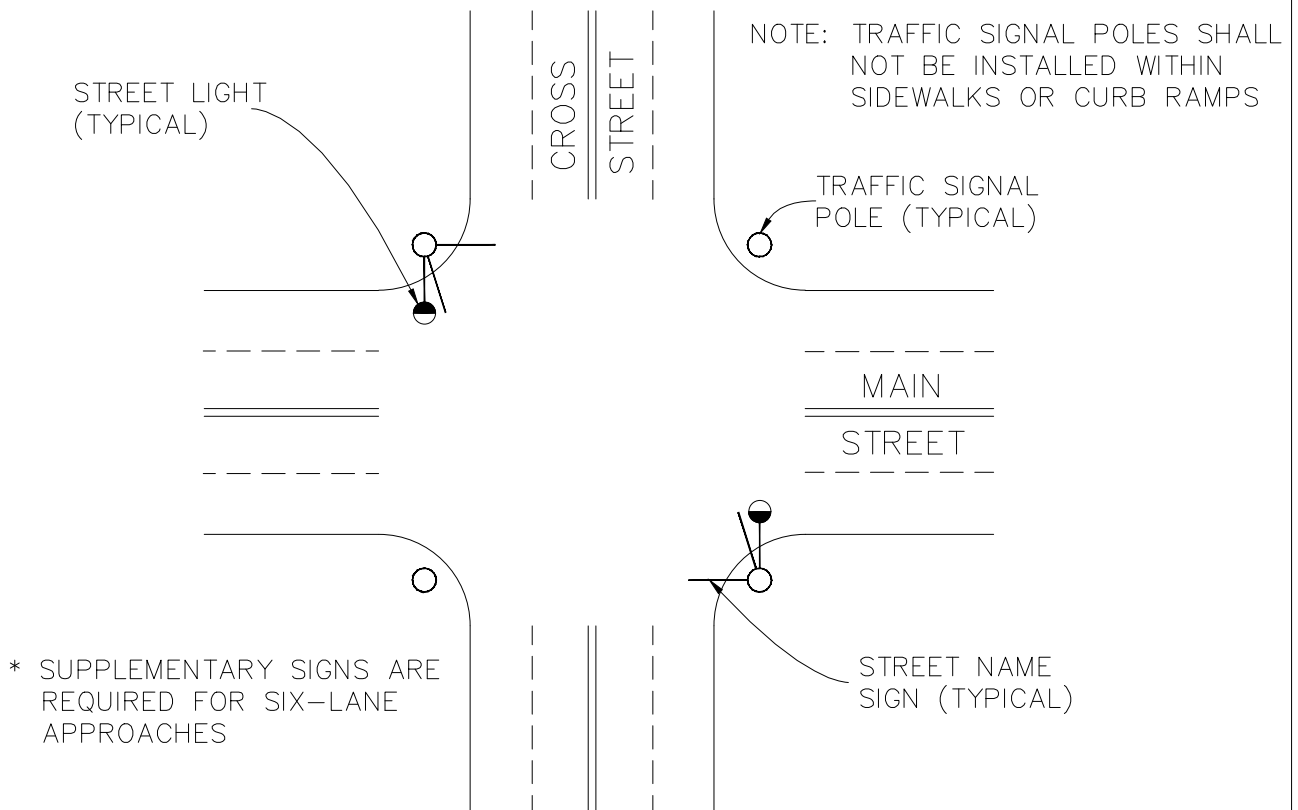
JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

TYPICAL ARTERIAL / MAJOR COLLECTOR  
STREET LIGHTING 2 of 2

# STREET NAME SIGN AND BRACKET ON TRAFFIC SIGNAL POLE



## TYPICAL INSTALLATION \*



DATE: 08/23/2022

DRAWN BY: S.A.K.

CHECKED BY: STAFF

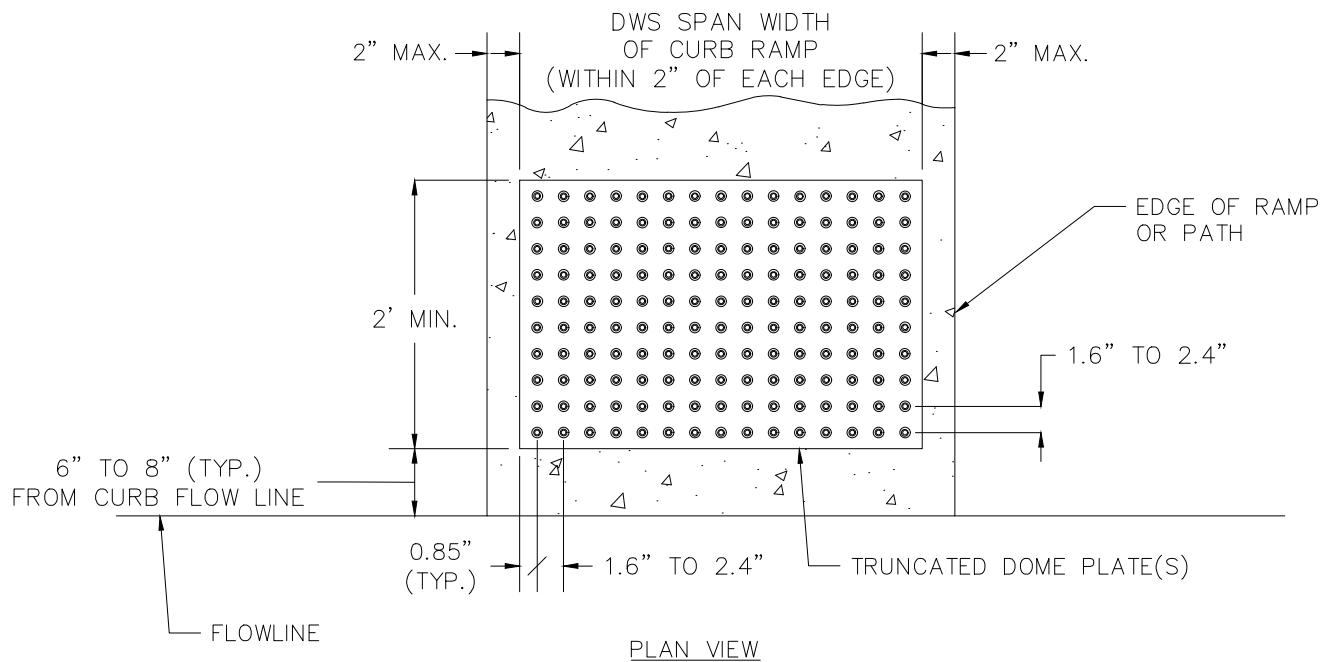
SCALE:

FILE: STND-17

JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

STREET NAME SIGN AND BRACKET ON  
TRAFFIC SIGNAL POLE - TYPICAL





## DETECTABLE WARNINGS ON CONCRETE CURB RAMPS

DATE: 08/23/2022	<div style="text-align: center;"> JEFFERSON COUNTY  DIVISION of TRANSPORTATION AND ENGINEERING  100 JEFFERSON CNTY. PKWY., SUITE 3500  GOLDEN, CO. 80419 (303) 271-8495 </div>
DRAWN BY: S.A.K.	
CHECKED BY: STAFF	
SCALE:	
FILE: STND-18	DETECTABLE WARNINGS ON CONCRETE CURB RAMPS

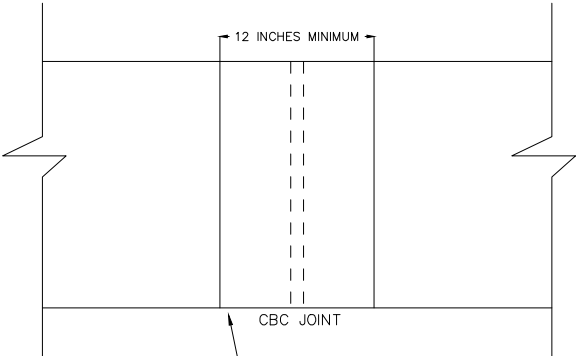
WATERPROOFING MEMBRANE APPLIED OVER  
ENTIRE HORIZONTAL SURFACE OF CBC.

OVERLAP EDGES OF ROLL MATERIAL 6  
INCHES MINIMUM AND SEAL.

WRAP 12 INCHES MINIMUM

CONCRETE BOX CULVERT





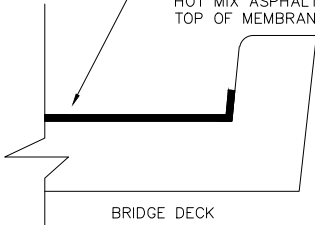
CBC JOINT

SEAL VERTICAL JOINTS WITH WATERPROOFING MEMBRANE OR SELF ADHESIVE ROLL MATERIAL.

JOINTS ARE SEALED ENTIRE HEIGHT OF CBC AND ON OUTSIDE CBC SECTIONS.

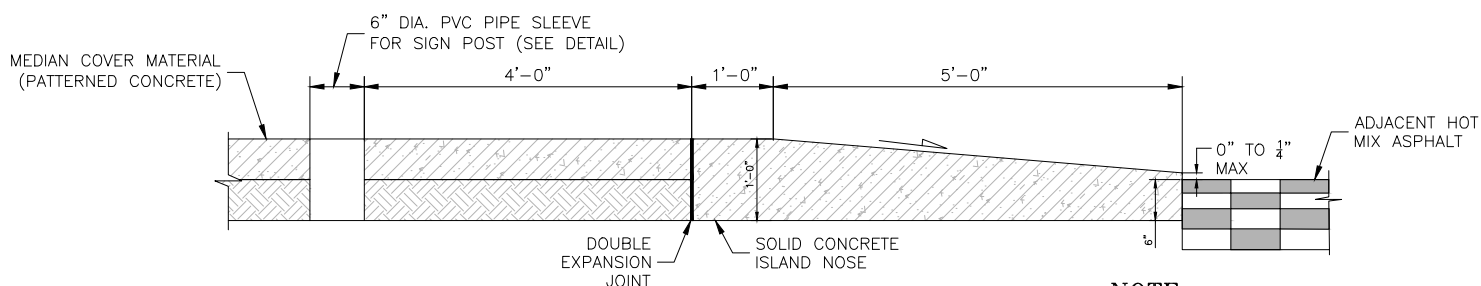
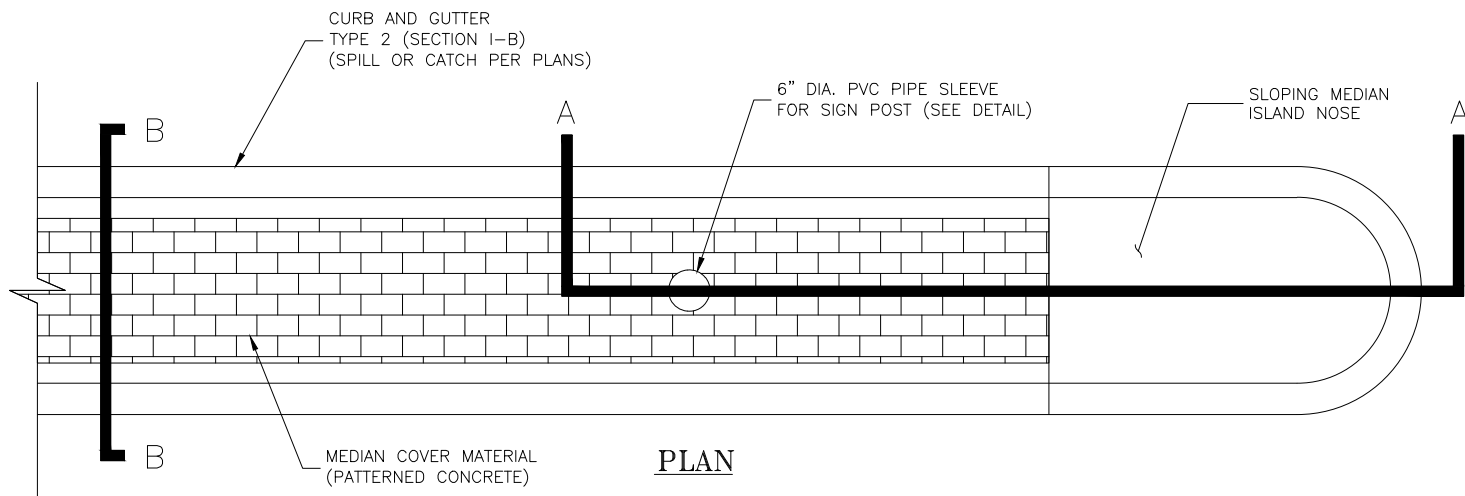
WATERPROOFING MEMBRANE APPLIED ON  
HORIZONTAL SURFACE OF BRIDGE DECK.

HOT MIX ASPHALT PLACED DIRECTLY ON  
TOP OF MEMBRANE.



WRAP 2 INCHES MINIMUM

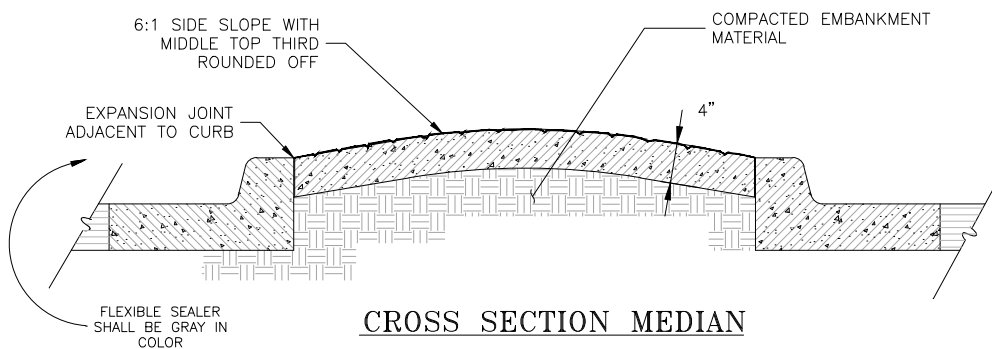
BRIDGE DECK



CROSS SECTION MEDIAN  
COVER MATERIAL SECTION A-A

NOTE:

- THE RISE AT GUTTER  
FLOWLINE SHALL BE 1/4"  
MAXIMUM, JUST ENOUGH  
FOR WATER TO RUN  
AROUND THE MEDIAN  
NOSE IF NEEDED.



CROSS SECTION MEDIAN  
COVER MATERIAL SECTION B-B

MEDIAN COVER MATERIAL  
PATTERNED CONCRETE

DATE: 08/23/2022

DRAWN BY: S.A.K.

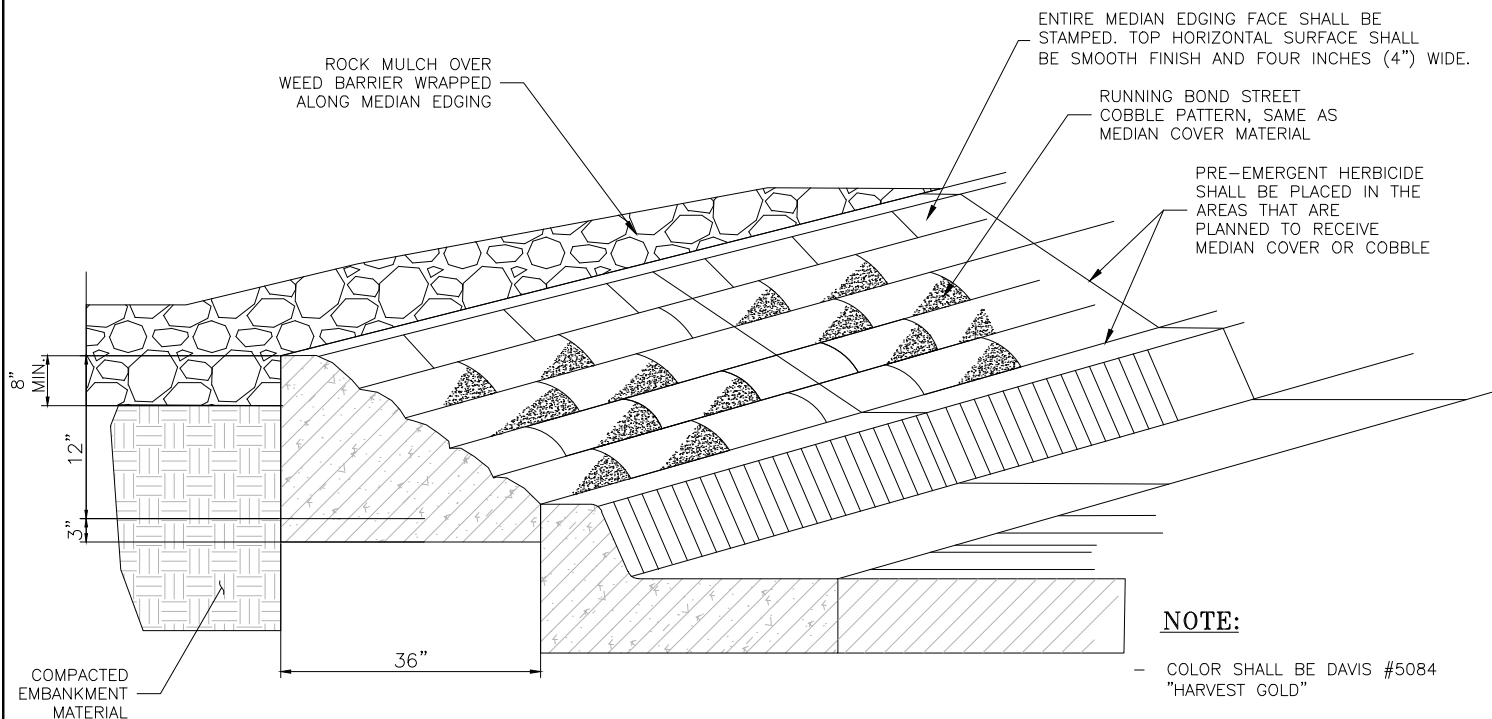
CHECKED BY: STAFF

SCALE:

FILE: STND-20

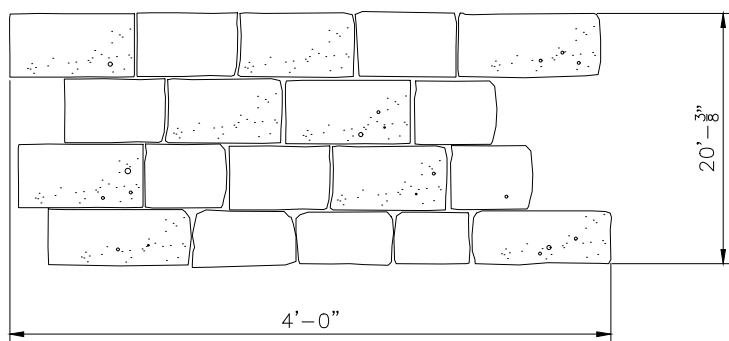
JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

MEDIAN COVER MATERIAL  
PATTERNED CONCRETE



**NOTE:**

- COLOR SHALL BE DAVIS #5084 "HARVEST GOLD"
- STAMP RELEASE SHALL BE CONCRETE COATINGS STAMP-TEK LIQUID RELEASE
- CONCRETE STAMP PATTERN SHALL BE UK COBBLESTONE. CONCRETE SHALL BE SEALED WITH SPECHEM CURESHIELD EX.
- CLEAR SEALER SHALL BE APPLIED ONCE LIQUID RELEASE HAS FULLY EVAPORATED.



**NOTE:**

- SAWCUT CONTROL JOINTS SHALL BE PLACED EVERY TEN (10) LINEAR FEET,  $\frac{1}{4}$  THE THICKNESS OF THE CONCRETE.
- EXPANSION JOINTS SHALL BE PLACED EVERY 100 LINEAR FEET.
- EXPANSION JOINTS SHALL HAVE A ZIP STRIP (SNAP-CAP) AND CURE SEALER (SIKAFLEX-2C) APPLIED. CURE SEALER FOR EXPANSION JOINTS IN THE PATTERNED CONCRETE SHALL BE TAN.

## MEDIAN EDGING PATTERNED CONCRETE

DATE: 08/23/2022

DRAWN BY: S.A.K.

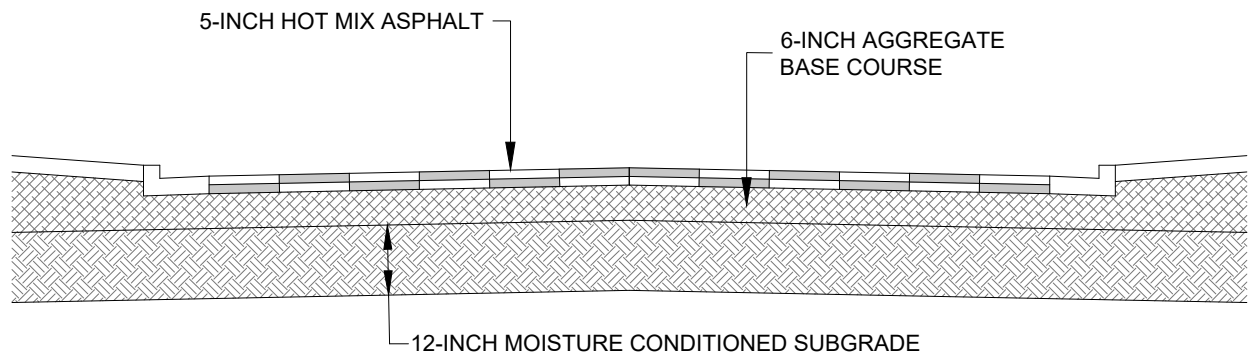
CHECKED BY: STAFF

SCALE:

FILE: STND-21

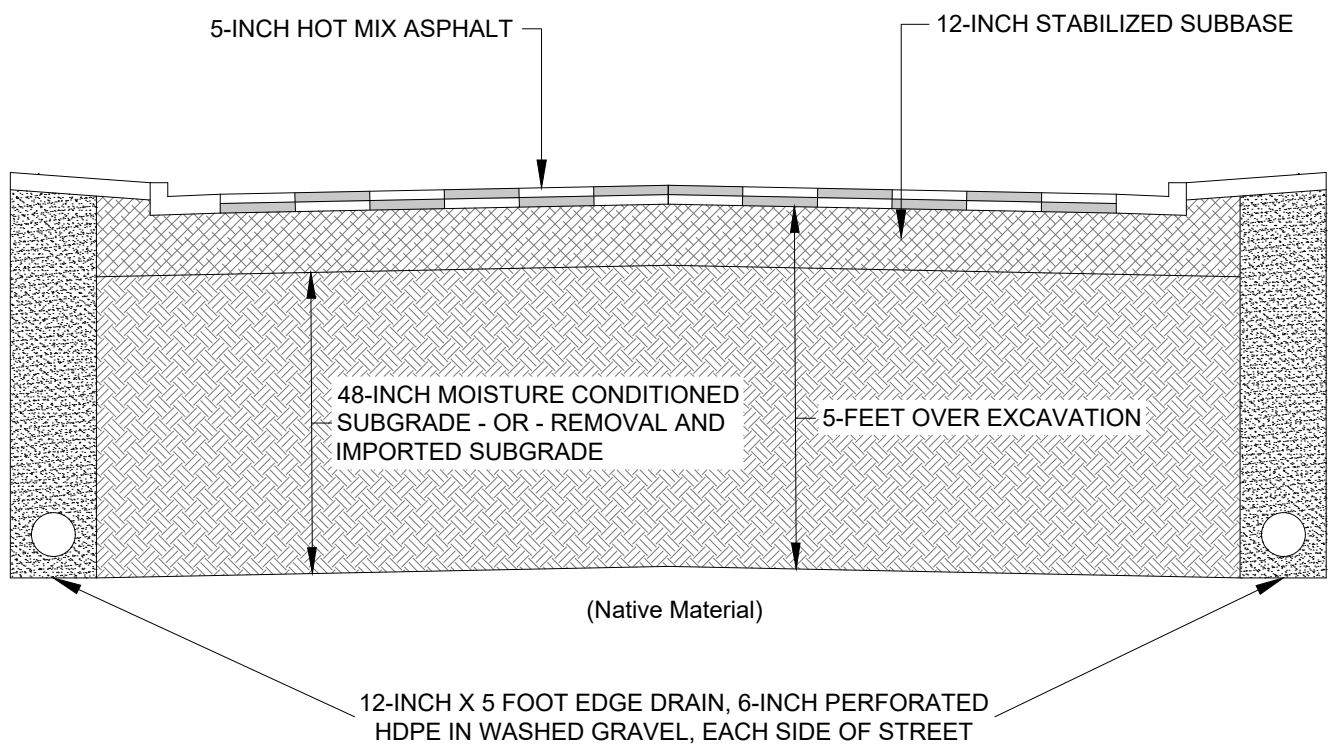
JEFFERSON COUNTY  
DIVISION of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

MEDIAN EDGING  
PATTERNED CONCRETE



ZONE 1:  
FOOTHILLS/MOUNTAIN AREA  
PRELIMINARY PAVEMENT DESIGN

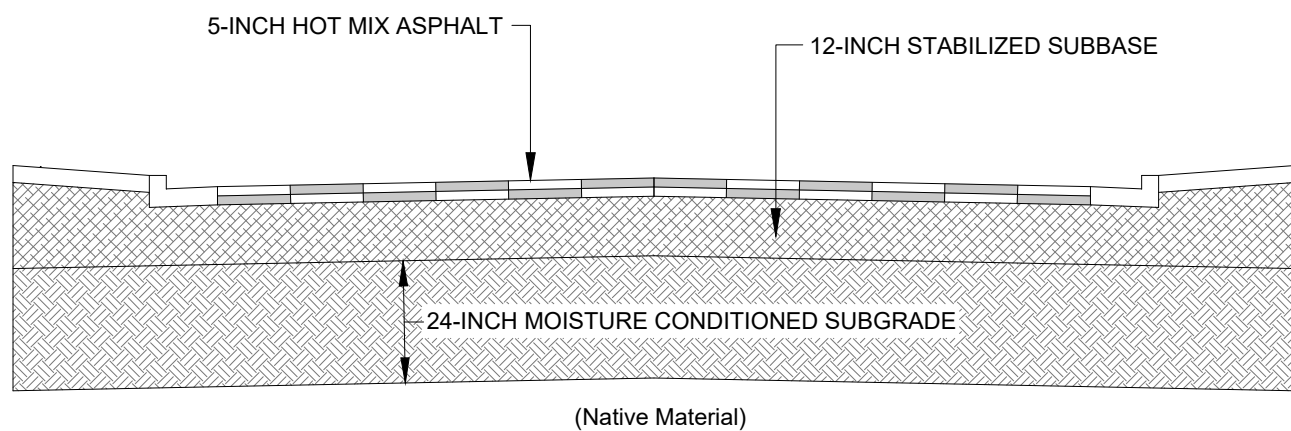
DATE: 08/23/2022	JEFFERSON COUNTY DIVISION. of TRANSPORTATION & ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8419
DRAWN BY: S.A.K.	
CHECKED BY: STAFF	ZONE 1 FOOTHILLS/MOUNTAIN AREA PRELIMINARY PAVEMENT DESIGN
SCALE:	
FILE: STND-22	



ZONE 2:  
DIPPING BEDROCK AREA  
PRELIMINARY PAVEMENT DESIGN

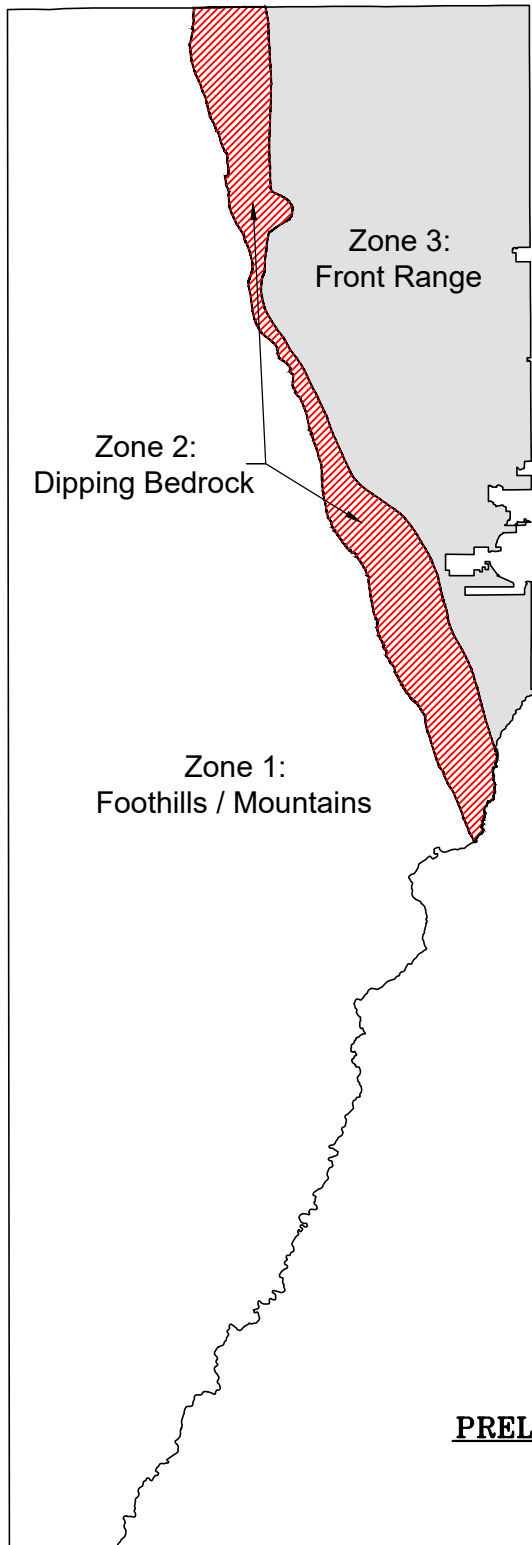
DATE: 08/23/2022	JEFFERSON COUNTY DIVISION. of TRANSPORTATION & ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8419
DRAWN BY: S.A.K.	
CHECKED BY: STAFF	ZONE 2 DIPPING BEDROCK AREA PRELIMINARY PAVEMENT DESIGN
SCALE:	
FILE: STND-23	





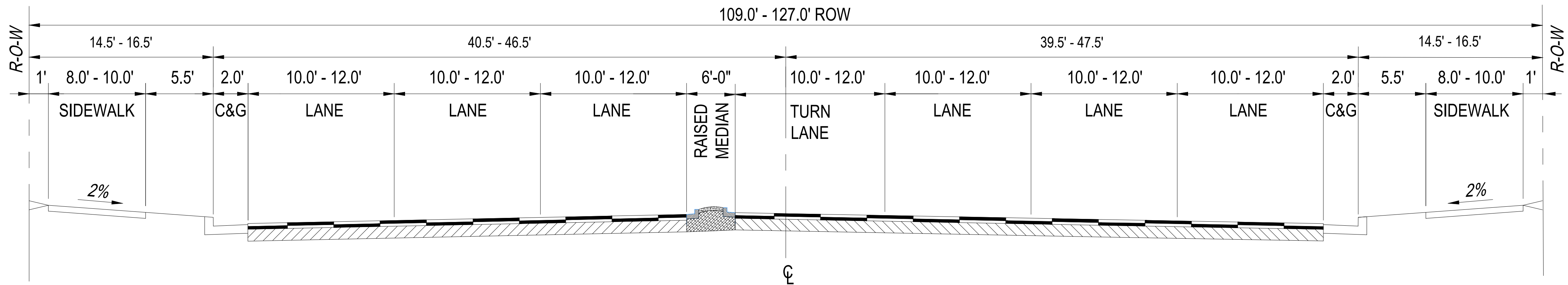
ZONE 3:  
FRONT RANGE AREA  
PRELIMINARY PAVEMENT DESIGN

DATE: 08/23/2022	JEFFERSON COUNTY DIVISION. of TRANSPORTATION & ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8419
DRAWN BY: S.A.K.	
CHECKED BY: STAFF	ZONE 3 FRONT RANGE AREA PRELIMINARY PAVEMENT DESIGN
SCALE:	
FILE: STND-24	



**DESIGN ZONE**  
**PRELIMINARY PAVEMENT SECTIONS**

DATE: 08/23/2022	JEFFERSON COUNTY DIVISION. of TRANSPORTATION & ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8419
DRAWN BY: S.A.K.	
CHECKED BY: STAFF	DESIGN ZONE PRELIMINARY PAVEMENT SECTIONS
SCALE:	
FILE: STND-25	

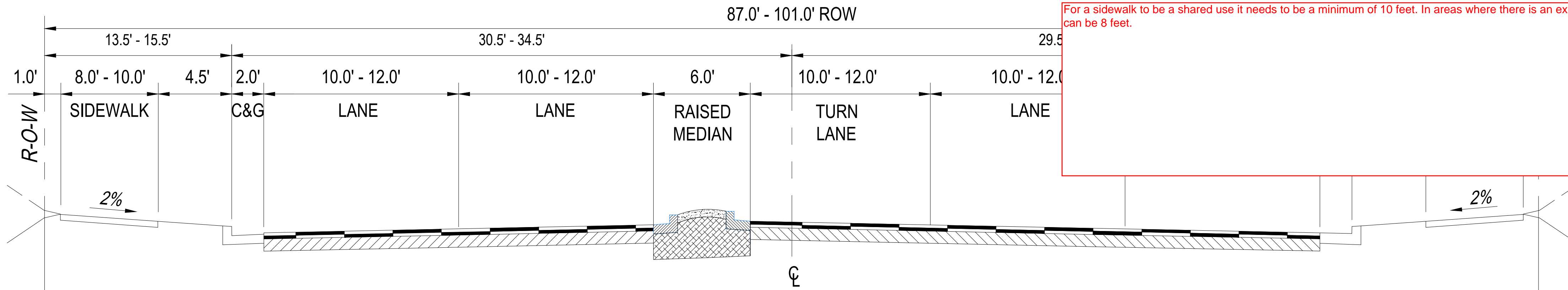


## PRINCIPAL ARTERIAL

### NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 25,000.
2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING.
3. ACCELERATION/DECELERATION LANES AND/OR TURN LANES MAY BE REQUIRED AND MAY NECESSITATE ADDITIONAL RIGHT-OF-WAY. SEE SECTION 3.7.3.
4. MEDIANS MAY BE RAISED, DEPRESSED, OR PAINTED AS APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING. SEE STANDARD NO. 9 FOR TYPICAL MEDIAN DESIGNS.
5. BICYCLES LANES ARE REQUIRED FOR STREETS IDENTIFIED WITH THE DESIGNATION 'PROPOSED BIKE LANES' IN THE JEFFERSON COUNTY BICYCLE PLAN OR ANY SUBSEQUENT PLAN THAT HAS BEEN APPROVED BY THE BOARD OF COUNTY COMMISSIONERS.
- ~~6. BIKE LANES MAY EXCEED 6' IF THEY INCLUDED A 1' - 3' BUFFER, WITH A MAXIMUM COMBINED BUFFER AND BIKE LANE WIDTH OF 9'~~

Sidewalk and lane widths shall be coordinated with Planning and Zoning and Transportation and Engineering



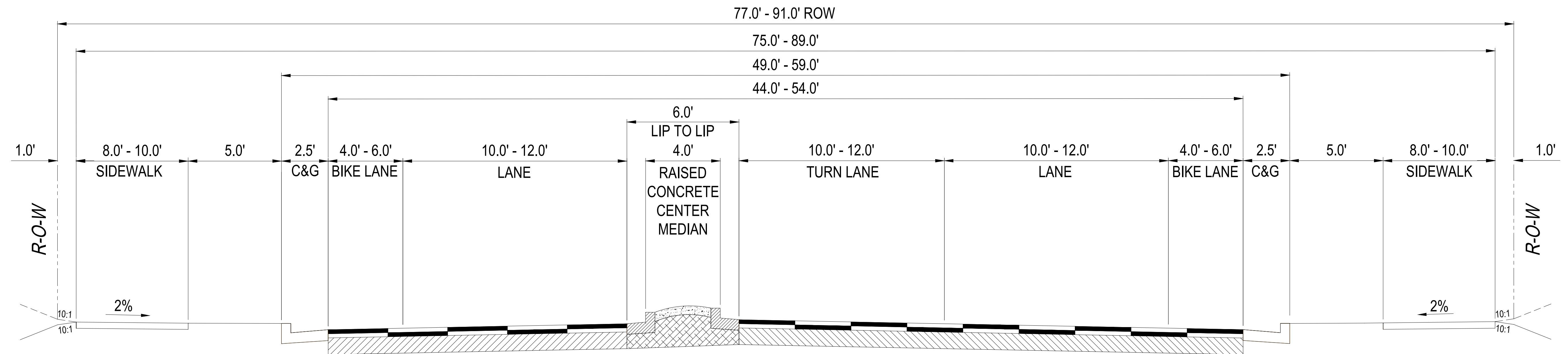
For a sidewalk to be a shared use it needs to be a minimum of 10 feet. In areas where there is an existing bike lane the sidewalk can be 8 feet.

## MINOR ARTERIAL

### NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 15,000 BUT LESS THAN 25,000.
2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY DEPARTMENT OF PLANNING & ZONING.
3. ACCELERATION/DECELERATION LANES AND/OR TURN LANES MAY BE REQUIRED AND MAY NECESSITATE ADDITIONAL RIGHT-OF-WAY. SEE SECTION 3.7.3.
4. MEDIANS MAY BE RAISED, DEPRESSED, OR PAINTED AS APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING. SEE STANDARD NO. 9 FOR TYPICAL MEDIAN DESIGNS.
5. BICYCLES LANES ARE REQUIRED FOR STREETS IDENTIFIED WITH THE DESIGNATION 'PROPOSED BIKE LANES' IN THE JEFFERSON COUNTY BICYCLE PLAN OR ANY SUBSEQUENT PLAN THAT HAS BEEN APPROVED BY THE BOARD OF COUNTY COMMISSIONERS.
- ~~6. BIKE LANES MAY EXCEED 6' IF THEY INCLUDED A 1' - 3' BUFFER, WITH A MAXIMUM COMBINED BUFFER AND BIKE LANE WIDTH OF 9'~~
7. SIDEWALKS MAY BE ATTACHED OR DETACHED AS APPROVED BY JEFFERSON COUNTY PLANNING AND ZONING.

Revisions:	Designed By:	STAFF	Scale:	(As Shown)	<div>JEFFERSON COUNTY COLORADO</div> <div>DIVISION OF Transportation and Engineering 100 JEFFERSON COUNTY PARKWAY, SUITE 3500 GOLDEN, COLORADO 80419 (303) 271-8495</div>	TEMPLATES 1 AND 2 JEFFERSON COUNTY		
	Drawn By:	D.A.M.	Date Created:					
	Checked By:	Staff	Plot Date:	8/16/22	F.I.R. Date:			
	File:	temp-1-2.dwg	F.O.R. Date:		For Const. Date:			
	File Location:	G:\_CAD\Standards\Figures\Working						
						Project No.:	----	Sheet <b>1</b> Of <b>1</b>



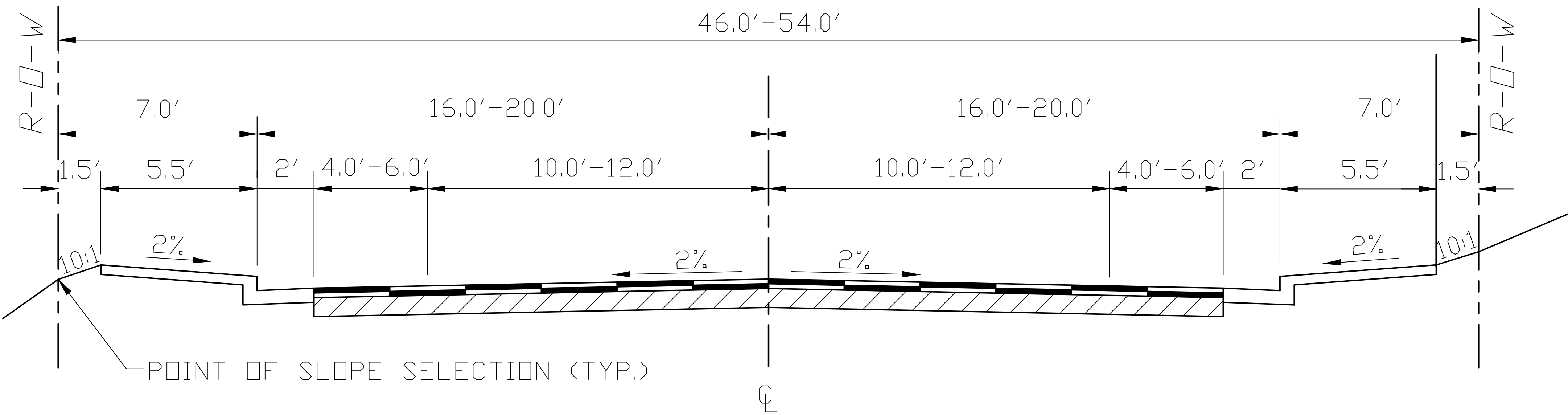
MAJOR COLLECTOR STREET

NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 8,000 BUT LESS THAN 15,000.
2. ACCESS POINTS SHALL BE APPROVED BY JEFFERSON COUNTY PLANNING & ZONING.
3. MEDIANS MAY BE RAISED, DEPRESSED, OR PAINTED AND WIDTH MAY VARY AS APPROVED BY JEFFERSON COUNTY PLANNING & ZONING. SEE STANDARD NO. 9 FOR TYPICAL MEDIAN DESIGNS.
4. VERTICAL CURB REQUIRED.
5. BICYCLES LANES ARE REQUIRED FOR STREETS IDENTIFIED WITH THE DESIGNATION 'PROPOSED BIKE LANES' IN THE JEFFERSON COUNTY BICYCLE PLAN OR ANY SUBSEQUENT PLAN THAT HAS BEEN APPROVED BY THE BOARD OF COUNTY COMMISSIONERS.
6. BIKE LANES MAY EXCEED 6' IF THEY INCLUDED A 1' - 3' BUFFER, WITH A MAXIMUM COMBINED BUFFER AND BIKE LANE WIDTH OF 9'

Add a note that the sidewalk can be attached or detached.

None of these typical include parking. Does the County not allow on street parking?



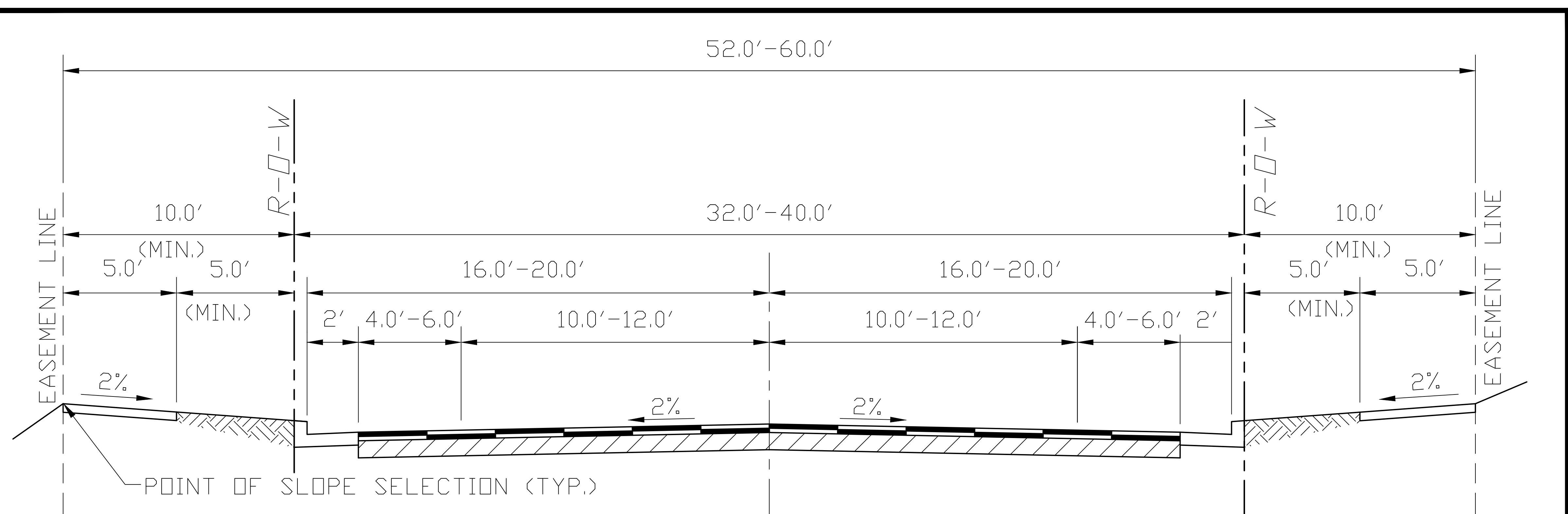
NOTES

- 1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 1,000 BUT LESS THAN 8,000.
- 2. ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING.
- 3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED TO ACCOMMODATE ADDITIONAL PARKING, TURN LANES, CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
- 4. VERTICAL CURB REQUIRED.
- 5. BIKE LANES MAY EXCEED 6' IF THEY INCLUDED A 1'-3' BUFFER, WITH A MAXIMUM COMBINED BUFFER AND BIKE LANE WIDTH OF 9'

DATE:	08/16/22
SCALE:	
Drawn By:	S.A.K.
Designed By:	STAFF
FILE:	TEMP-4

COLLECTOR STREET  
(36' E TO E)  
WITH ATTACHED SIDEWALKS

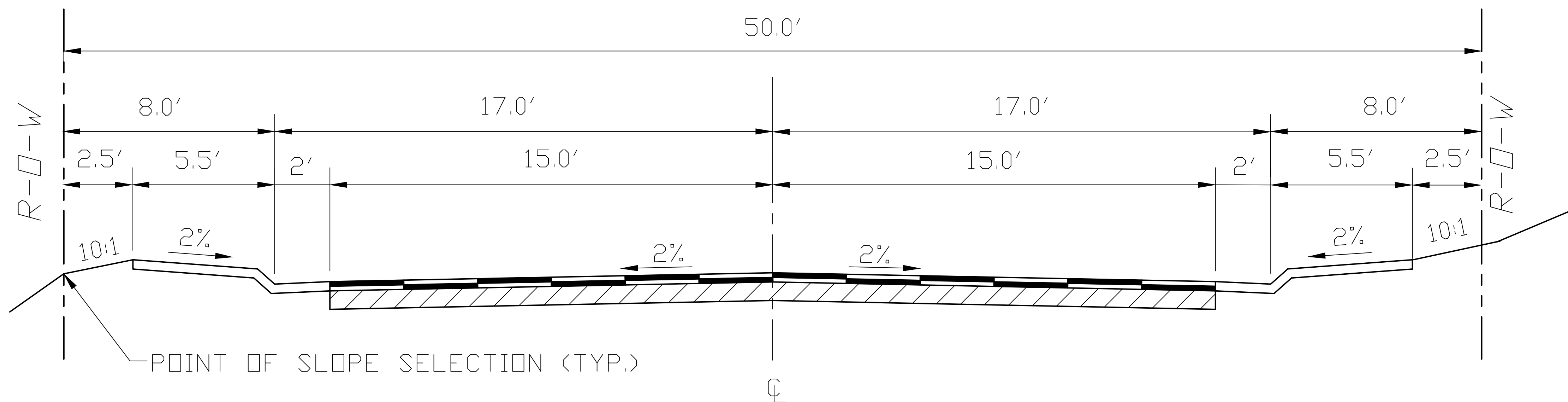
JEFFERSON COUNTY  
DIVISION of  
TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 1,000 BUT LESS THAN 8,000.
2. ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY DEPARTMENT OF PLANNING & ZONING.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED TO ACCOMMODATE ADDITIONAL PARKING, TURN LANES, CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. SIDEWALK MAY MEANDER WITHIN EASEMENTS.
5. VERTICAL CURB REQUIRED.
6. BIKE LANES MAY EXCEED 6' IF THEY INCLUDED A 1'-3' BUFFER, WITH A MAXIMUM COMBINED BUFFER AND BIKE LANE WIDTH OF 9'

DATE: 08/16/22	<p>COLLECTOR STREET (36' <math>\square</math> TO <math>\square</math>) WITH DETACHED SIDEWALKS</p>	<p>JEFFERSON COUNTY DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495</p>
SCALE:		
Drawn By: S.A.K		
Designed By: STAFF		
FILE: TEMP-5		



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS LESS THAN 1,000.
2. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. MOUNTABLE CURB ALLOWED.

DATE: 01/04/2016

SCALE:

Drawn By: D.A.M.

Designed By: STAFF

FILE: TEMP-6

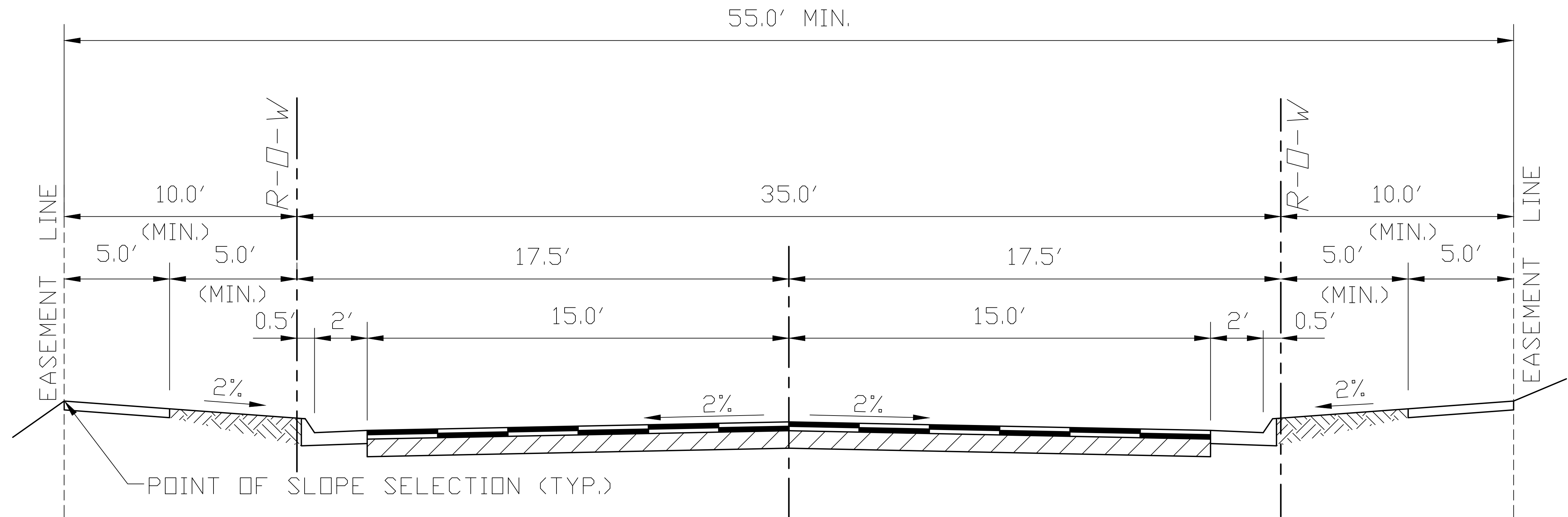
LOCAL STREET  
(34'  $\overline{\text{L}}$  TO  $\overline{\text{L}}$ )  
WITH ATTACHED SIDEWALKS

JEFFERSON COUNTY

DIVISION of

TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495





## NOTES

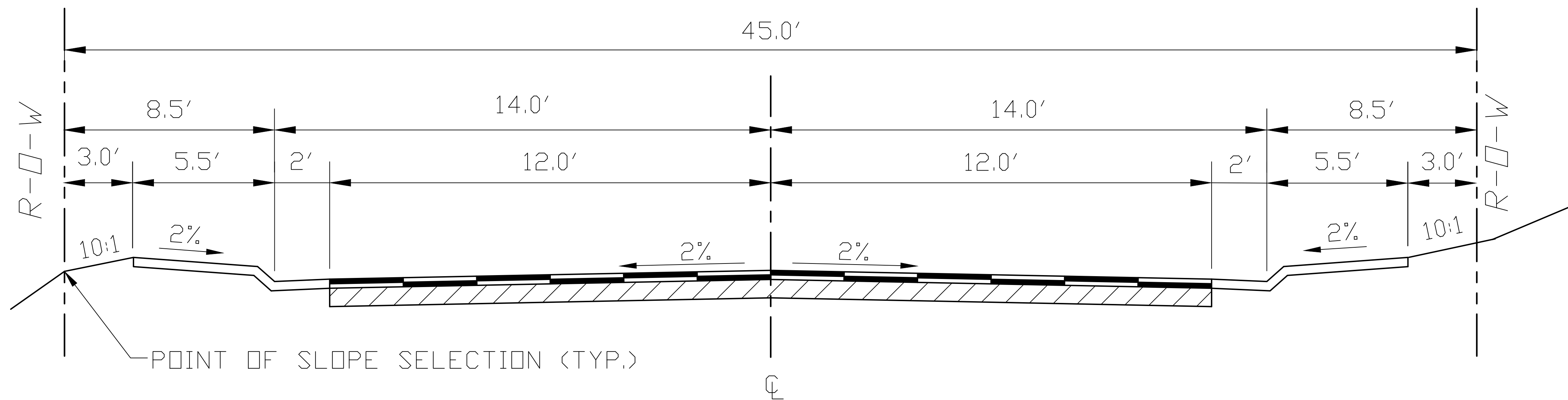
1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS LESS THAN 1,000.
2. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. MOUNTABLE CURB ALLOWED.

DATE: 01/04/2016  
 SCALE:  
 Drawn By: D.A.M.  
 Designed By: STAFF  
 FILE: TEMP-7

LOCAL STREET  
 (34'  $\nabla$  TO  $\nabla$ )  
 WITH DETACHED SIDEWALKS

JEFFERSON COUNTY  
 DIVISION of  
 TRANSPORTATION AND ENGINEERING  
 100 JEFFERSON CNTY. PKWY., SUITE 3500  
 GOLDEN, CO. 80419 (303) 271-8495





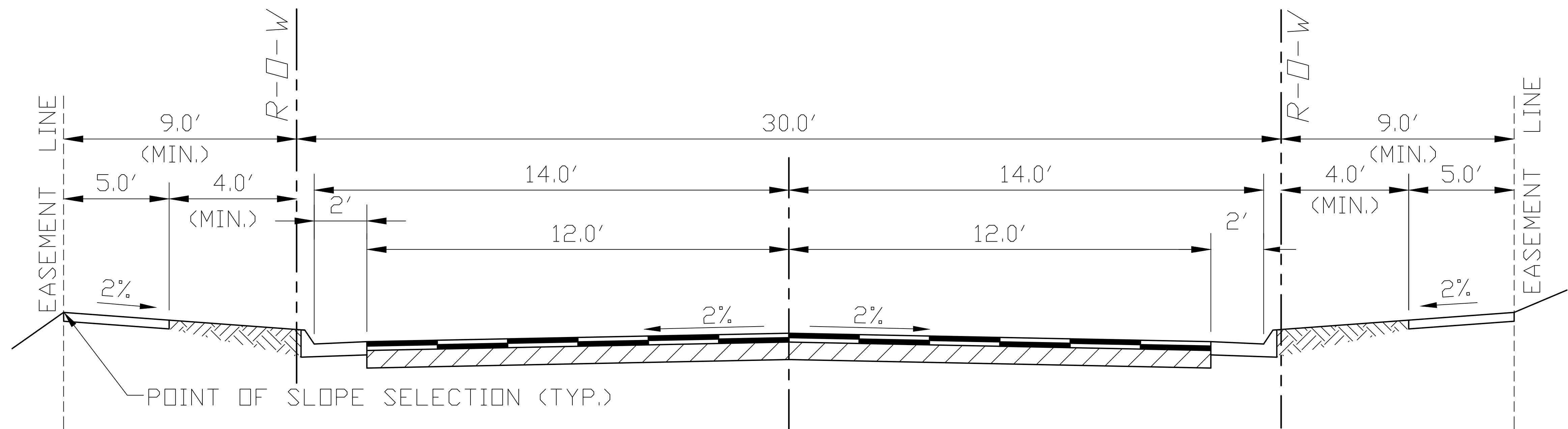
## NOTES

1. THIS TEMPLATE MAY BE USED WHERE THE DESIGN ADT IS LESS THAN 350 SUBJECT TO APPROVAL BY PLANNING AND ZONING BASED ON SAFETY AND TRAFFIC OPERATIONS AND SPECIFIC SITE CONDITIONS.
2. A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. ON STREET PARKING IS NOT PERMITTED.
5. MOUNTABLE CURB ALLOWED.

DATE: 01/04/2016  
 SCALE:  
 Drawn By: D.A.M.  
 Designed By: STAFF  
 FILE: TEMP-8

LOCAL STREET  
 (28'  $\overline{L}$  TO  $\overline{L}$ )  
 WITH ATTACHED SIDEWALKS

JEFFERSON COUNTY  
 DIVISION of  
 TRANSPORTATION AND ENGINEERING  
 100 JEFFERSON CNTY. PKWY., SUITE 3500  
 GOLDEN, CO. 80419 (303) 271-8495



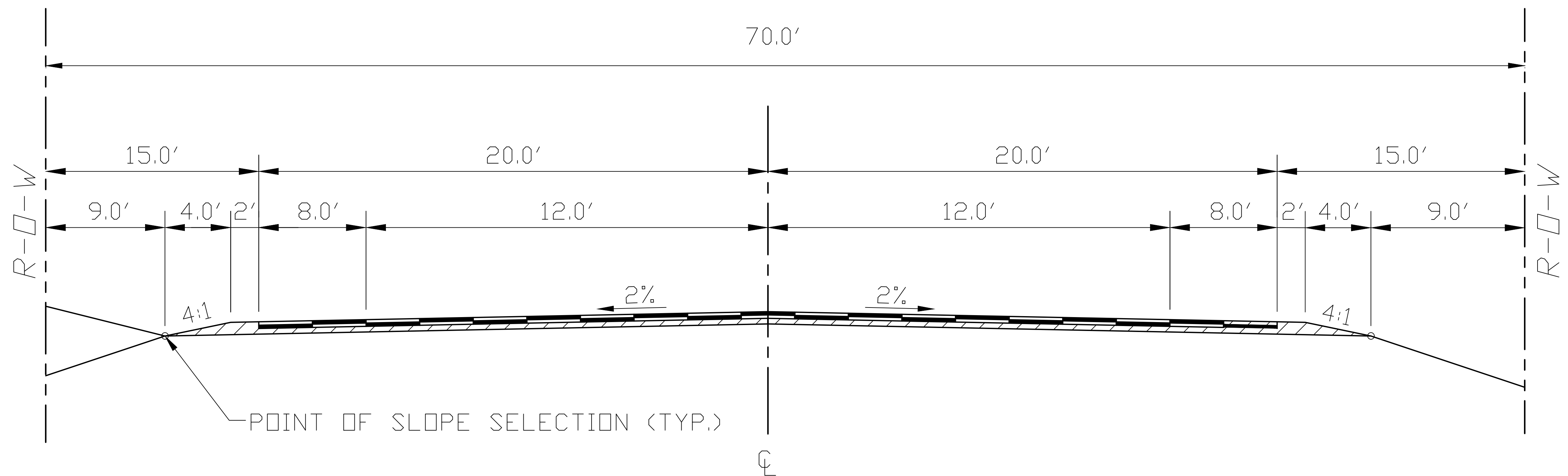
## NOTES

- THIS TEMPLATE MAY BE USED WHERE THE DESIGN ADT IS LESS THAN 350 SUBJECT TO APPROVAL BY PLANNING AND ZONING BASED ON SAFETY AND TRAFFIC OPERATIONS AND SPECIFIC SITE CONDITIONS.
- A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED.
- ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
- ON STREET PARKING IS NOT PERMITTED.
- VERTICAL CURB REQUIRED.

DATE: 01/04/2016  
SCALE:  
Drawn By: D.A.M.  
Designed By: STAFF  
FILE: TEMP-9

LOCAL STREET  
(28'  $\pm$  TO  $\pm$ )  
WITH DETACHED SIDEWALKS

JEFFERSON COUNTY  
DIVISION of  
TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495



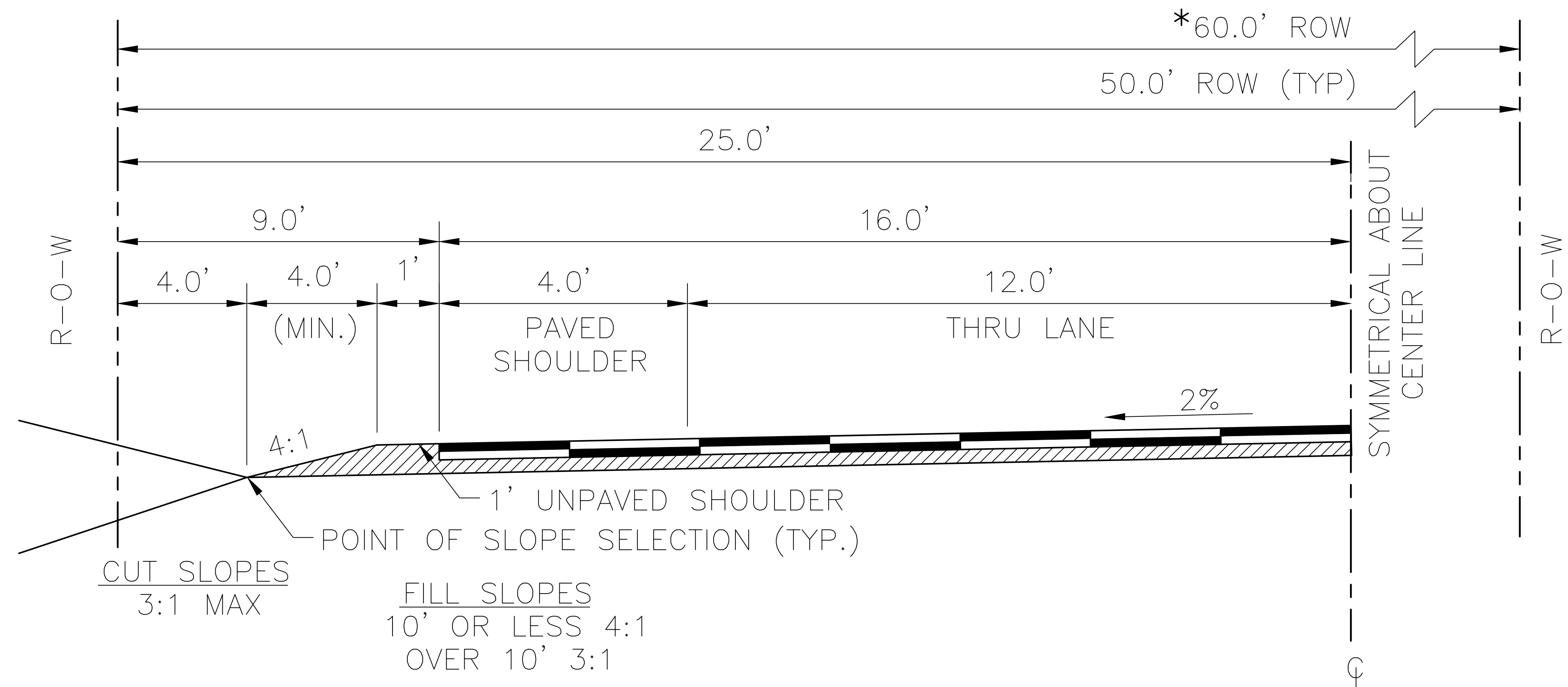
## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 8,000.
2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY JEFFERSON COUNTY PLANNING & ZONING. ACCELERATION/DECELERATION, LEFT TURN AND/OR CLIMBING LANES MAY BE REQUIRED AND WILL NECESSITATE ADDITIONAL RIGHT-OF-WAY.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.

DATE:	09/25/2017
SCALE:	
Drawn By:	D.A.M.
Designed By:	STAFF
FILE:	TEMP-10

MINOR  
ARTERIAL ROAD

JEFFERSON COUNTY  
DIVISION of  
TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495



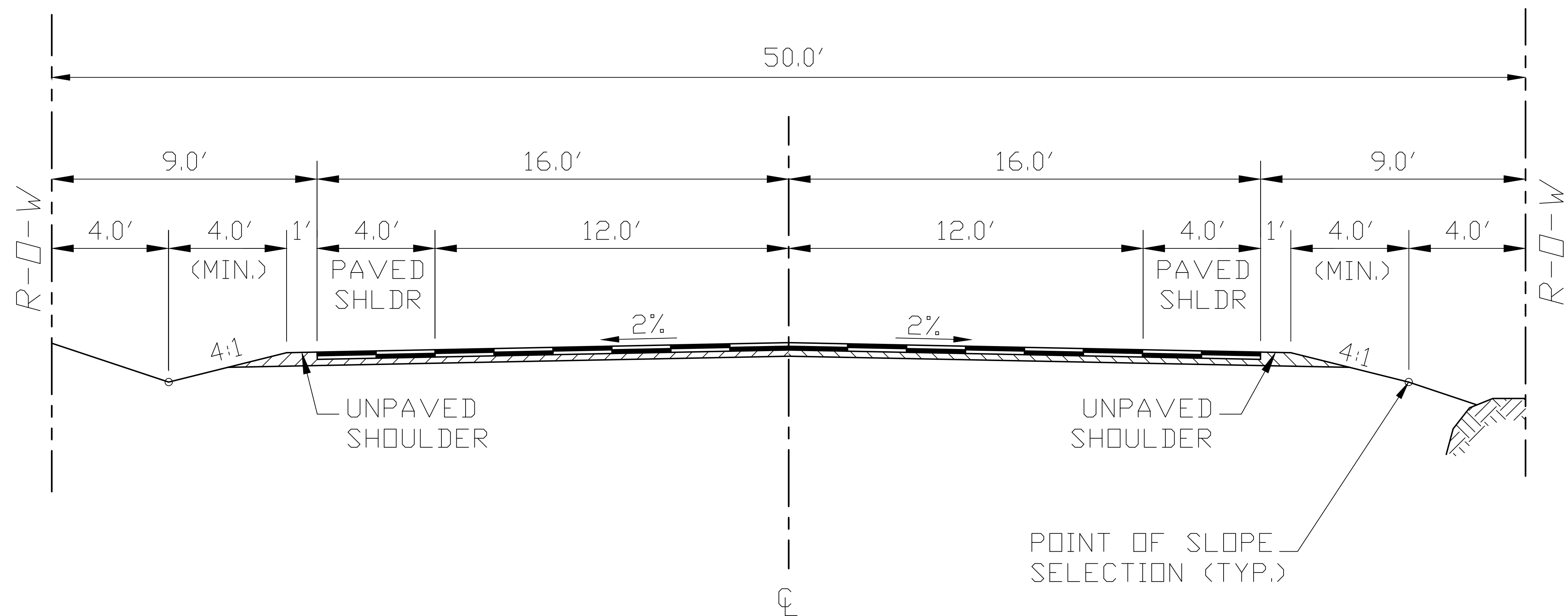
## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 2,000 BUT LESS THAN 8,000.
- \*2. INTERSECTION DESIGN AND ACCESS POINTS SHALL BE APPROVED BY JEFFERSON COUNTY PLANNING & ZONING. ACCELERATION/DECELERATION, LEFT TURN AND/OR CLIMBING LANES MAY BE REQUIRED AND WILL NECESSITATE ADDITIONAL RIGHT-OF-WAY.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.

DATE: 09/25/2017  
 SCALE:  
 Drawn By: D.A.M.  
 Designed By: STAFF  
 FILE: TEMP-11

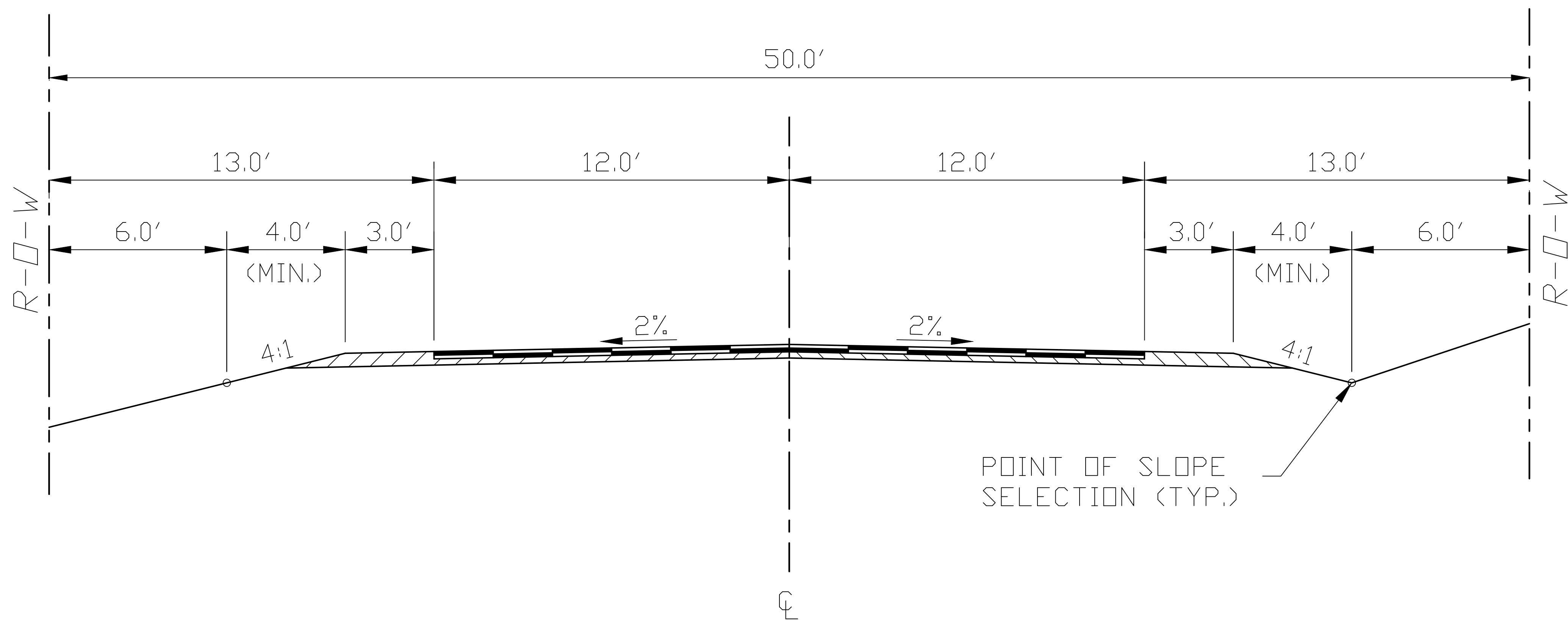
## MAJOR COLLECTOR ROAD

JEFFERSON COUNTY  
 DIVISION of  
 TRANSPORTATION and ENGINEERING  
 100 JEFFERSON CNTY. PKWY., SUITE 3500  
 GOLDEN, CO. 80419 (303) 271-8495



1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS GREATER THAN 1,000 BUT LESS THAN 2,000.
2. ACCESS POINTS SHALL BE APPROVED BY THE JEFFERSON COUNTY PLANNING & ZONING.
3. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.

COLLECTOR ROAD



## NOTES

1. THIS TEMPLATE SHALL BE USED WHERE THE DESIGN ADT IS LESS THAN 1,000.
2. ADDITIONAL RIGHTS-OF-WAY/EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
3. GUARDRAIL MAY BE REQUIRED DEPENDING ON FILL SLOPE HEIGHT/SLOPE AND/OR PRESENCE OF OTHER HAZARDS. SEE SECTION 3.10.1.

DATE: 09/25/2017

SCALE:

Drawn By: D.A.M.

Designed By: STAFF

FILE: TEMP-13

LOCAL ROAD

JEFFERSON COUNTY

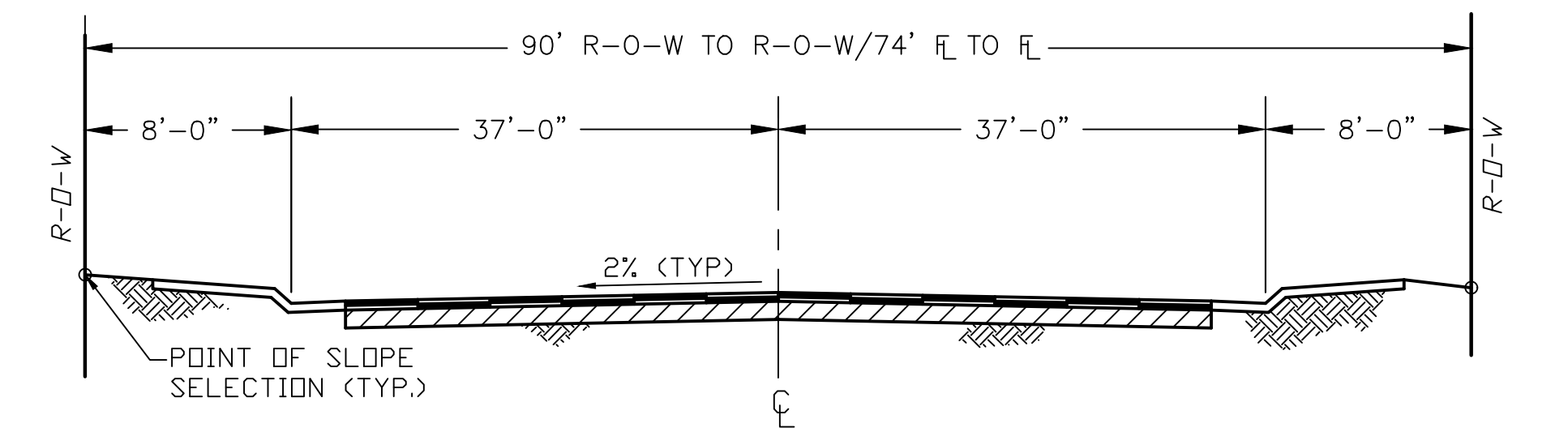
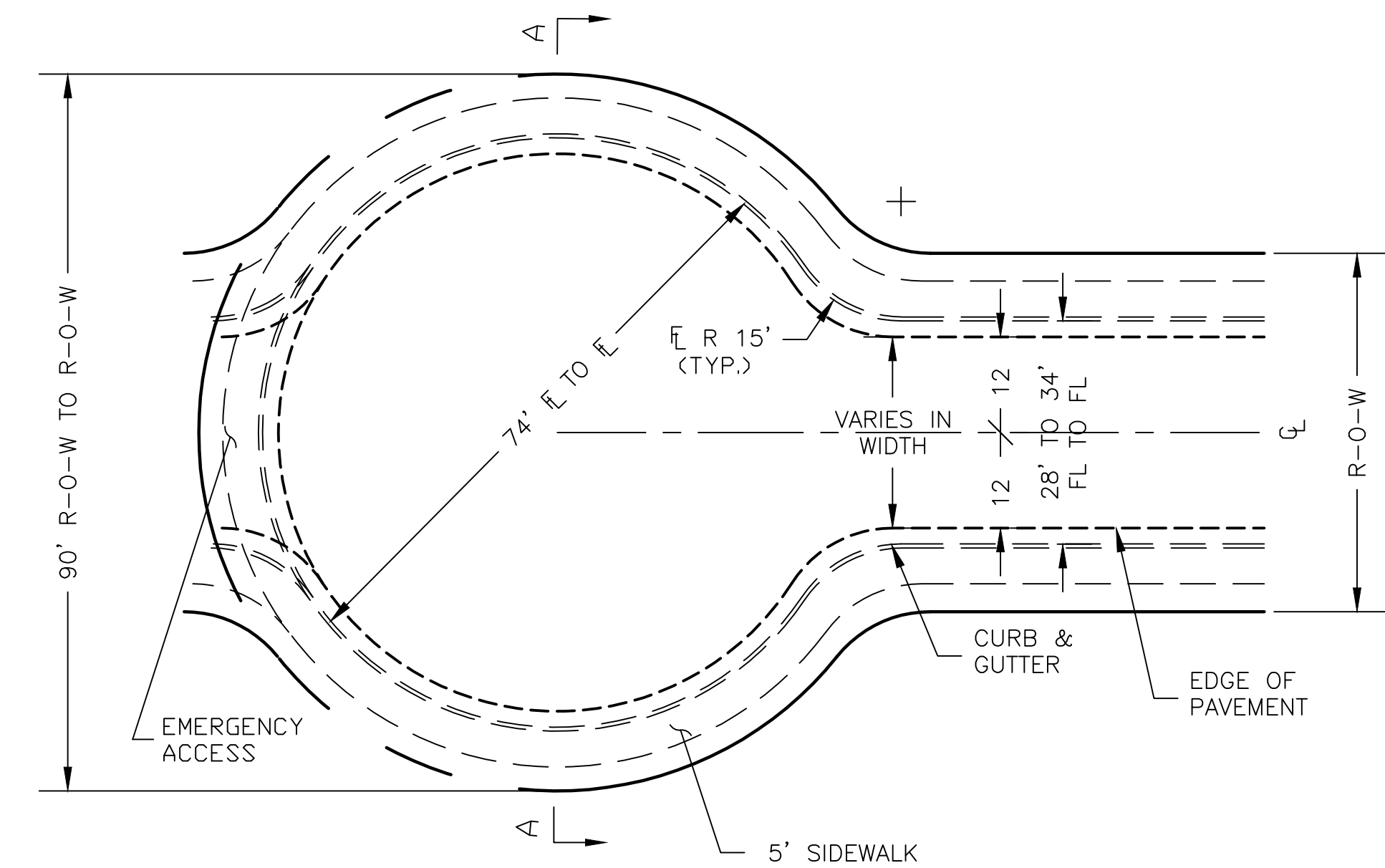
DIVISION of

TRANSPORTATION AND ENGINEERING

100 JEFFERSON CNTY. PKWY., SUITE 3500

GOLDEN, CO. 80419 (303) 271-8495

OPTION 1



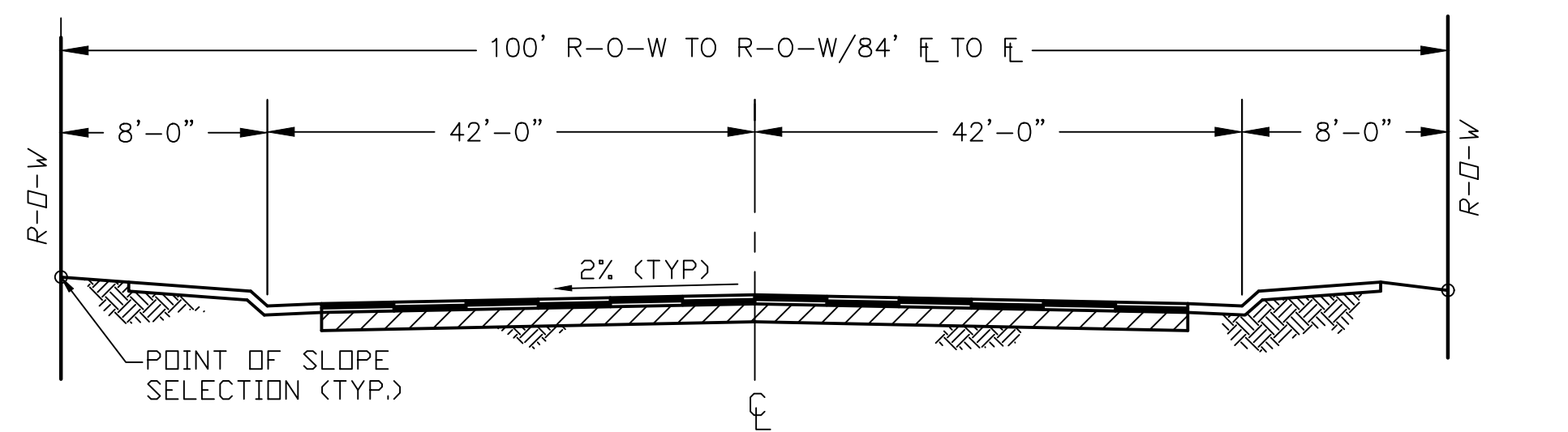
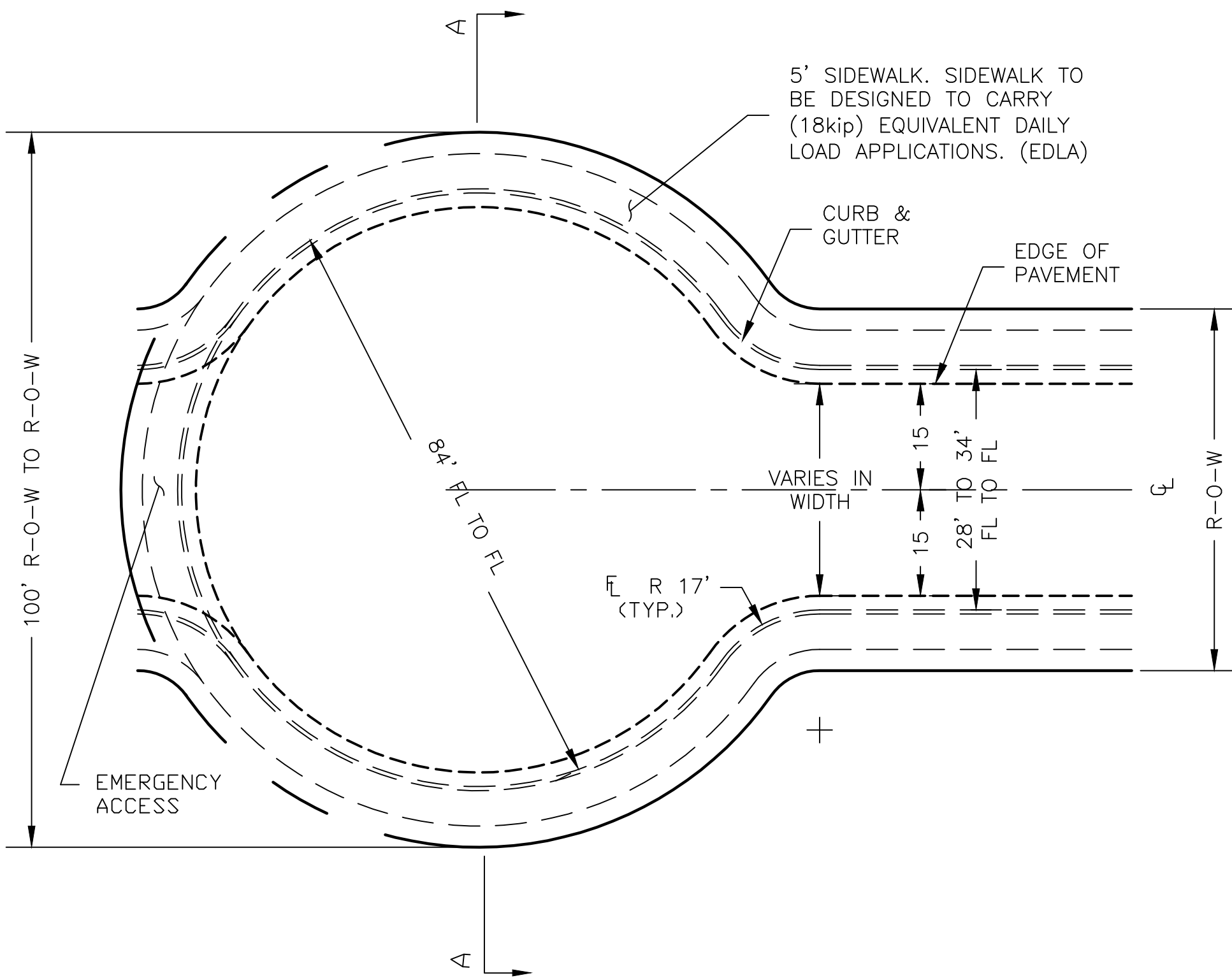
CUT SLOPES 3:1 MAX  
FILL SLOPES 10' OR LESS 4:1 OVER 10' 3:1

SECTION A - A  
74' FL to FL

NOTE:

1. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9
2. THE FLOWLINE TO FLOWLINE DISTANCE OF 74' AND ON-STREET PARKING IS ALLOWED IF THERE IS EMERGENCY ACCESS CONNECTED TO THE CUL-DE-SAC THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.

OPTION 2



CUT SLOPES 3:1 MAX  
FILL SLOPES 10' OR LESS 4:1 OVER 10' 3:1

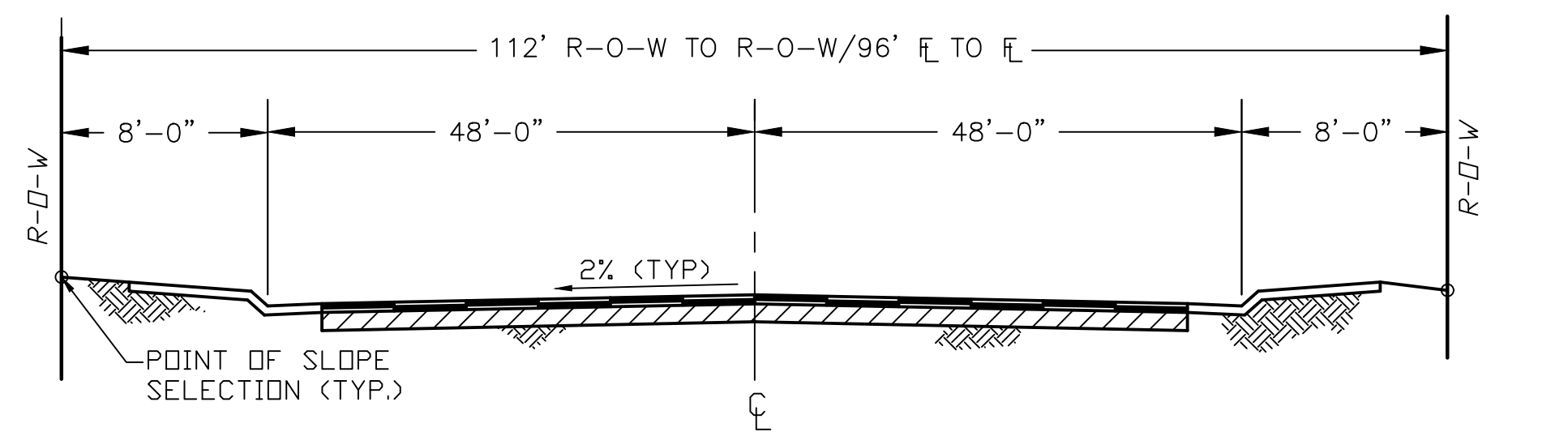
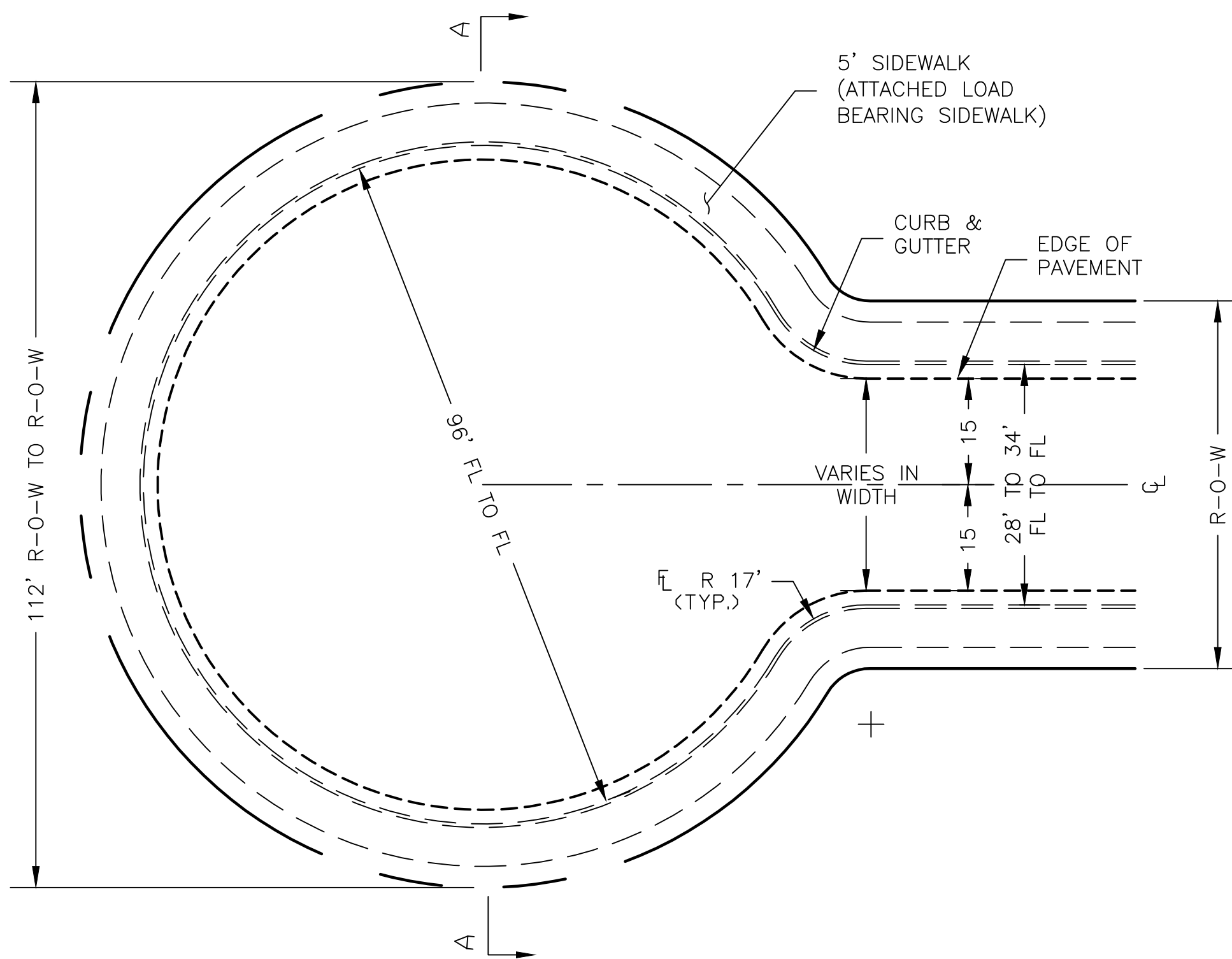
SECTION A - A  
84' FL to FL

NOTE:

1. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9
2. THE FLOWLINE TO FLOWLINE DISTANCE OF 84' AND ON-STREET PARKING IS ALLOWED IF THERE IS EMERGENCY ACCESS CONNECTED TO THE CUL-DE-SAC THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.
3. IF EMERGENCY ACCESS CONNECTION IS NOT PROVIDED, A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ON STREET PARKING IS NOT PERMITTED. ATTACHED SIDEWALK IS REQUIRED.

NOTE: Other than option 1 shown hereon, alternate standards for cul-de-sacs shall be approved by the appropriate fire protection district.

OPTION 3



CUT SLOPES 3:1 MAX  
FILL SLOPES 10' OR LESS 4:1 OVER 10' 3:1

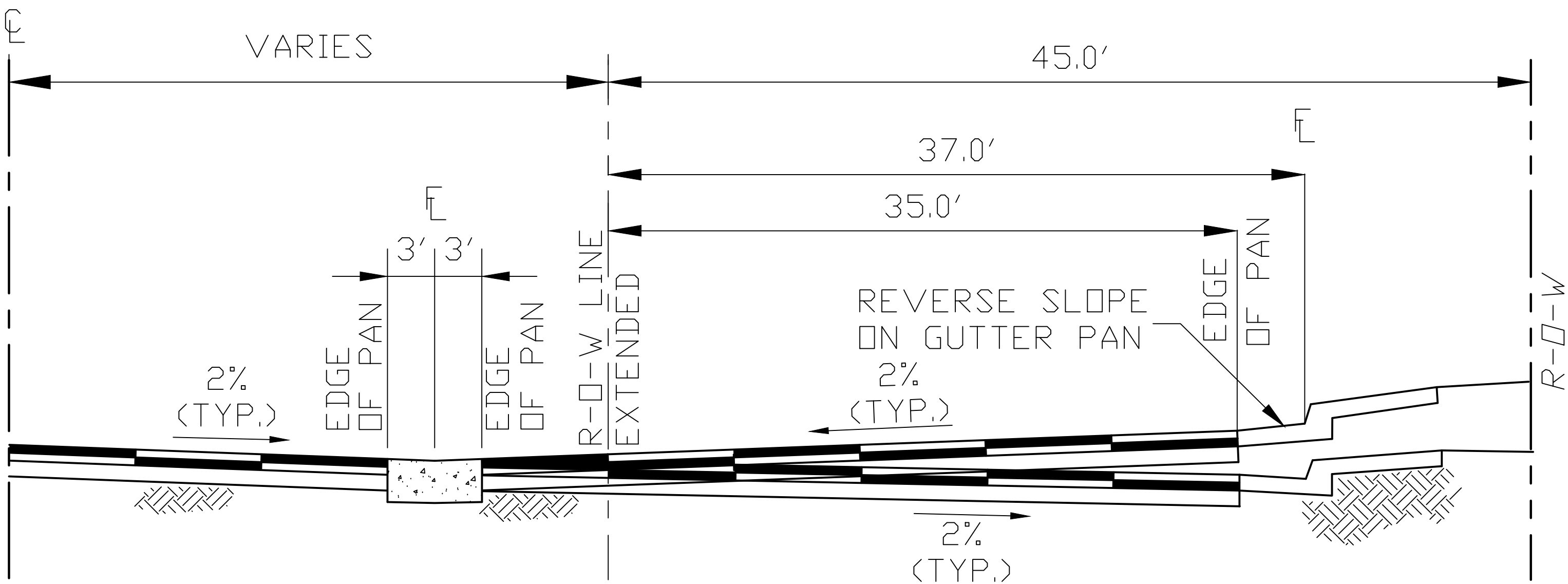
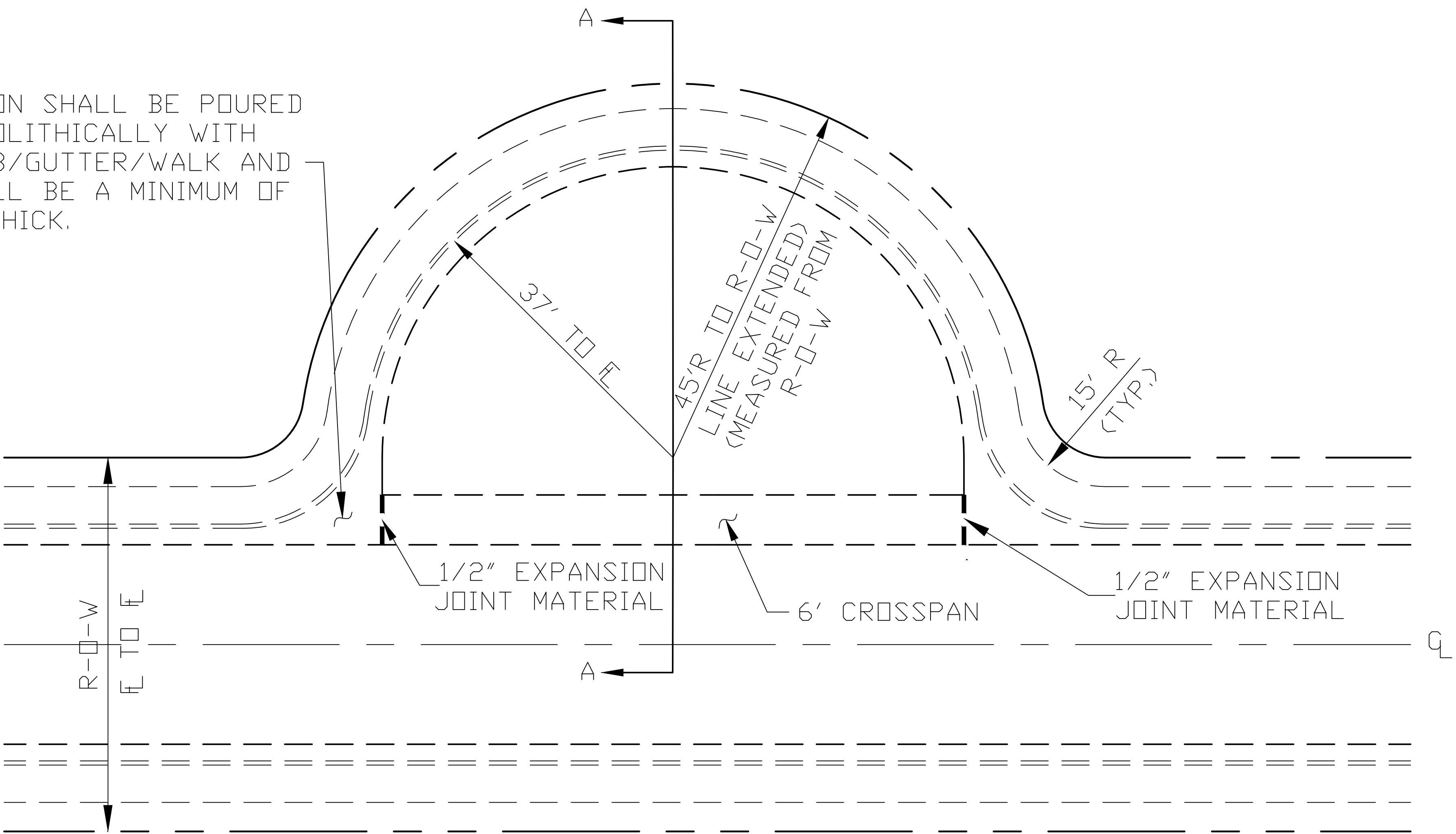
SECTION A - A  
96' FL to FL

NOTE:

1. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9
2. A MINIMUM OF FOUR OFF-SITE STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ON-STREET PARKING IS NOT PERMITTED.

Revisions:	Designed By:	STAFF	Scale:		(As Shown)
	Drawn By:	D.A.M.	Date Created:		
	Checked By:	Staff	Plot Date:	8/16/22	F.I.R. Date:
	File:	TEMP-14-NEW.dwg	F.O.R. Date:	For Const. Date:	
	File Location:		G:\_CAD\Standards\Road-Templates		

APRON SHALL BE POURED MONOLITHICALLY WITH CURB/GUTTER/WALK AND SHALL BE A MINIMUM OF 8" THICK.



- NOTE:
1. IF SUFFICIENT FALL IS AVAILABLE AROUND THE FLOWLINE OF THE PARTIAL CUL-DE-SAC (> 1%), THE CUL-DE-SAC MAY SLOPE AWAY FROM THE CROSSPAN. SHOW SPOT ELEVATIONS AND FLOW ARROWS ON THE CONSTRUCTION PLANS.

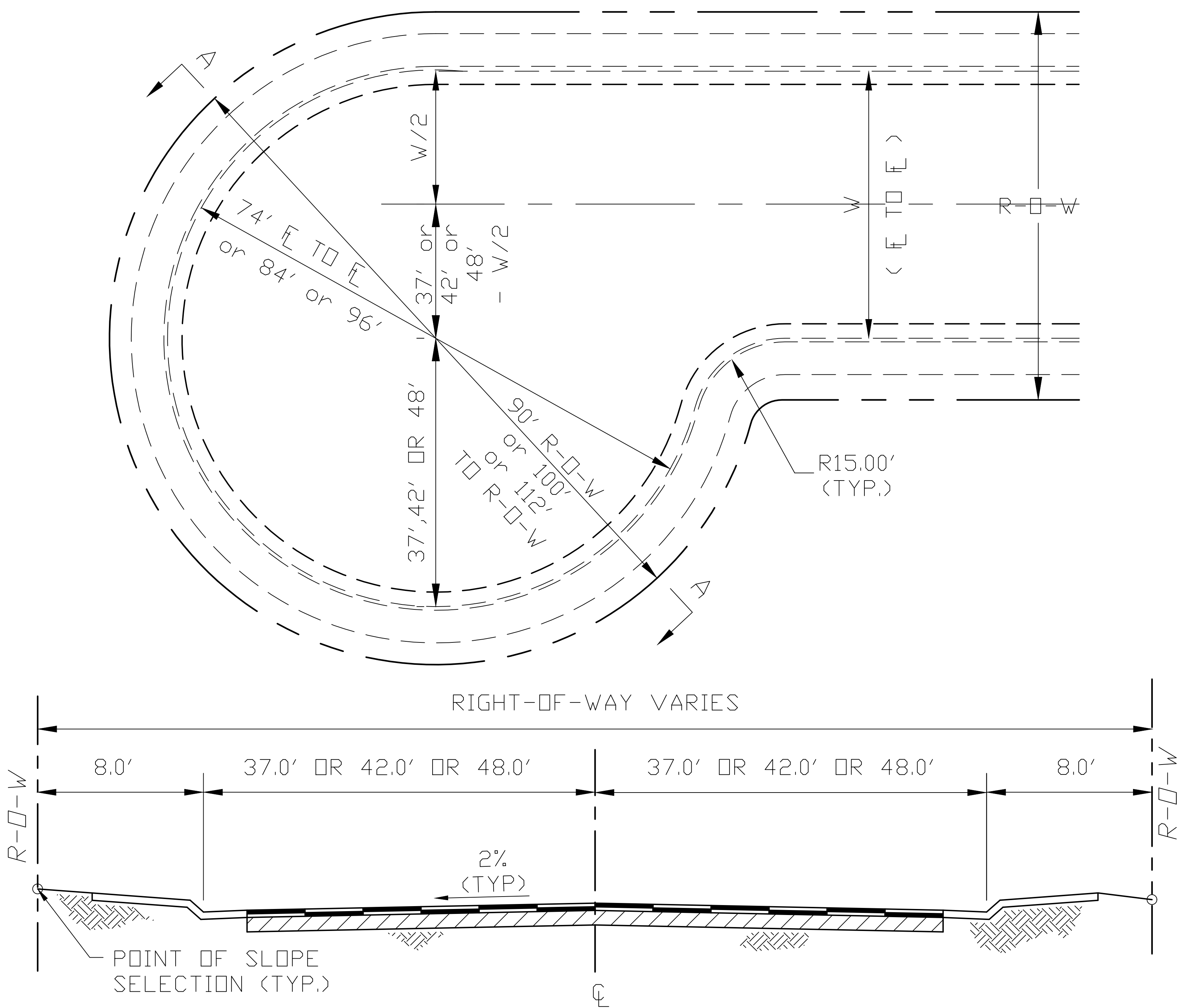
2. SEE STANDARD NO.10 FOR CONCRETE JOINT DETAILS.

3. SEE STANDARD NO.5 FOR CROSSPAN DETAIL.

4. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9

DATE: 01/04/2016	JEFFERSON COUNTY DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	PARTIAL CUL-DE-SAC FOR LOCAL STREETS
SCALE:	
FILE: TEMP-15	



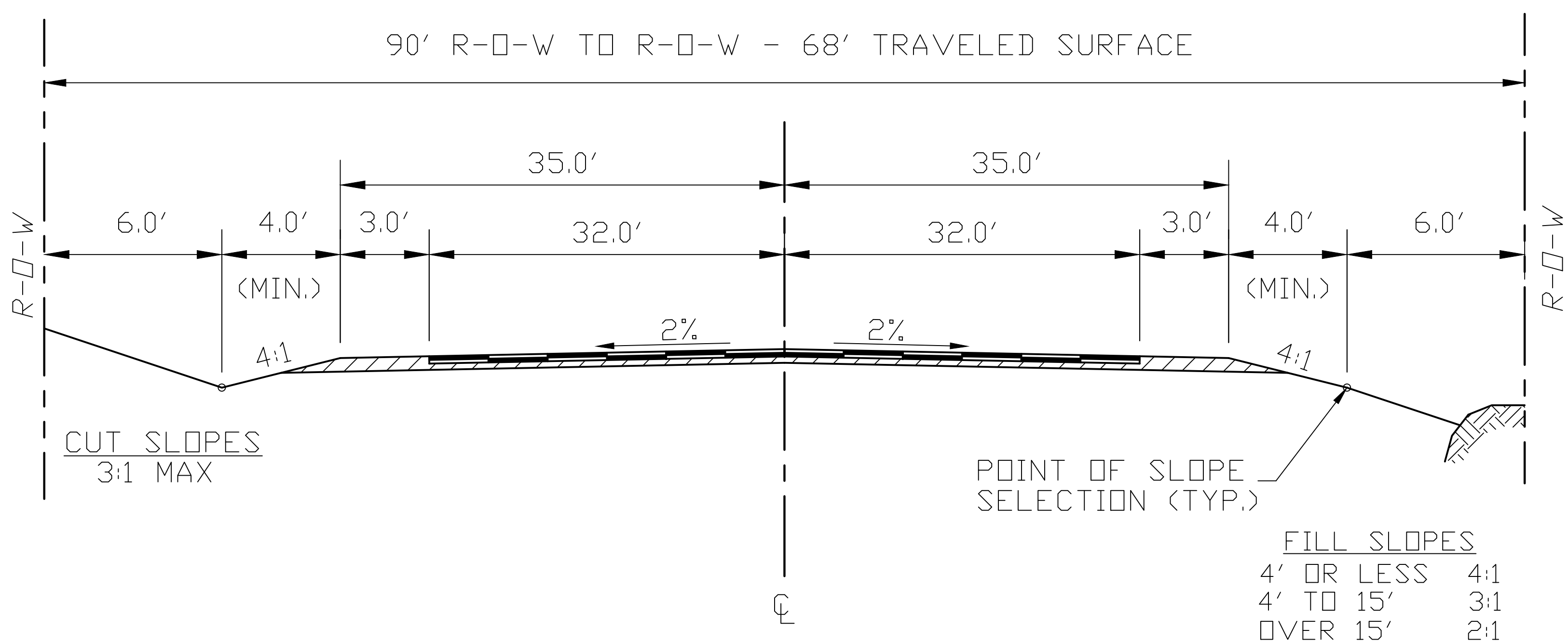
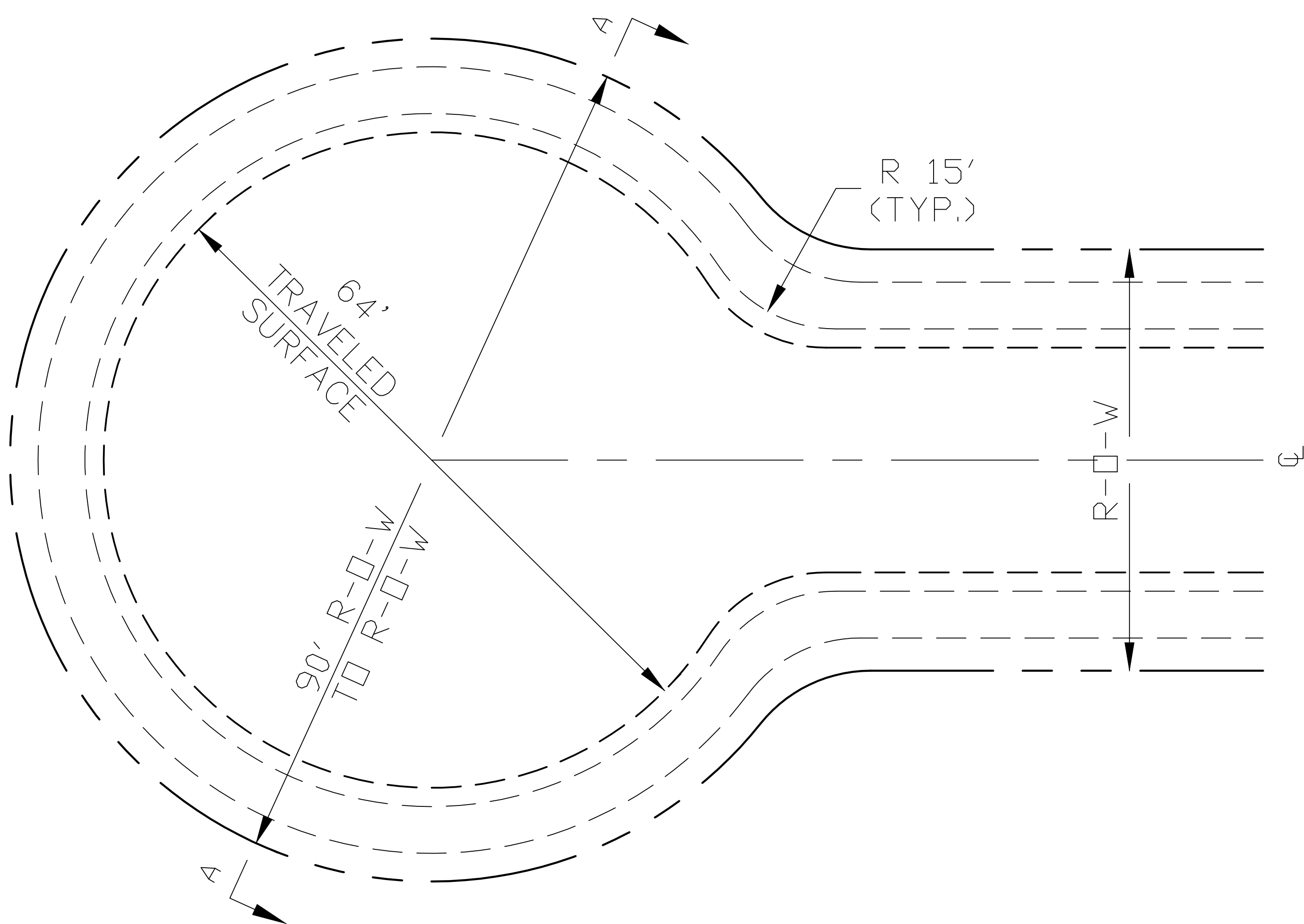


## SECTION A - A

### NOTES:

1. OFFSET CUL-DE-SAC FOR LOCAL ROADS SHALL BE BUILT ACCORDING TO THE SECTIONS SHOWN ON TEMPLATE NUMBER 16.
2. ALL DIMENSIONS SHALL BE SHOWN ON THE PLANS.
3. SIDEWALK MAY BE DETACHED AS SHOWN ON TEMPLATES 7 AND 9.
4. IF THE FLOWLINE TO FLOWLINE DISTANCE IS LESS THAN 96', A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ONSTREET PARKING IS NOT PERMITTED.
5. THE FLOWLINE TO FLOWLINE DISTANCE OF 84' IS ALLOWED PROVIDED THE ATTACHED SIDEWALK HAS A LOAD BEARING CAPACITY THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.
6. THE FLOWLINE TO FLOWLINE DISTANCE OF 74' AND ON-STREET PARKING IS ALLOWED IF THERE IS EMERGENCY ACCESS CONNECTED TO THE CUL-DE-SAC THAT IS ACCEPTABLE TO THE APPROPRIATE FIRE PROTECTION DISTRICT.

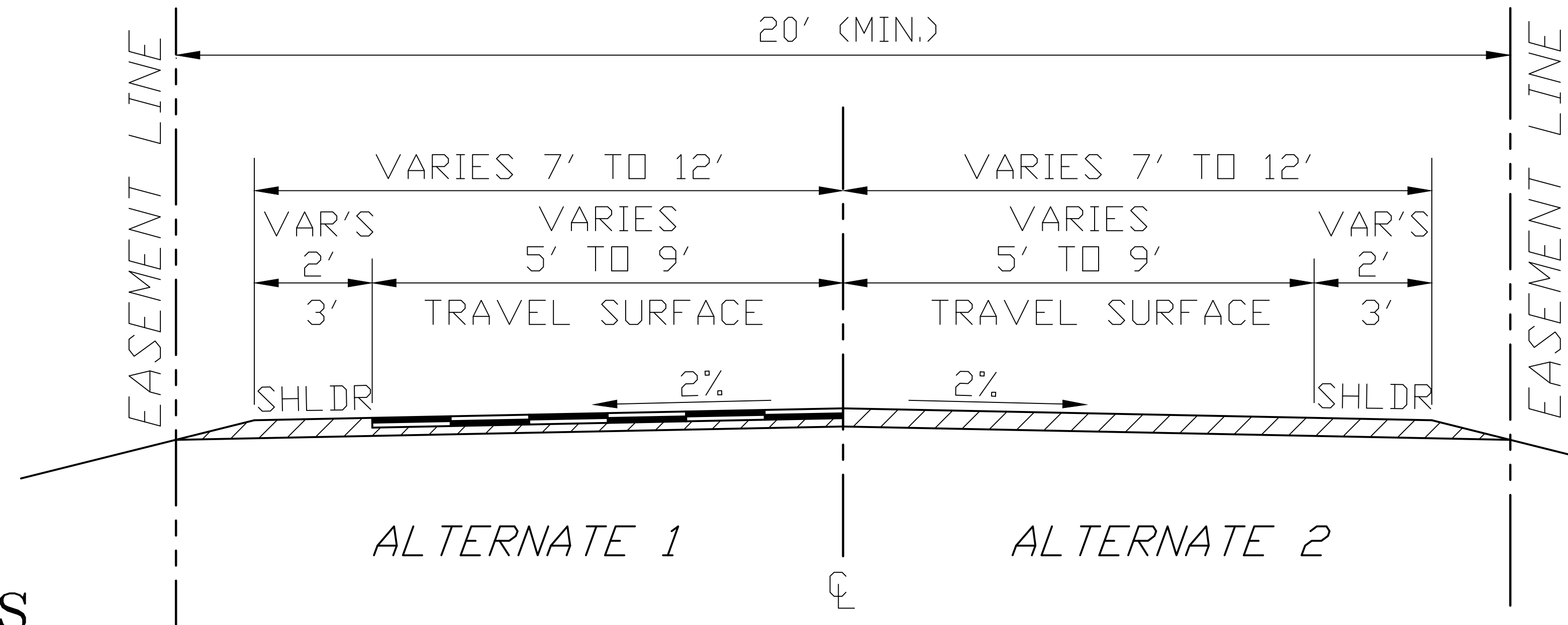
DATE: 01/04/2016	JEFFERSON COUNTY DIVISION of TRANSPORTATION AND ENGINEERING 100 JEFFERSON CNTY. PKWY., SUITE 3500 GOLDEN, CO. 80419 (303) 271-8495
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	
SCALE:	
FILE: TEMP-16	OFFSET CUL-DE-SAC FOR LOCAL STREETS



## SECTION A - A

1. A MINIMUM OF FOUR OFF-STREET PARKING SPACES PER DWELLING UNIT IS REQUIRED AND ON ROAD PARKING IS NOT PERMITTED.

DATE: 01/04/2016	<p>JEFFERSON COUNTY</p> <p>DIVISION of TRANSPORTATION AND ENGINEERING</p> <p>100 JEFFERSON CNTY. PKWY., SUITE 3500</p> <p>GOLDEN, CO. 80419 (303) 271-8495</p>
DRAWN BY: D.A.M.	
CHECKED BY: STAFF	
SCALE:	
FILE: TEMP-17	<p>CUL-DE-SAC</p> <p>FOR LOCAL ROADS</p>



## NOTES

1. ALTERNATE 1 (PAVED SURFACE) IS REQUIRED FOR PRIVATE STREETS/ROADS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS.
2. ALTERNATE 2 (ALL WEATHER SURFACE) IS PERMITTED FOR DRIVEWAYS AND FOR PRIVATE STREETS/ROADS SUBJECT TO THE LAND DEVELOPMENT REGULATIONS.
3. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR CUT AND FILL SLOPES, DRAINAGE STRUCTURES AND MAINTENANCE.
4. CURB AND GUTTER AND/OR DITCHES ARE REQUIRED FOR PRIVATE STREETS SUBJECT TO THE LAND DEVELOPMENT REGULATION.
5. SEE SECTION 3.7.8 FOR ADDITIONAL DESIGN CRITERIA.
6. DRIVEWAYS LONGER THAN 150 FEET ARE REQUIRED TO HAVE 12 FOOT WIDE TRAVEL SURFACE WITH 2 FOOT WIDE SHOULDERS ON BOTH SIDES.
7. ON STREET/ROAD PARKING IS NOT PERMITTED.
8. ALL-WEATHER TRAVEL SURFACE MAY BE USED.

9. Super-elevation on driveways may be allowed for drainage purposes as approved by Planning and Zoning.

DATE: 08/16

SCALE:

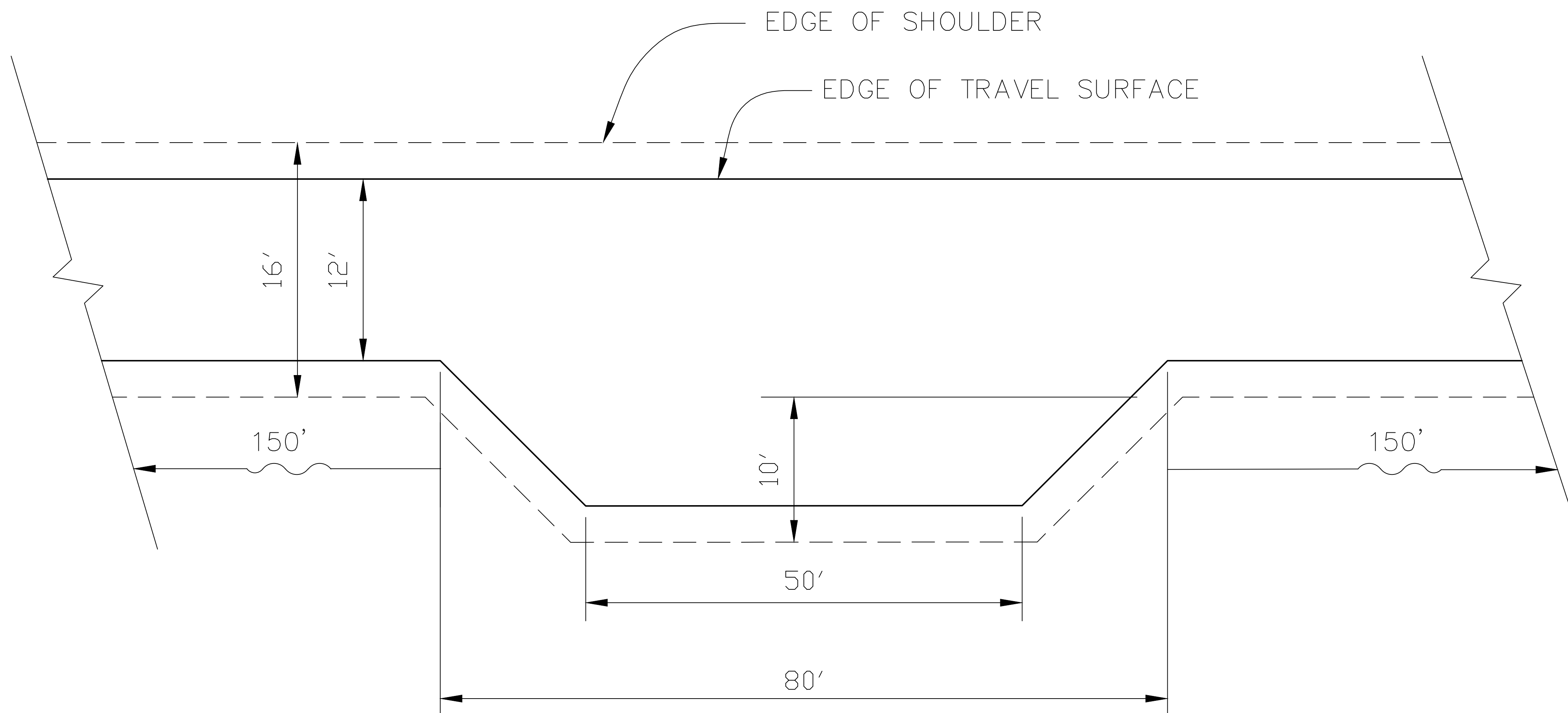
Drawn By: D.A.M.

Designed By: STAFF

FILE: TEMP-18

DRIVEWAY/PRIVATE STREET/  
ROAD & NON-MAINTAINED STREET/  
ROAD IN COUNTY ROW

JEFFERSON COUNTY  
DIVISION of  
TRANSPORTATION and ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495



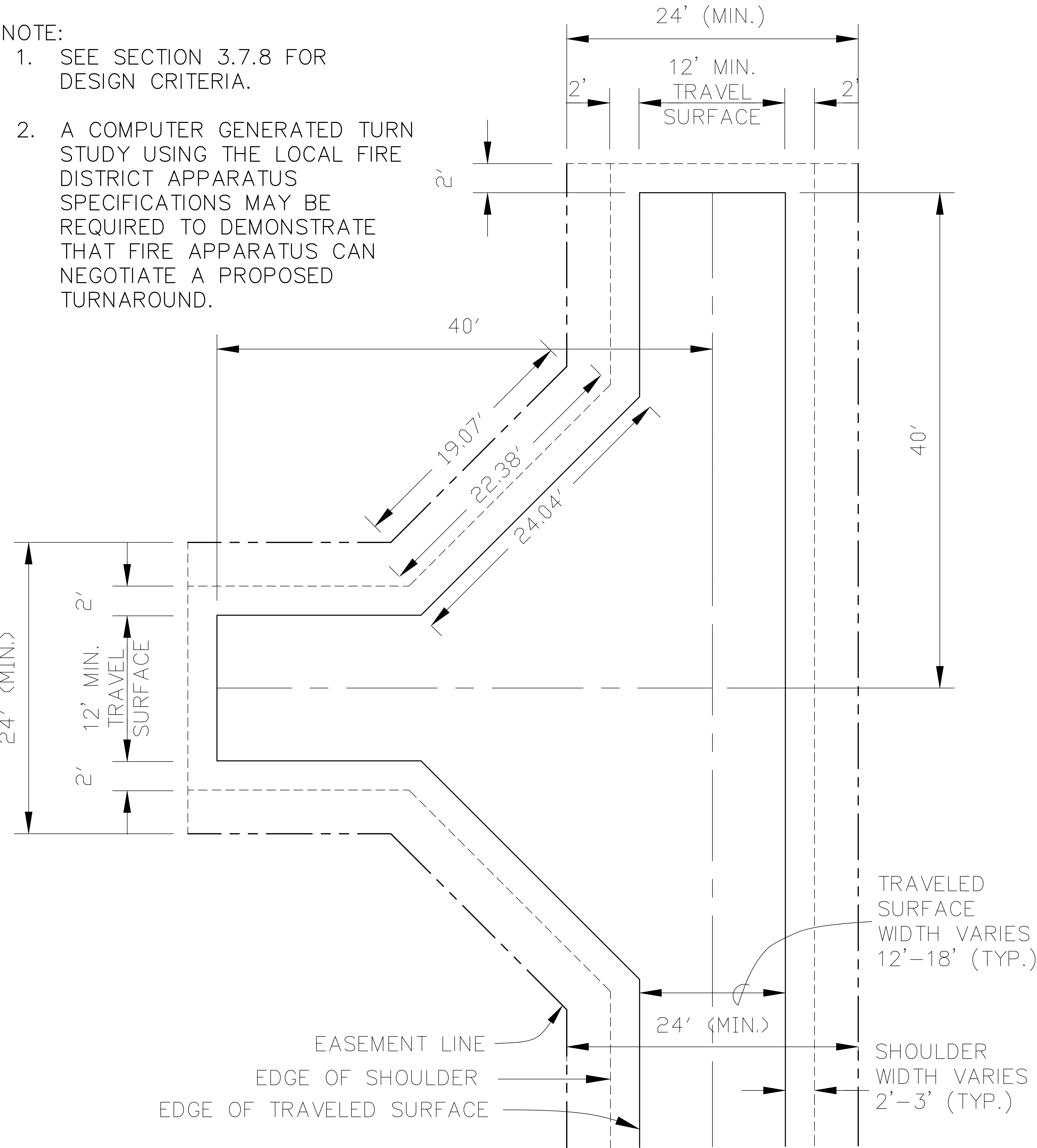
DATE:	12/9/2015
SCALE:	
Drawn By:	D.A.M.
Designed By:	STAFF
FILE:	TEMP-19

PULL OUT FOR PRIVATE  
ROAD

JEFFERSON COUNTY  
DIVISION of  
TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

NOTE:

- 1. SEE SECTION 3.7.8 FOR DESIGN CRITERIA.
- 2. A COMPUTER GENERATED TURN STUDY USING THE LOCAL FIRE DISTRICT APPARATUS SPECIFICATIONS MAY BE REQUIRED TO DEMONSTRATE THAT FIRE APPARATUS CAN NEGOTIATE A PROPOSED TURNAROUND.



DATE: 12/9/2015

DRAWN BY: D.A.M.

CHECKED BY: STAFF

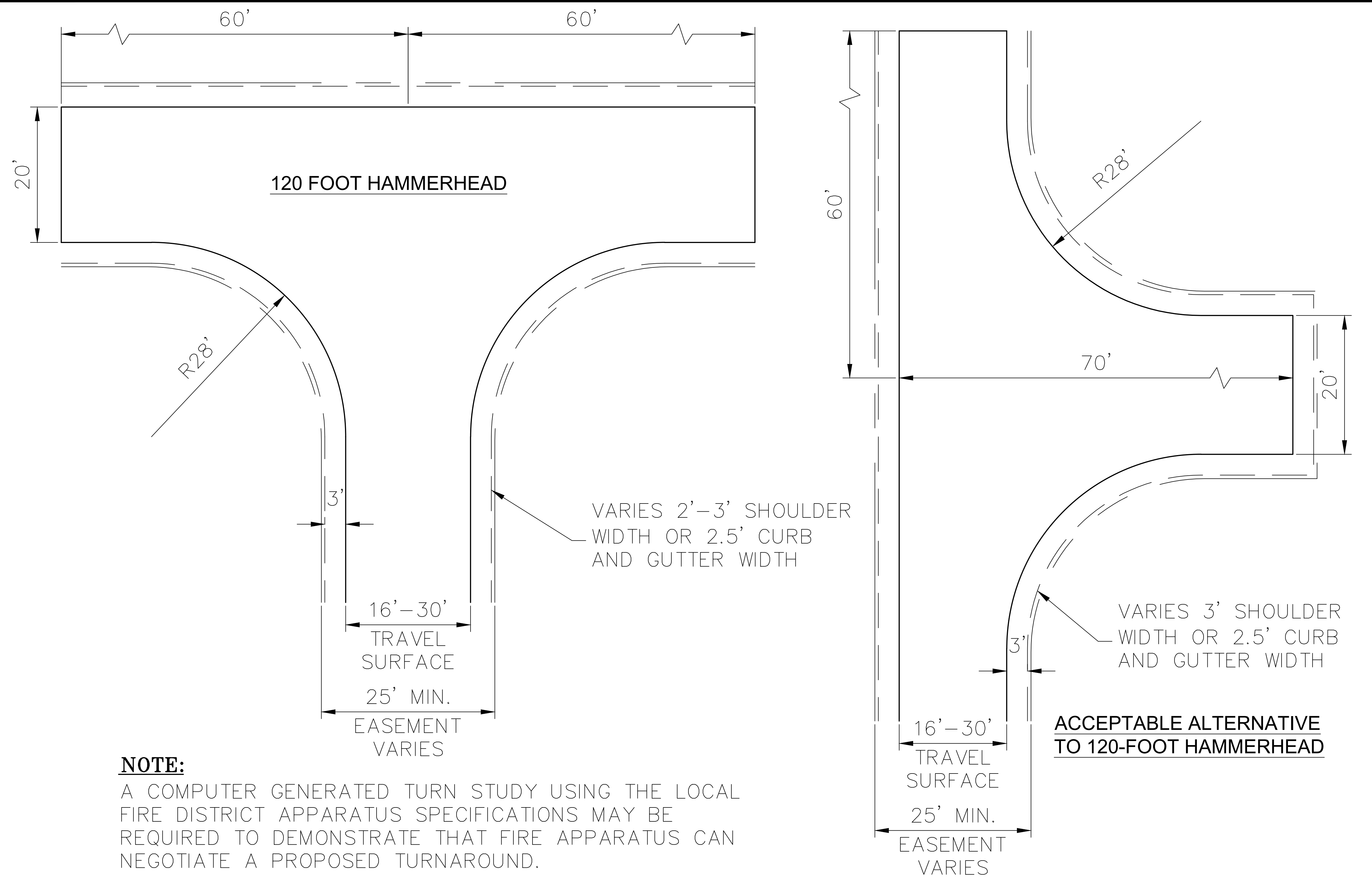
SCALE: NTS

FILE: TEMP-20

JEFFERSON COUNTY

DIVISION. of TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495

HAMMERHEAD TURNAROUND  
FOR DRIVEWAYS/PRIVATE ROADS



DATE:	01/04/2016
SCALE:	
Drawn By:	D.A.M.
Designed By:	STAFF
FILE:	TEMP-21

HAMMERHEAD TURNAROUND  
FOR PRIVATE STREET

JEFFERSON COUNTY  
DIVISION of  
TRANSPORTATION AND ENGINEERING  
100 JEFFERSON CNTY. PKWY., SUITE 3500  
GOLDEN, CO. 80419 (303) 271-8495



# COMMUNITY DEVELOPMENT

One DesCombes Drive • Broomfield, CO 80020 • 303.438.6389 • [www.broomfield.org](http://www.broomfield.org)

**TO:** Lindsey Wire, P.E. (JeffCo)  
**FROM:** Matthew Deaver, P.E., Development Review Engineering Manager (CCOB)  
**DATE:** November 23, 2022  
**SUBJECT:** Regulation Amendment Case 22-122945AM (Transportation Design and Construction Manual) - Comment Letter

.....

Thank you for submitting revisions for the above manual. Comments from internal City and County of Broomfield reviewers are provided below.

## Traffic Comments

- See Redline comments [here](#). Please let me know if you have any questions.

## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Monday, December 5, 2022 1:15 PM  
**To:** Lindsey Wire  
**Cc:** Troy Jones  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Building Division

**Results: No Comment (no further review)**

**Review Comments:**

**Scheduled End Date: 11/23/2022**

**Reviewer: Troy Jones**

**Description: Regulations Amendment to the Transportation and Construction Manual**



Heather Gutherless, Long Range Planning  
Jefferson County Planning & Zoning  
100 Jefferson County Parkway  
Golden CO 80419

VIA EMAIL

November 21, 2022

To: Heather Gutherless, Senior Planner.

Cc: Chris O'Keefe, Director of Planning & Zoning and Steve Durian, Director of Traffic & Engineering.

From: Paul R. Olson, P.E., T.E. for the *Conifer & South Evergreen Community Committee*.

Subject: Review comments regarding proposed updates to the Transportation Design and Construction Manual, "Redline\_TDCM\_DRAFT\_10202022.pdf".

#### GENERAL COMMENTS

As a general matter, the Transportation Design and Construction Manual (TDCM) defines engineering standards; therefore, it is appropriate that the TDCM is under the strict authorship control of the Jefferson County Traffic & Engineering Division (or similar authority) NOT the Planning & Zoning Division. There is actually very little in the document that provides guidance with respect to planning and/or zoning. Similar documents authored by other cities, counties, and state departments of transportation are the domain of the engineering staff within the agency.

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Moreover, the design standards, construction templates, and other guidance presented in the TDCM should also be reviewed and approved then sealed by a professional engineer.

The TDCM reader would benefit from a document that contains a coherent figure, table, and page numbering system.

## SPECIFIC COMMENTS

The following are the Committee's specific comments with respect to the TDCM Chapter 3 Design and Technical Criteria:

1. **Section 3.4 Standard Templates:** *Under 'Private street/road templates and Non-maintained streets/roads in County ROW templates', minimum requirements for private driveways are undefined. Additionally, the table references LDR Section 15, which contains roadway design requirements; however, during many design and construction scenarios, the TDCM and LDR Section 15 document will be in conflict; therefore, the Committee recommends that roadway design and construction requirements be removed for LDR Section 15.*
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4. **Section 3.7.8.1.2 Width:** *The Committee has determined that 500' is too long a distance; therefore, the width specification should be based and justified by the length of hose that the firefighting apparatus carries.*
5. **Section 3.7.8.1.3 Grade:** *Grade limitations are generally positive; however, the TDCM also needs to address the maximum change of grade from one roadway section to another. In many scenarios, going from 12% down to 12% up in a short distance will be a safety hazard. Additionally, there should be an explanation for this statement reading, for example: "Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West". Moreover, all other possible orientations should also be specified.*
6. **Section 3.7.8.2.1 Curve Radius:** *What is this 30' curve radius based upon? There needs to be a reference or justification for this specification: It could be that a 30' radius is not sufficient in many scenarios.*
7. **Section 3.7.8.2.2 Width (For a street/road serving up to 15 dwelling units):** *Will parking be allowed on these roadways? What about horizontal and vertical obstructions? This width specification should be situationally based.*
8. **Section 3.7.8.3:** *The use of the clause, "The off-site driveway or private road shall meet requirements of this section" is ambiguous. Such as clause as this*

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*Additionally, my reaction to the following statement, "Such statement shall bear the professional engineer's seal, signature and date,..." is that, as a professional engineer, I (Paul Olson) would not risk my professional engineer's license to approve plans for an on-site driveway or private roadway in a circumstance where the actual requirements are so ill-defined.*

*Moreover, if the driveway cannot safely accommodate a fire protection district apparatus then there is NO condition where an exception should be granted – this requirement should be deleted completely – inasmuch as it is not clear how Jefferson County Staff will judge any requested exemption under this clause. In my opinion (Paul Olson), this clause will only cause Staff and the public significant, ongoing difficulties that are unnecessary. Again, there are no templates or drawings that detail the minimum requirements for driveways as they intersection with the county roadway!*

The following are the Committee's specific comments with respect to the TDCM Transportation Studies Appendix:

1. **General:** *This section is greatly improved! However, it needs better section numbering to match the rest of the document and there needs to be a separate section on Traffic Signals which would include a specification for engineering studies of MUTCD Warrants and Alternatives.*
2. **Requirements for Transportation Studies (TS):** *The trip generation analysis should include both weekdays and weekend. This is particularly important for commercial developments but also residential developments in the vicinity of commercial developments such as shopping centers.*

*For mountain area developments, the study should also analyze the impact of major transportation corridors. For example, a currently active proposed development within the Conifer/Aspen Park community – the proposed Conifer Center PD, Case No. 20-111200RZ – should study the impact to U.S.-285 in the Turkey Creek Canyon. This is a major bottleneck, in particular for emergency access and routes for evacuation.*

3. **Trip Generation Summary Table:** *Columns to be modified in and added to the table, "1) columns for Weekdays AM Peak & PM Peak, 2) columns for Saturday AM Peak & PM Peak, and 3) columns for Sunday AM Peak & PM*

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*All counts shall be sufficient to clearly identify peaks and to show that the analysis is not based upon the lowest volumes collected. All counts shall establish the average daily volumes as well as the peak hour volumes.*

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*Would a facility that operates at LOS D or V/C of 0.90 for 12 consecutive hours a day be acceptable? What are the limits on how many hours a day that a facility could operate in congested conditions? An hour in the peaks may be OK but not more.*

**Jefferson County Transportation and Engineering Level of Service Criteria for Arterials is based on Volume-to-Capacity Ratios Level of Service Description V/C:**

- A. Free-flow conditions with unimpeded maneuverability, stopped delay at signalized intersection is minimal, that is, on the order of 0.00 to 0.60.
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#### QUALIFICATIONS

I present the following qualifications as ample proof that I am more than qualified in Traffic Engineering to make the above comments.

- *Registered Civil Engineer WA, OR, CA, AZ, NV*
- *Registered Traffic Engineer CA, OR*
- *Fellow at Institute of Transportation Engineers*
- *ITE Professional Traffic Operations Engineer, Retired*
- *8 Years Washington State DOT*  
*15 Years Consulting Engineer*  
*18 Years Federal Highway Administration*
- *Educator:*
  - *Washington State University*
  - *University of Idaho*
  - *University of Maryland*
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## CONCLUSION

The Committee is hopeful that the above recommendations will help improve the future health, safety, and welfare of both residents, visitors, and travelers in the unincorporated areas of Jefferson County.

Respectfully submitted,

Paul R. Olson, P.E., T.E.

25587 Conifer Road

STE 105-611

Conifer CO 80433

*Conifer and South Evergreen Community Committee*

Heather Gutherless, Long Range Planning  
Jefferson County Planning & Zoning  
100 Jefferson County Parkway  
Golden CO 80419

VIA EMAIL

November 21, 2022

To: Heather Gutherless, Senior Planner.

Cc: Chris O'Keefe, Director of Planning & Zoning and Steve Durian, Director of Traffic & Engineering.

From: Paul R. Olson, P.E., T.E. for the *Conifer & South Evergreen Community Committee*.

Subject: Review comments regarding proposed updates to the Transportation Design and Construction Manual, "Redline\_TDCM\_DRAFT\_10202022.pdf".

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## CONCLUSION

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Respectfully submitted,

Paul R. Olson, P.E., T.E.

25587 Conifer Road

STE 105-611

Conifer CO 80433

*Conifer and South Evergreen Community Committee*

## Lindsey Wire

---

**From:** Roger Parker <rparker@elkcreekfire.org>  
**Sent:** Monday, November 21, 2022 4:57 PM  
**To:** PZ-Regulation-Revisions  
**Subject:** --{EXTERNAL}-- 22-122945AM Proposed Revisions to the Transportation Design and Construction Manual

**CAUTION: This email originated from outside Jefferson County Government. Do not click links or open attachments unless you recognize the sender and know the content is safe.**

I have the following comments. I'm not sure what version I'm supposed to be commenting on so I hope you can understand my comments. .

3.7.8 - we support this clarification.

3.7.8.1.3.1 - we support this proposed change to improve the safety of occupant evacuations and fire apparatus access. In addition, this increased clearance on each side of the driveway would provide better sunshine access to help melt snow and ice, especially on excessive grades. I find many driveways that have been approved for grade variances iced over and impassable in the winter because they're in the shade.

3.7.8.1.4 - we support this proposed change. The increase to 15% grade has been our practice for many years with the appropriate fire mitigation system, which is a residential fire sprinkler system. This change would make the increase to 15% automatic without having to obtain approval from the fire districts.

3.7.8.1.7 - we support this proposed change to improve the safety of occupant evacuations and fire apparatus access.

3.7.8.1.4 - Turnarounds. I'd recommend that a maximum cross grade be added to turnarounds. It's very difficult and can be unsafe to turnaround a large fire apparatus when the grade is over 4%. I would also recommend that the location of the approved turnaround be located a minimum of 30 feet away from the building exterior to keep fire apparatus away from the collapse zone and radiant heat. We recently had major paint damage to two fire apparatus that was too close to a house fire.

3.7.8.2.4 Exception - Grades - I'd recommend that P2904 sprinkler systems be added after NFPA 13D. These are nationally recognized fire sprinkler systems that comply with the code.

3.7.8.2.5 - we would support this proposed change if it were modified to add the applicable building, fire, and wildland codes. Since this section covers private roads serving more than one dwelling unit it's important that they also meet fire and wildland codes to improve the safety of occupant evacuations and emergency vehicle access.

3.7.8.3 #4 - I'd recommend that P2904 sprinkler systems be added after NFPA 13D. These are nationally recognized fire sprinkler systems that comply with the code.

3.7.8.3 - Who's responsibility is to determine if the offsite driveway or private road meets the requirements in this section ? At this time we require the applicant to have a civil engineer evaluate the offsite for compliance and provide the fire district a written report.

Let me know if you have questions.

Roger Parker  
Fire Marshal  
Elk Creek Fire Protection District  
11993 Blackfoot Rd./PO Box 607  
Conifer, CO 80433  
[rparker@elkcreekfire.org](mailto:rparker@elkcreekfire.org)

*Providing Fire Marshal services for the following Fire Districts:*

*Inter-Canyon Fire Protection District  
Genesee Fire Protection District  
Indian Hills Fire Protection District  
Platte Canyon Fire Protection District  
North Fork Fire Protection District*

*Please email all requests to [rparker@elkcreekfire.org](mailto:rparker@elkcreekfire.org)*

**INSPECTIONS ARE CONDUCTED BY APPOINTMENT ONLY. REQUESTS MUST BE MADE 72 HOURS IN ADVANCE BY EMAIL.**

## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Friday, November 18, 2022 10:34 AM  
**To:** Lindsey Wire  
**Cc:** Nathan Seymour  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

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**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Engineer (Development Review)

**Results: Complete**

**Review Comments:**

**Scheduled End Date: 11/23/2022**

**Reviewer: Nathan Seymour**

**Description: Regulations Amendment to the Transportation and Construction Manual**



# Evergreen Fire/Rescue

1802 Bergen Parkway • Evergreen, Colorado 80439  
Phone: 303-674-3145 • Fax: 303-674-8701

November 23, 2022

Jefferson County Planning and Zoning  
100 Jefferson County Parkway  
Golden, Colorado 80401

The following are comments from Evergreen Fire/Rescue on the proposed changes to the Transportation Design and Construction Manual, Case Number 22-122945AM.

3.7.8 – We support this clarification.

3.7.8.1.2 – We support this proposed change to increase the safety of the residents and first responders.

3.7.8.1.3 - We support this proposed change allowing the 15% grade to be automatic without having to gain approval from the fire district. With this grade increase an automatic fire sprinkler system allows for increased safety of the occupants and mitigates the fire hazard surrounding the structure.

3.7.8.2.2 - We support this proposed change to improve the safety occupants and responders and allow for pullouts to be modified depending on site topography.

3.7.8.2.4 - We would support this proposed change if it were modified to add the applicable building, fire, and wildland codes. Since this section covers private roads serving more than one dwelling unit it's important that they also meet fire and wildland codes to improve the safety of occupant evacuations and emergency vehicle access.

3.7.8.3 – We support these changes but believe that further clarification will be needed to determine the parameters for item 3 and determining a fire district serving the residence safely and effectively.

We support the additional proposed changes on this draft but do not have any further comments.

Respectfully,

Rachel Rush

Rachel Rush  
Fire Marshal  
Evergreen Fire/Rescue







# Foothills Fire Protection District

November 23, 2022

Jefferson County Planning & Zoning  
100 Jefferson County Parkway  
Golden, Colorado 80419

RE: Foothills Fire TDCM Update Comments

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3.7.8 – We support this clarification.

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We support the additional proposed changes on this draft but do not have any further comments.

Please contact me if you have any questions regarding this information.

Respectfully,

Randon Grimes  
Captain/Inspector  
Foothills Fire Protection District

To: Heather Gutherless, Jefferson County P&Z Staff  
From: Barbara Ford, PE *GeoHydroScience Ilc* Ford@GeoHydroScience.com  
Date November 22, 2022  
**Subject: Comments and questions on proposed changes to Jeffco's Transportation Construction and Design Manual Case 22-104558AM?**

Please add these comments to the public record, and forward to the Board of County Commissioners and Planning Commissioners.

Please also refer to my earlier comments (July 2022 - appended) of the previous P&Z Staff-proposed revisions to the MANUAL.

At the July 2022 Hearing, testimony was offered by four parties, all of whom objected to the proposed revisions for a few reasons. Three of the four are licensed professional engineers (including one Planning Commissioner who is a PE). The PC approved the changes anyway.

Following PC approval, P&Z Staff retracted its revisions before the case proceeded before the Board, and has since offered another set of revisions (October 20, 2022) to the **Transportation Construction and Design Manual** (MANUAL). We were informed that the retraction was based on Staff's intent to consult with an Engineering Contractor as some of us had recommended at the Hearing, although we now understand that no such consultation occurred.

It is my opinion as a licensed Professional Engineer not specializing in road design, that any changes to the MANUAL should only be undertaken by licensed Transportation Engineers in the Jeffco Transportation and Engineering Division, and not by P&Z (engineers and planners), who have demonstrated that Transportation Engineering considerations are outside of their expertise (present to PC, acquire approval, and later retract). I also include a relevant example of Staff's employment of the Section 3.7.8 language from case 19-104466PF in this submittal to support my opinions, interpretations and recommendations.

There are significant problems in the October 20, 2022 proposed MANUAL language revisions. As stated in my July 2022 comments, my concerns are not relevant to private driveways and roads that serve one landowner.

#### **P&Z PROPOSE THAT MANUAL MINIMUM ENGINEERING STANDARDS BE DISCARDED FOR DEVELOPERS WHO CANNOT MEET THE REQUIREMENTS**

It is my opinion that Staff (and the PC and Board) continues to misunderstand/misapply the General Provisions of the MANUAL with which the Board is directed to enforce per Colorado Revised Statutes, and the Colorado Supreme Court.<sup>1</sup>

Specifically (from pg. 3 of the MANUAL):

---

<sup>1</sup> Penneboscott

## 1.2. Jurisdiction

The requirements of this MANUAL shall apply to all subdividers, developers or other landowners, their employees, agents or contractors designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations.

## 1.3. Purpose and Effect

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads.

The MANUAL contains the “**minimum design and technical criteria**”, meaning that the Engineering Standards cannot be further reduced, as P&Z Engineering and Planning Staff still propose in Section 3.7.8 (below). It is apparent that the County Attorney’s Office too misunderstands the MANUAL requirements and the Board’s responsibilities.

~~“3.7.8.3. The appropriate fire protection district may approve alternative standards for driveways and private roads. Plans shall be submitted that bear the written approval of the appropriate fire protection district. The off-site driveway or private road shall meet the requirements as described in this section. If the off-site driveway or private road does not cannot meet the requirements of this section, the following shall be submitted to Planning and Zoning”~~

...  
“3) A certified statement by a qualified Colorado-registered professional engineer indicating that the off-site driveway or private road will be able to serve the residents effectively and safely. This statement shall include a detailed explanation of how an emergency apparatus within the appropriate Fire Protection District will be able to serve a residence safely and effectively. and will be safe for fire apparatus. Such statement shall bear the professional engineer's seal, signature and date..”

The rationale in allowing developers who “cannot” meet even the Minimum Engineering Standards is not supported by the MANUAL, LDRs, State Statutes, and the Board’s obligations to make decisions regarding development that furthers “public health, safety, integrity, and general welfare.” § 24-67-102(1), C.R.S.2007.

Allowing for diluted and uncertain “engineering designs” for the developers who cannot meet the MANUAL Engineering Standards defies common sense.

Does Jeffco make similar allowances for developers that will use public roads? Does Jeffco allow construction of bridges and tunnels to likewise adhere to a lower “engineering designs” when the developer/constructor cannot meet industry-accepted Engineering Standards? P&Z’s (and the Board’s and PC’s) misapplication of the MANUAL section 3.7.8 is not defensible in my opinion.

P&Z Staff, the PC and the Board ignored the MANUAL Provisions and Engineering Standards in subdivision case 19-104466PF in which the non-compliant, privately owned and privately maintained road across our property that could not be approved by County Engineers, was

“accepted” by the Fire Chief, against our objections. The Fire Chief is not an engineer and was not required to submit engineering plans, contrary to the LDR and MANUAL.

The Fire Chief should be afforded a review, but only to agree that the private road meeting Engineering Standards will in fact, also accommodate emergency equipment. This is not how Staff has employed the Fire Districts so far though.

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I recommend that if the County is to continue to discard of MANUAL Engineering Standards on private roads, that Colorado-licensed Professional Engineers in the Transportation and Engineering Division be prepared to sign and seal such “certified statements” as P&Z proposes, and the County be held accountable for irresponsible decisions.

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In anticipation of comments by Staff and PC for the upcoming Hearing, the following responses are offered herein, because the Public is not afforded a true or effective opportunity at the Hearings based on my observations made in the last few years.

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“flexibility” in the Engineering designs, even an unspecified design offered by a Fire Chief.

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Staff intends that compliance with the Manual Engineering Standards be demonstrated at the time of acquisition of a building permit, instead of prior to Board approval of the development/subdivision. This revision is contradictory to the LDR, the MANUAL, Colorado Revised Statutes, and a Colorado Court of Appeals decision (see below).

From page 3 of the Engineering Manual:

##### **1.2. Jurisdiction**

The requirements of this MANUAL shall apply to all subdividers, developers ...designing and constructing public and/or private streets/roads within unincorporated

areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations. The foregoing design and construction of transportation systems are subject to review and approval by the County pursuant to any County regulation or requirement.

### **1.3. Purpose and Effect**

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads. All land development or any other proposed construction submitted for approval under the provisions of the LDR and/or ZR as applicable, shall include adequate transportation system analysis and appropriate transportation system design. Such analysis and design shall conform to the criteria set forth herein....”

The Colorado Court of Appeals found that the Board of County Commissioners (in a Mineral County case<sup>3</sup>) abused its discretion because it approved a development where the required provision for access was not secured before awarding its approval of the development.

#### **“III. Access**

##### **A. State Law**

Section 30-28-133.1, C.R.S.2007, provides:

Subdivision plan or plat-access to public highways. No person **may submit an application for subdivision approval to a local authority UNLESS the subdivision plan or plat provides**, pursuant to section 43-2-147, C.R.S., that all lots and parcels created by **the subdivision will have access** to the state highway system in conformance with the state highway access code.”...

**“We do not** read the plain language of this statute to **allow postponing access beyond the application for final subdivision approval.** The statute imposes a condition (“unless”) on a current activity (“submit an application”) and uses a present tense term (“provides”). This condition would be meaningless if the application need only address how access might be obtained in the future. See Black’s Law Dictionary 1224 (6th ed. 1990) (“Provide” is defined as “To make, procure, or furnish for further use, prepare. To supply; to afford; to contribute.”).”

“While “will have access” expresses the future tense, in our view that wording reflects the three-phase progression of all regulated land development: (1) planning; (2) approval; and (3) build out. Thus, a subdivision “will have access” only when its internal roads have been completed and connected with a state highway. **But that connection must still be provided for in the application.**”

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<sup>3</sup> Mineral County, Colorado. From Colorado Court of Appeals, Div. VI. WOLF CREEK SKI CORPORATION, Colorado Wild, and San Luis Valley Ecosystem Council, Plaintiffs-Appellees and Cross-Appellants, v. BOARD OF COUNTY COMMISSIONERS OF MINERAL COUNTY and Leavell-McCombs Joint Venture, Defendants-Appellants and Cross-Appellees. No. 06CA0113. Decided: September 20, 2007

The Court found “... an abuse of discretion because the subdivision might never have the required statutory access”. Likewise, the Court would also find unlawful the postponement of the statutory access requirement until the time of issuance of a building permit, as P&Z Staff now proposes. If a developer cannot meet the Minimum Engineering Standards for the access route, then the access has not been secured as State Law requires.

The Court required that the application must have such provisions prior to Board approval.

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Furthermore, the Court recognized the burden that such postponements into the future present to objectors and other interested parties (see below), a burden that Jeffco Staff, the PC and the Board do not seem to recognize in a continuing effort to postpone critical considerations and demonstrations until after Board approval.

This was done for numerous issues in case 19-104466PF, and the Board failed to make adequate (or any, in some cases) provisions for them – road, water supply, off-site drainage, etc, leaving a significant burden to us, our neighbors and also to future perspective buyers of the parcels, exactly as the Court of Appeals discourages in the Mineral County case.

“Such a conditional final approval would also burden the zoning authority to revisit and perhaps modify the condition or extend the time for compliance. **A similar burden would fall on members of the public who opposed the development, but would have to continue appearing at subsequent proceedings to preserve their opposition whenever the zoning authority revisited the condition.** See § 24-67-104(1)(e), C.R.S.2007 (the county resolution must set “forth the procedures pertaining to the application for, hearing on, and tentative and final approval of a planned unit development which shall afford procedural due process to interested parties”).”

I hope that presentation of this case (based on a Professional Engineer’s interpretation) gives the PC and Board some perspective. But of much greater importance to me, I hope that it is useful for other Jeffco residents who have been burdened or impacted by PC and Board approval of inappropriate development. There are many concerned citizens in Conifer. I also move to have the Board institute term limits on PC.

Thank you.



## APPENDIX A

To: Jefferson County P&Z Staff

From: Barbara Ford, PE *GeoHydroScience Ilc* Ford@GeoHydroScience.com

Date July 26, 2022

**Subject: Comments and questions on proposed changes to various Jeffco regulations**

### SECTION 1 - Case 22-104558AM

Comments and questions regarding proposed language changes to the Proposed Wildfire Regulation Updates including those proposed in the County Transportation Design and Construction Manual.

Some questions and comments submitted during the community meeting remain unacknowledged and unaddressed in the log of comments posted. During the meeting P&Z's Heather Gutherless said that an engineer made the changes but she was unable to answer submitted questions. They are repeated below.

I have no comments regarding Engineering Standards as applied to private driveways serving one property.

If these proposed changes apply to private roads and/or driveways serving multiple property owners, it is inappropriate for the County to prioritize the interests of the "unable landowner/developer" over the interests of the other property owners without a legal basis.

It is proposed that the County Transportation Design and Construction Manual be revised as follows, apparently as related to the Wildfire Regulations:

3.7.8.3. The offsite driveway or private road shall meet the requirements as described in this section or the appropriate fire protection district may approve an alternative standards design allowing deviation from the standard when the property owner does not have the ability to make improvements to the offsite property for driveways and private roads. Plans shall be submitted that bear the written approval of all alternative standards is required of the appropriate fire protection district.

1. It is unclear why Jeffco Engineers displace the burden of road Engineering Standards to the Fire Protection Districts (FPD).
2. The proposed changes will reduce road safety, including in wildfire prone areas by:
  - a. Eliminating the need for private roads intended to carry increased traffic from development to meet County Engineering Standards;
  - b. eliminating the requirement that plans be submitted by the Fire Protection District;
  - c. instead allowing the FPD to submit a "design" that will not be approved by a Colorado-licensed Professional Transportation Engineer; and

- d. allow development with increased traffic on private roads that do not meet County Engineering Standards and were not designed for such traffic load.
  - e. Please provide examples of how a FPD might offer alternate designs when
    - i. The road is steeper than the maximum grade;
    - ii. The road is narrower than the required widths;
    - iii. The road is not paved;
    - iv. The road is lined with significant tree canopy;
    - v. There are inadequate fire truck turnarounds – size, locat, frequency; and
    - vi. There are inadequate fire truck pull offs/outs are inadequate – size location, frequency, etc.
    - vii. and how the proposed alternate design, that is inferior to Engineering Standards, may be considered acceptable anyway, and to whom is should be acceptable.
  - f. Please identify the threshold conditions/characteristics under which an alternate design will be considered unacceptable? ie X Width, X grade, X pullouts, etc.
3. What is meant by the language “when the property owner does not have the ability to make improvements to the offsite property”?
- a. What allowances are considered for such “unable” landowner/developers?
4. The language regarding “written approval” is unclear.
- a. Who must provide written approval?
  - b. What must their qualifications be?
  - c. Who at the County will accept this written approval?
  - d. Please provide sufficient detail.

Additional proposed changes include the following:

3.7.8.2.5 Maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100) feet provided the appropriate fire mitigation systems are in place based on the applicable building code.

Why is an increase in maximum road grade from 10 to 15 percent being considered when the County Engineering Standards formerly required a maximum of 10 percent on straight sections, and 12 percent where the dip of the terrain bears South 60 degrees East and South 45 degrees West?

**SECTION 2 - Case Number: 21-109265AM**

*Proposed Land Disturbance Revisions to the Zoning Resolution and the Land Development Regulation*

**Case Number:** 21-109265AM

**Case Manager:** Nathan Seymour

Formerly several constraints were identified, but now it appears that only a threshold area is used to trigger the need for a permit/Notice of Intent.

Why is the County relaxing the requirements triggering the need for such permits? Were the former regulations too burdensome ?

Thank you.

Barbara Ford, PE

To: Heather Gutherless, Jefferson County P&Z Staff  
From: Barbara Ford, PE *GeoHydroScience Ilc* Ford@GeoHydroScience.com  
Date November 22, 2022  
**Subject: Comments and questions on proposed changes to Jeffco's Transportation Construction and Design Manual Case 22-104558AM?**

Please add these comments to the public record, and forward to the Board of County Commissioners and Planning Commissioners.

Please also refer to my earlier comments (July 2022 - appended) of the previous P&Z Staff-proposed revisions to the MANUAL.

At the July 2022 Hearing, testimony was offered by four parties, all of whom objected to the proposed revisions for a few reasons. Three of the four are licensed professional engineers (including one Planning Commissioner who is a PE). The PC approved the changes anyway.

Following PC approval, P&Z Staff retracted its revisions before the case proceeded before the Board, and has since offered another set of revisions (October 20, 2022) to the **Transportation Construction and Design Manual** (MANUAL). We were informed that the retraction was based on Staff's intent to consult with an Engineering Contractor as some of us had recommended at the Hearing, although we now understand that no such consultation occurred.

It is my opinion as a licensed Professional Engineer not specializing in road design, that any changes to the MANUAL should only be undertaken by licensed Transportation Engineers in the Jeffco Transportation and Engineering Division, and not by P&Z (engineers and planners), who have demonstrated that Transportation Engineering considerations are outside of their expertise (present to PC, acquire approval, and later retract). I also include a relevant example of Staff's employment of the Section 3.7.8 language from case 19-104466PF in this submittal to support my opinions, interpretations and recommendations.

There are significant problems in the October 20, 2022 proposed MANUAL language revisions. As stated in my July 2022 comments, my concerns are not relevant to private driveways and roads that serve one landowner.

#### **P&Z PROPOSE THAT MANUAL MINIMUM ENGINEERING STANDARDS BE DISCARDED FOR DEVELOPERS WHO CANNOT MEET THE REQUIREMENTS**

It is my opinion that Staff (and the PC and Board) continues to misunderstand/misapply the General Provisions of the MANUAL with which the Board is directed to enforce per Colorado Revised Statutes, and the Colorado Supreme Court.<sup>1</sup>

Specifically (from pg. 3 of the MANUAL):

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<sup>1</sup> Penneboscott

## 1.2. Jurisdiction

The requirements of this MANUAL shall apply to all subdividers, developers or other landowners, their employees, agents or contractors designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations.

## 1.3. Purpose and Effect

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads.

The MANUAL contains the “**minimum design and technical criteria**”, meaning that the Engineering Standards cannot be further reduced, as P&Z Engineering and Planning Staff still propose in Section 3.7.8 (below). It is apparent that the County Attorney’s Office too misunderstands the MANUAL requirements and the Board’s responsibilities.

~~“3.7.8.3. The appropriate fire protection district may approve alternative standards for driveways and private roads. Plans shall be submitted that bear the written approval of the appropriate fire protection district. The off-site driveway or private road shall meet the requirements as described in this section. If the off-site driveway or private road does not cannot meet the requirements of this section, the following shall be submitted to Planning and Zoning”~~

...  
“3) A certified statement by a qualified Colorado-registered professional engineer indicating that the off-site driveway or private road will be able to serve the residents effectively and safely. This statement shall include a detailed explanation of how an emergency apparatus within the appropriate Fire Protection District will be able to serve a residence safely and effectively. and will be safe for fire apparatus. Such statement shall bear the professional engineer's seal, signature and date..”

The rationale in allowing developers who “cannot” meet even the Minimum Engineering Standards is not supported by the MANUAL, LDRs, State Statutes, and the Board’s obligations to make decisions regarding development that furthers “public health, safety, integrity, and general welfare.” § 24-67-102(1), C.R.S.2007.

Allowing for diluted and uncertain “engineering designs” for the developers who cannot meet the MANUAL Engineering Standards defies common sense.

Does Jeffco make similar allowances for developers that will use public roads? Does Jeffco allow construction of bridges and tunnels to likewise adhere to a lower “engineering designs” when the developer/constructor cannot meet industry-accepted Engineering Standards? P&Z’s (and the Board’s and PC’s) misapplication of the MANUAL section 3.7.8 is not defensible in my opinion.

P&Z Staff, the PC and the Board ignored the MANUAL Provisions and Engineering Standards in subdivision case 19-104466PF in which the non-compliant, privately owned and privately maintained road across our property that could not be approved by County Engineers, was

“accepted” by the Fire Chief, against our objections. The Fire Chief is not an engineer and was not required to submit engineering plans, contrary to the LDR and MANUAL.

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## APPENDIX A

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Date July 26, 2022

**Subject: Comments and questions on proposed changes to various Jeffco regulations**

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  - d. Please provide sufficient detail.

Additional proposed changes include the following:

3.7.8.2.5 Maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100) feet provided the appropriate fire mitigation systems are in place based on the applicable building code.

Why is an increase in maximum road grade from 10 to 15 percent being considered when the County Engineering Standards formerly required a maximum of 10 percent on straight sections, and 12 percent where the dip of the terrain bears South 60 degrees East and South 45 degrees West?

**SECTION 2 - Case Number: 21-109265AM**

*Proposed Land Disturbance Revisions to the Zoning Resolution and the Land Development Regulation*

**Case Number:** 21-109265AM

**Case Manager:** Nathan Seymour

Formerly several constraints were identified, but now it appears that only a threshold area is used to trigger the need for a permit/Notice of Intent.

Why is the County relaxing the requirements triggering the need for such permits? Were the former regulations too burdensome ?

Thank you.

Barbara Ford, PE

## Lindsey Wire

---

**From:** Chuck Newby <cosecc.co@gmail.com>  
**Sent:** Tuesday, December 6, 2022 10:34 AM  
**To:** Nathan Seymour; Lindsey Wire  
**Cc:** wsufans; Heather Gutherless; Cassidy Clements  
**Subject:** Re: --{EXTERNAL}-- Committee comments RE proposed updates to TDCM...

**Follow Up Flag:** Follow up  
**Flag Status:** Completed

Good Morning Nathan and Lindsey,

With respect to updates to the TDCM, what is the update process and timeline going forward?

Best,

-Chuck  
*Conifer & South Evergreen Community Committee*

On Nov 21, 2022, at 1:06 PM, Heather Gutherless <hgutherl@co.jefferson.co.us> wrote:

Thank you, Chuck! I am forwarding these comments onto Nathan Seymour and Lindsey Wire, who are managing this regulation update.

**Heather Gutherless, AICP**

Planning Supervisor, Long Range Planning  
Planning and Zoning Division  
Jefferson County

o 303-271-8716

hgutherl@jeffco.us | Find us on the web: [planning.jeffco.us](http://planning.jeffco.us)

Planning and Zoning is open to the public and we are offering both virtual and in-person appointments. For the convenience and safety of the public and our staff, virtual appointments are encouraged. Many staff are still working remotely to provide online and virtual services Monday through Thursday. County offices are closed on Fridays. Please schedule [appointments \[jeffco-planning-and-zoning-hqorx.appointlet.com\]](http://jeffco-planning-and-zoning-hqorx.appointlet.com) and submit [applications](#) online. Go to [planning.jeffco.us](http://planning.jeffco.us) for more information.  
<image001.png>

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**From:** Chuck Newby <cosecc.co@gmail.com>  
**Sent:** Monday, November 21, 2022 12:53 PM  
**To:** Heather Gutherless <hgutherl@co.jefferson.co.us>  
**Cc:** Chris OKeefe <cokeefe@co.jefferson.co.us>; Steve Durian <sdurian@co.jefferson.co.us>; Cassidy Clements <cclement@co.jefferson.co.us>; wsufans <wsufans@wispertel.net>  
**Subject:** --{EXTERNAL}-- Committee comments RE proposed updates to TDCM...

**CAUTION: This email originated from outside Jefferson County Government. Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Heather,

On behalf of our Committee, please find attached written comments relating to Jefferson County Transportation Design and Construction Manual (TDCM) proposes updates written by Paul Olson P.E. & T.E. — please distribute to the appropriate parties.

All the best,

-Chuck  
*Conifer & South Evergreen Community Committee*

On Sep 13, 2022, at 1:26 PM, Heather Gutherless <hgutherl@co.jefferson.co.us> wrote:

Hi Paul – Thanks for this information. I have saved it to the file so that it will be easy to bring up at the hearing tomorrow evening.

We have a new process for testifying that we are going to “soft launch” at tomorrow’s PC hearing. It is pre-registration for testifying at the hearing. I’m not sure if you already saw this on our website, but [www.jeffco.us/testimony](http://www.jeffco.us/testimony) will take you to a form where you can sign up to testify. You’ll want to make sure you are signing up for the correct case. This will not preclude people from showing up and testifying, but it will allow us to get an idea of how many people to expect and for people to share presentations they may have with staff, like you just did. (You don’t need to share it again.) Plus we will take the testimony of those that pre-registered first and then others that attend. Registration does close 24 hours prior to the hearing.

Thanks,

**Heather Gutherless, AICP**  
Planning Supervisor, Long Range Planning  
Planning and Zoning Division  
Jefferson County  
o 303-271-8716

hgutherl@jeffco.us | Find us on the web: [planning.jeffco.us](http://planning.jeffco.us)

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<image001.png>

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**From:** PRO <[wsufans@wispertel.net](mailto:wsufans@wispertel.net)>  
**Sent:** Tuesday, September 13, 2022 10:18 AM  
**To:** Cassidy Clements <[cclement@co.jefferson.co.us](mailto:cclement@co.jefferson.co.us)>; Heather Gutherless <[hgutherl@co.jefferson.co.us](mailto:hgutherl@co.jefferson.co.us)>  
**Cc:** 'Chuck Newby' <[cosecc.co@gmail.com](mailto:cosecc.co@gmail.com)>  
**Subject:** --[EXTERNAL]-- 9/14 Planning commission hearing

**CAUTION: This email originated from outside Jefferson County Government. Do not click links or open attachments unless you recognize the sender and know the content is safe.**

I would like to make the attached presentation to the commission tomorrow.

Paul R. Olson P.E., T.E.  
6642 S Valley Drive  
Morrison, CO 80465  
303-885-7275

<CoSECC Comments RE Proposed Updates to the TDCM -final- 11-21-22.pdf>

## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Tuesday, December 6, 2022 9:14 AM  
**To:** Lindsey Wire  
**Cc:** EOBRIEN@JEFFCO.US  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

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**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Open Space

**Results: No Comment (no further review)**

**Review Comments:**

**Scheduled End Date: 11/23/2022**

**Reviewer: Elizabeth Stoner**

**Description: Regulations Amendment to the Transportation and Construction Manual**



## Lindsey Wire

---

**From:** Dylan Monke  
**Sent:** Thursday, September 29, 2022 2:48 PM  
**To:** Lindsey Wire; Heather Gutherless; Nick Nelson; Russell Clark; Nathan Seymour; Cassidy Clements  
**Subject:** Re: Regulation Advisory Panel - October 10th Meeting

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Hey Lindsey,

Maybe y'all already talked about this, but assuming these are approved as written, how will it be communicated that a Sprinkler system is required if grades over 15% are approved for on-site driveways? (3.7.1.8.4. & 3.7.8.2.5) Is this something that could be noted painfully obvious for the review planner in the GPA to ease the review of the subsequent BP?

Perhaps an even easier option would be to require the same letter from the homeowner to install the system that is required for off-site driveways of the same grade?

"4) a written statement from the property owner that a fire sprinkler system will be installed per NFPA 13D at the time of Building Permit."

Also love what y'all did with the traffic impact analysis sections. Excited see imagine proposed mitigations and to have so many fun tables for applicants to complete. Anyway we could require them to evaluate bicycle trip generation and parking as well? Certainly a personal wish list item so feel free to disregard.

Thanks,  
Dylan

---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Thursday, September 29, 2022 2:26 PM  
**To:** mlrichardson@apc.us.com <mlrichardson@apc.us.com>; 1812eagle@gmail.com <1812eagle@gmail.com>; childreth@foxrothschild.com <childreth@foxrothschild.com>; Ethan Watel <ethan@baselinecorp.com>; dmsmn5@aol.com <dmsmn5@aol.com>; phorn@martinmartin.com <phorn@martinmartin.com>; deb@carneylaw.net <deb@carneylaw.net>; Dean Dalvit <dean@evstudio.com>; Glenn Douglass <douglassengineering1@gmail.com>; ynotbev@aol.com <ynotbev@aol.com>; jveres0@gmail.com <jveres0@gmail.com>; Brooks, Kelly <kbrooks@westmetrofire.org>; Heather Gutherless <hgutherl@co.jefferson.co.us>; Dylan Monke <dmonke@co.jefferson.co.us>; Nick Nelson <nnelson@co.jefferson.co.us>; Russell Clark <rclark@co.jefferson.co.us>; Nathan Seymour <nseymour@co.jefferson.co.us>; Mike Schuster <mschuste@co.jefferson.co.us>; Pat OConnell <poconnel@co.jefferson.co.us>; chris@ballprop.com <chris@ballprop.com>; Chris OKeefe <cokeefe@co.jefferson.co.us>; Kristin Cisowski <kcisowsk@co.jefferson.co.us>; Cassidy Clements <cclement@co.jefferson.co.us>; Rachel Rush <rrush@evergreenfirerescue.com>; Melodie Clayton <mclayton@co.jefferson.co.us>; Dixie Shear <dshear@co.jefferson.co.us>; Gary Campbell <gcampbel@co.jefferson.co.us>; Shaun Kyser <skyser@co.jefferson.co.us>; meredith ward <meredithaward@msn.com>; Christina Lane <clane@co.jefferson.co.us>; Kelly Dunne <kdunne@co.jefferson.co.us>  
**Subject:** Regulation Advisory Panel - October 10th Meeting

Hi Everyone,

Please follow this [link](#) to view the draft amendments to the Transportation Design and Construction Manual which will be discussed at the October 10<sup>th</sup> Regulation Advisory Panel Meeting.

Thank you,

**Lindsey Wire, P.E.**

Planning & Zoning  
Engineering Supervisor  
303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



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**MEMO**

**TO:** Lindsey Wire  
Jefferson County Planning and Zoning Division

**FROM:** Tracy Volkman  
Jefferson County Environmental Health Services Division

**DATE:** November 16, 2022

**SUBJECT:** Case #22-122945 AM  
Transportation And Construction Manual  
Jefferson County Planning & Zoning Division

Jefferson County Public Health reviewed the proposed changes to the Transportation and Construction Manual and have no comments at this time. We support the proposed changes made by Planning and Zoning.

## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Monday, February 13, 2023 12:41 PM  
**To:** Lindsey Wire  
**Cc:** Mark Weiden  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Road & Bridge

**Results: No Comment (no further review)**

**Review Comments:**

**Scheduled End Date: 11/23/2022**

**Reviewer: Mark Weiden**

**Description: Regulations Amendment to the Transportation and Construction Manual**



**COLORADO**  
Department of Transportation

Permit Unit - Traffic & Safety  
2829 W. Howard Place  
Denver, CO 80204

## MEMORANDUM

TO: Lindsey Wire, Jefferson County Planning

FROM: Rick Solomon, Permit Supervisor

DATE: Nov 3, 2022

RE: Referral 22-122945 AM Roadway cross sections

Not sure how to even offer comments on this.

Please note that most CDOT Rights of Way in Jefferson County are functionally classified, by which we would look to our rules and standards outlined in Code regarding access spacing, and a long list of design elements & considerations. Usually, if/when County standards are better and safer than CDOT's we will go with the stronger standards. Our standards do not define RoW widths, as we rely on and respect those of the local agencies. For example, if a landscaped center median is needed, that would be defined by the local agency, not CDOT. This is a frequent mis-conception by developers. When a plan like the 2018 West Connect PEL was adopted by your local officials, and it already has cross sections within it, should those not be used instead of these?

Under the referral materials forward to us, we see but are not quite clear of the distinction and rule of when a suburban roadway design is warranted that is different from the rural and mountain roadway design. We are not sure for example, how the county determines when the major collector with curb, gutter & sidewalk is needed, and when it is not.

Recent instructions CDOT staff is given from the State political level (Transportation Commission) is to advocate for more Multi-modal accommodations in our rights of Way, offering choices over driving. In great part this translates to share the road and sidewalks. We noted that many of the profiles do not show these elements and seem to have a minimum threshold based on ADT. That seems to be counter-intuitive since the purpose of multi-modal is to lessen the dependency of vehicles for short trips. As a suggestion: CDOT has put forward a checklist of strategies called TDM, which describes some of these public improvements – which these roadway cross sections might engage or adapt to.

I wish to share three examples in Jefferson County that might illustrate some real question of how these translate (i.e. which template applies?):

- A heavily traveled 2-lane corridor with bus service (such as SH 75-Platte River Rd) Should there not be a sidewalk and auxiliary lane for a bus pull out and pedestrian landings? (noted: this road has multi-jurisdictions)
- A heavily traveled 2 lane mountain corridor such as SH 74 through Evergreen. Should there be a sidewalk on both sides and maybe room for parallel parking?
- The collector of Rainbow Hills Rd – currently under consideration to be relocated & rebuilt located inside a split diamond interchange of I-70, would it be under the standard of the file called Temp 5, or Temp 11 or 12 noting the developer has a park-n-ride and tourist oriented development proposed – with a lot of pedestrians anticipated.

If I was a property owner, I would like to know on either corridor example above which minor arterial or collector standard applies.

CDOT uses the most current M & S Standards on roadway design. Please note they were recently updated/revised on Sep 6, 2022.

When the County eventually adopts these roadway standards, CDOT request a full version for our reference. When referrals are sent for CDOT comment and input, especially subdivision platting, it would be most helpful to identify the roadway classification of any CDOT abutting RoW so we are in-sync with these standards.

Lastly and very important, is that CDOT follows the Utility Accommodation Code and our rights-of way allow wet and dry utilities to share and cross our right of way under certain rules. Along interstates and expressways, we discourage any manholes in the roadway and push utilities as far to the outside of right of way as possible. Roadways with higher speeds generally greater than 40 mph, be very careful of allowing manholes in the roadway. Routine access into a manhole translates into lane closures and delays, which we try to avoid by better design. Relocating utilities is a very costly factor in roadway design and rebuild. It is recommended you add a general note about what rules should be followed to accommodate utilities in each roadway cross section. Indeed, it is complicated when storm pipes, traffic signals and traffic lights exist there too and it all has to fit.

Please advise if this is the kind of feedback you seek? I can solicit other staff members throughout our CDOT Region 1 for input, but every engineer will have their own specialty and interest of concern.

# **SOUTH METRO FIRE RESCUE**

## **FIRE MARSHAL'S OFFICE**

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Lindsey Wire, P.E.  
Jefferson County Planning and Zoning  
100 Jefferson County Parkway, Suite 3550  
Golden, Colorado 80419  
303.271.8717  
lwire@jeffco.us

Project Name: Transportation Design And Construction Manual  
Project File #: **22-122945AM**  
S Metro Review # REFOTH22-00216

Review date: November 17, 2022

Plan reviewer: Jeff Sceili  
720-989-2244  
Jeff.Sceili@Southmetro.org

**Project Summary:** Regulation Amendment

Code Reference: 2018 Fire Code Edition, 2018 Building Code Edition

South Metro Fire Rescue (SMFR) has reviewed the above proposed regulation amendments and has no comments.

## P&Z REFERRAL T&E RESPONSE

**To:** Lindsey Wire

**Case #:**22-122945 AM

**Case Name, Address, or PIN:**

**From:** Transportation & Engineering

**Due Date:**November 23, 2022

Transp. Design & Const. Manual

**Amanda Attempt Result & Attachments:**

☐ Comments Sent (no further review)

☐ Comments Sent (request re-review)

☒ No Comment (no further review)

### Drainage

☐ T&E is currently working on a project in the area. See attached information.

☐ No concerns.

☐ Other Notes:

### Right-of-Way / Roadway Corridor Expansion Projects

☒ **Corridor Projects / ROW**

☐ Land owner will need to refund the county \$ \_\_\_\_\_ for ROW purchased in \_\_\_\_\_ for  
 This amount **must** be paid before plat is recorded and / or plans are approved and released for construction.

☐ Documentation attached in AMANDA. ☐ Documentation to follow.

☐ Additional ROW needed for upcoming T&E project. Plan sheet attached with required width / area.

☐ Fee-in-lieu of adjacent roadway construction preferred, due to planned construction by the county. Please have the applicant submit a cost estimate.

☒ No Concerns.

☐ Other Notes:

### Traffic Operations / Transportation Planning

	Included in referral	Reviewed		<input type="checkbox"/> Transportation Planning <input type="checkbox"/> Transportation Engineering
		No	Yes	
Traffic Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Signage & Striping Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Signal Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Trails or Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Street / Road Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

☐ No Concerns.

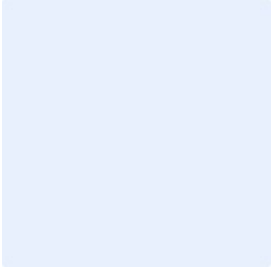
☐ Other Notes:



## Additional Comments

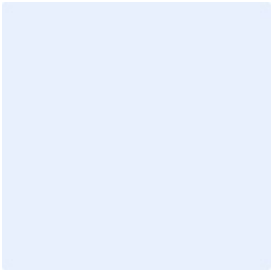
☐ Name:

Comments:



☐ Name:

Comments:



# Jefferson County

# Transportation Design & Construction

# Manual

JEFFERSON COUNTY, COLORADO PLANNING AND ZONING DIVISION

*Revision Dates*

*The Transportation Design & Construction Manual, formerly known as Roadway Design & Construction Manual, adopted by the Board of County Commissioners of Jefferson County, Colorado on March 21, 1995, has since been amended on the following dates:*

*December 5, 1995*

*May 12, 1998*

*March 23, 1999*

*October 1, 2002*

*July 1, 2003*

*November 25, 2003*

*December 5, 2006*

*May 20, 2008*

*October 13, 2009*

*November 24, 2015*

*July 17, 2018*

*December 17, 2019*

*XX-XX-XX*

Jefferson County Planning and Zoning Division  
100 Jefferson County Parkway, Suite 3550, Golden, Colorado 80419  
303-271-8700 • <http://planning.jeffco.us>

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- 1.4. Enactment Authority
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- 1.8. Interpretation
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*Transportation Studies*

*Resolution*

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**General Provisions**

**1.1. Short Title**

These regulations together with all future amendments shall be known as the “Jefferson County Transportation Design and Construction Manual” (hereafter called MANUAL) as referenced in the Jefferson County Land Development Regulation (hereafter called LDR) and the Jefferson County Zoning Resolution (hereafter called ZR).

**1.2. Jurisdiction**

The requirements of this MANUAL shall apply to all subdividers, developers or other landowners, their employees, agents or contractors designing and constructing public and/or private streets/roads within unincorporated areas of Jefferson County (hereafter called County), except where superseded by State and/or the Federal regulations. The foregoing design and construction of transportation systems are subject to review and approval by the County pursuant to any County regulation or requirement.

**1.3. Purpose and Effect**

Presented in this MANUAL are the minimum design and technical criteria for the design and construction of streets/roads. All land development or any other proposed construction submitted for approval under the provisions of the LDR and/or ZR as applicable, shall include adequate transportation system analysis and appropriate transportation system design. Such analysis and design shall conform to the criteria set forth herein. Technical criteria not specifically addressed in this MANUAL shall follow the provisions of the American Association of State Highway and Transportation Officials (AASHTO) “A Policy of Geometric Design of Highways and Streets”, as amended; the Colorado Department of Transportation (CDOT) Design Standards, as amended; and the Manual on Uniform Traffic Control Devices (MUTCD), as amended.

**1.4. Enactment Authority**

The LDR has been adopted pursuant to the authority conferred within: Article 28 of Title 30 (County Planning); Article 2 of Title 43 (State, County, and City Highway Systems); Article 20 of Title 29 (Land Use Control and Conservation); and other applicable sections of the Colorado Revised Statutes, as amended.

This MANUAL is adopted by resolution of the Board of County Commissioners, as the authority provided by which the County promulgates the LDR.

**1.5. Amendment and Revisions**

These criteria may be amended as new technology is developed and/or if experience gained in the use of this MANUAL indicates a need for revision. Amendments and revisions will be made by resolution of the Board of County Commissioners.

## **1.6. Enforcement Responsibility**

It shall be the obligation of the Board of County Commissioners acting through the Department of Development and Transportation to enforce the provisions of this MANUAL.

## **1.7. Review and Approval**

The County will review all submittals for compliance with this MANUAL. An approval by the County does not relieve the owner, engineer, or designer from responsibility of ensuring that the calculations, plans, specifications and construction are in compliance with the MANUAL and accepted engineering practices.

## **1.8. Interpretation**

In interpretation and application of the provisions of the MANUAL, the following shall govern:

1.8.1. The provisions shall be regarded as the minimum requirements for the protection of public health, safety, comfort, convenience, prosperity, and welfare of the residents of the County.

1.8.2. Whenever a provision of this MANUAL and any other provision of the LDR or any provision in any law, ordinance, resolution, rule, or regulation of any kind, contains any restriction covering any of the same subject matter, whichever restrictions are more restrictive or impose higher standards of requirements shall govern.

1.8.3. This Jefferson County Transportation Design and Construction Manual was adopted by the Board of County Commissioners on March 21, 1995. Any amendments to this MANUAL shall be immediately effective upon its adoption by the Board of County Commissioners. All applications shall be subject to the provisions of this MANUAL that are in effect at the time of the formal application submittal, unless otherwise specified by the Board of County Commissioners resolution.

## **1.9. Relationship to Other Standards**

If the State or Federal Government imposes stricter criteria, standards, or requirements, these shall be incorporated into the County's requirement after due process and public hearings needed to modify the County's regulations and standards.

### *Chapter 2*

## **Construction Drawing Requirements**

### **2.1. General Requirements**

Construction drawings must be submitted in Portable Document Format (PDF) unless otherwise approved for hard copy submittal, to scale, shall be a complete package, which includes all details and documentation necessary for the construction of the proposed improvements. The plans shall be prepared by, or under the direction of a professional engineer, registered in the State of Colorado, and qualified in the field of civil engineering.

The final set of plans (hard copy) for each drawing shall be 24" x 36", unless otherwise approved by the County, and shall contain a title block, sheet number, scale, north arrow, and date.

The developer's engineer shall comply with Colorado Revised Statute 9-1.5-101 through 9-1.5-108 "Excavation Requirements" when the nature of work proposed (1) will involve a contract with Jefferson County (this shall include, but not be limited to binding agreements such as permits and Subdivision Improvement Agreements); (2) will involve primarily Horizontal Construction and not the construction of buildings; (3) will involve excavation that exceeds two (2) feet in depth and that is a contiguous 1,000 square feet, or involve Utility Boring; and (4) requires the design services of a licensed professional engineer. Existing and Proposed Subsurface Utilities shall be identified on the design plans in accordance with ASCE 38 Standards. For more information please reference the Colorado Revised Statutes and Federal Highway Administration websites.

## 2.2. Cover Sheet

A cover sheet should be provided with each submittal which contains the following:

1. A vicinity map at a minimum scale of 1" - 2000' which shows the location and name of all arterial streets/roads within one mile of the proposed development and all streets/roads within the proposed development.
2. A legend, scale, and north arrow.
3. General notes.
4. Index of sheets.
5. Seal, signature, and date of the professional engineer responsible for plan preparation.
6. A permanent benchmark description and location based on USGS datum. At least one permanent benchmark must be established within each subdivision or filing thereof, located on public property.

If a cover sheet is not provided, the above information shall be included on the first sheet of the submittal.

## 2.3. Plan

The plan view shall include but not be limited to, the following:

1. The scale shall be a minimum of one (1) inch to fifty (50) feet and shown on the plan.
2. Locations and dimensions of existing and proposed improvements, property lines, easements, and Right-of-Way. Plan view limits shall extend 100 linear feet before the Point of Beginning, and 100 linear feet after the Construction End. Each Point of Beginning and Construction End shall be clearly labeled and identified with stationing.
3. Names of streets/roads.
4. Survey line ties to section or quarter corners.
5. Survey lines and centerline stationing. Stationing shall be equated to flowline stationing at horizontal radius curves, cul-de-sacs, and other departures from normal roadway cross sections.
6. Centerline stations for all intersecting roadways and commercial driveways.
7. Existing and proposed street/road improvements (sidewalk, curb, gutter, pavement limits, bridges, culverts, inlets, manholes, asphalt core sample locations, guardrails, curb ramps, etc.). Existing improvements shall be clearly depicted by a dashed line; proposed improvements shall be depicted by a solid line and or greyscale or hatching. Plans shall include existing and proposed limits for asphalt pavement, including areas of milling and overlaying, as well as new asphalt placement. All items shall have a corresponding legend.
8. Curve layout including radius, degree of curve, deflection angle, length of curve, point of curvature, and point of tangency.
9. Elevations and station shall be noted for all curb returns, points of curvature, points of tangency, and high or low points of all vertical curves. The existing and proposed percent cross slope shall be repeated on the plan sheets at select points. Include elevations and cross slopes, existing and proposed, for all lanes of intersection improvements, regardless if construction is planned for opposing streets.
10. Rate of super elevation.
11. Typical template(s) for streets/roads.
12. Match lines and consecutive sheet numbers.
13. Key map.
14. A minimum of one (1) permanent bench mark, based on United States Geological Survey's datum, fully described, within each subdivision or filing thereof.

15. Existing and proposed utilities and structures, including but not limited to: water, fire hydrants, sanitary sewer, storm sewer, telephone, gas, electric, cable television, fiber optic. Existing utility pothole information shall be organized on a separate plan sheet to identify location, depth, utility type, pipe size and material, conflicts with proposed improvements, and other information obtained during subsurface investigation. Subsurface investigation shall include new laterals or service connections to existing main lines and be clearly shown on separate plan sheets. \*

16. Stations and critical elevations of all utility and drainage appurtenances. \*

17. Construction phasing. \*

18. Major Collector and/or Arterial intersection design at a scale of one (1) inch to twenty (20) feet. \*

19. Traffic signal design at a scale of one (1) inch to twenty (20) feet. \*

20. Signing and Striping Plan.

20. Noise attenuation measures/details. \*

21. Trails. \*

22. Sediment and erosion control measures/details. \*

23. Landscaping. \*

\*May be included on separate plan sheets.

## 2.4. Profile

The profile shall include, but not be limited to the following:

1. The scale shall be a minimum of one (1) inch to five (5) feet for street profiles and a minimum of one (1) inch to ten (10) feet for road profiles, and be shown on the plan.
2. Existing (dashed line) and proposed (solid line) grades.
3. Continuous centerline stationing for the entire portion of the existing and proposed roadway shown in the plan. Clearly label centerline stationing for all intersecting roadways and commercial driveways.
4. All design elevations shall be centerline, flowline, back of curb, or lip of gutter.
5. Vertical curve data including length of curve, P.V.C., P.V.T., P.V.I., beginning and end grades. All vertical curves shall be symmetrical.
6. Curb return profiles at a horizontal scale of 1" = 10' and vertical scale of 1" = 1'.
7. All existing curbs, gutters, sidewalks, culverts or storm sewers, ditches and irrigation structures and asphalt adjacent to the proposed design, as well as the same such features that are 100 linear feet before the Point of Beginning and continue for 100 linear feet beyond the Construction End. Basis for existing grades shall be as-built elevations at intervals not to exceed fifty (50) feet. All existing grades, locations and alignments shall be field surveyed by a licensed Professional Land Surveyor for design of the proposed improvements. Previously approved designs are not an acceptable means of establishing existing grades.
8. Separate flowline or top of curb profiles shall be provided for all proposed curb and gutter, including for design of cul-de-sacs and any other departure from a 2% street/road cross slope. In addition, cross-sections at intervals not to exceed 50 feet are required if a departure from a normal cross-slope is proposed.
9. Existing and proposed utilities. \*

\*May be included on separate plan sheets.

## 2.5. Cross Sections

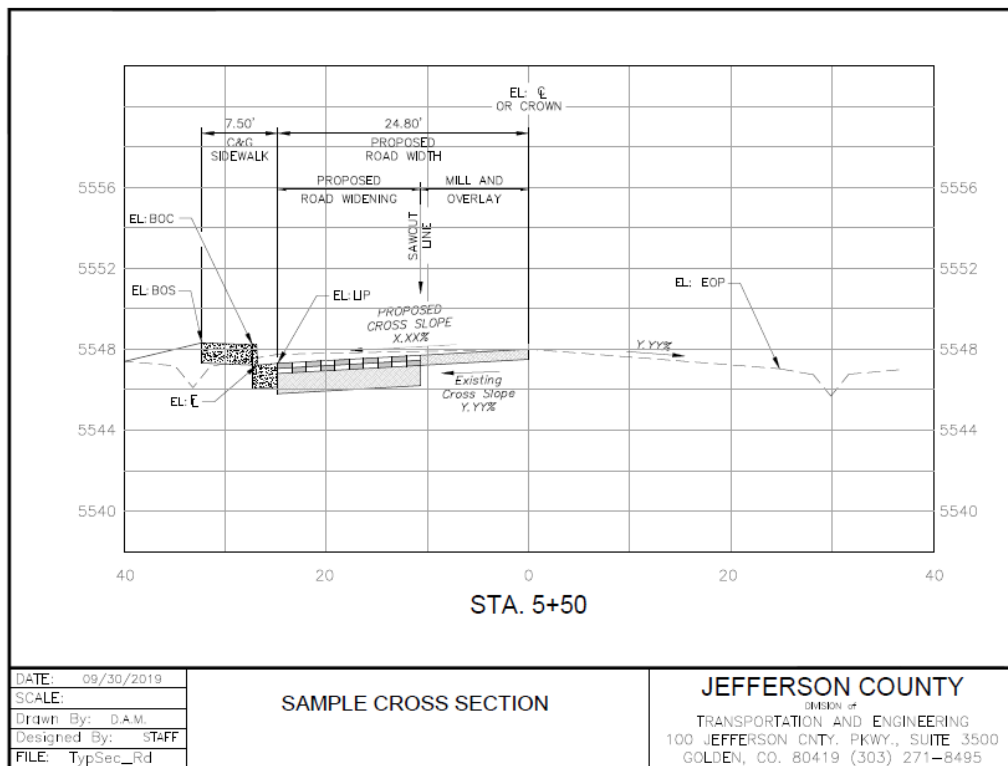
1. On widening or matching projects, or as required by the Jefferson County Planning & Zoning, cross sections of the proposed new construction and existing improvements within the Right-of-Way shall be provided at survey stationing at a maximum of fifty foot Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

intervals and at locations of cross culverts. The scale shall correspond to that used on the plan and profile.

2. Cross sections shall identify both the existing or matching percent cross slope of the roadway, as well as percent proposed cross slope.
3. Cross sections shall identify the elevation at the point of match for widening projects for each station interval.
4. Cross sections shall identify the proposed new road segment in gray scale or other hatching.
5. Cross sections shall identify the proposed pavement treatment or alterations, such as mill and overlay of the match point; as well as the proposed new pavement section and respective lifts asphalt.
6. Core samples shall be collected from the existing roadway prior to construction to determine the existing asphalt depth and condition. Such cores shall not exceed 4-inches in diameter and shall be collected at the centerline of the existing road, as well as edge of existing asphalt. The existing depth of asphalt shall be represented on the cross sections.
7. Proposed widening shall avoid cross sections with gross inverts or peaks at the match point. Normal roadway cross sections shall follow AASHTO design criteria that limit the minimum cross slope to 1.5% and maximum cross slope to 3.0%. Cross slope grade change shall not exceed +/- 0.5% as measured every 50 linear feet along the station intervals. There shall be no change in existing cross slope greater than +/- 1.0% from the match point to the proposed edge of asphalt, or the flow line or the lip of the gutter pan.

Refer to Figure 2-1 "Sample Cross Section" below:

Figure 2-1 - Sample Cross Section





## 2.6. Details

Jefferson County or CDOT standard details may be referenced as applicable. Where these standards cannot be used, a separate detail sheet shall be provided with an explanation detailing why these standard details are not being used.

## 2.7. Standard Notes

The following general notes shall appear on the cover sheet or the first sheet of the plans for all street/road construction plan packages.

1. A Construction Permit from Transportation and Engineering is required prior to commencing work within County Right-of-Way.
2. Any work within State Right-of-Way will require a State Construction Permit.
3. The contractor shall notify Transportation and Engineering at least 24 hours prior to starting construction within the Right-of-Way.
4. The contractor shall provide all signs, barricades, flagmen, lights, or other devices necessary for safe construction traffic control in accordance with the current edition of the MUTCD and as modified by the Colorado Supplement to the MUTCD. A construction traffic control plan shall be submitted to and approved by Transportation and Engineering prior to the issuance of any construction permit for work within County Right-of-Way.
5. The contractor shall contact the Utility Notification Center of Colorado at least 48 hours prior to construction.
6. Construction specification: Current edition of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, special provisions and revisions thereto, and as amended by Chapter 5 of this MANUAL.
7. The subgrade material shall be scarified or removed to a depth required by Jefferson County per information obtained from laboratory tests and/or as required in the Pavement Design Report. Additives or approved material may be required if the native material is unsatisfactory. The subgrade shall be compacted to a minimum density and moisture content range of 2 percent below optimum to 2 percent above as determined in accordance with AASHTO designation T180 or T99 and in accordance with the Standard Specifications Section 203.07.
8. Class 6 aggregate base course for shoulders shall be placed and compacted 95 percent modified Proctor Test (AASHTO T180) after placement of asphalt.
9. Existing asphalt pavement shall be straight sawcut or blade-cut when adjoining with new asphalt pavement. SS-1 tack coat shall be applied to all surfaces.
10. Structural section, including subbase and asphalt, shall be constructed according to the Final Pavement design that has been prepared by the developer's engineer, and approved by Transportation and Engineering according to Chapter 4 of this MANUAL. Existing structural section at the match point shall comply with the minimum Full Depth Asphalt thickness identified in Table 4.3 "Minimum Pavement Sections" of this MANUAL for the respective road classification, regardless of the original thickness of asphalt and / or sub-base.

The following notes shall appear in addition to the above for all street construction, as applicable:

1. Concrete may be placed by machine methods if all finish lines are within 1/8" + tolerance of the lines shown on the plans. The flowline must be free draining and comply with this MANUAL.
2. One half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.
3. The contractor is advised to first obtain inspection of forms by Transportation and Engineering before placing concrete curb, gutter, sidewalk, inlets, and/or other concrete drainage structures.

### *Chapter 3*

## **Design and Technical Criteria**

### **3.1. General**

This section sets forth the minimum design and technical criteria to be used in the preparation of all street/road construction plans. All street/road design shall be in accordance with the current edition of AASHTO Geometric Design of Highways and Streets, unless modified herein.

For this regulation, streets shall be used in the Plains and roads shall be used in the Mountains, except as indicated below:

3.1.1 Roads may be allowed in the Plains in locations with slopes greater than 15%, subject to approval by Planning and Zoning.

3.1.2 Streets may be required in the following Mountains locations as directed by Planning and Zoning: 1) Areas where urban development is projected based on Community Plans designations, 2) Areas where curb and gutter would be needed to mitigate drainage impacts.

### **3.2. Street/Road Types**

3.2.1 Public Streets/Roads: Streets or roads that are owned and maintained by the City, County or State for public use.

3.2.2 Private Streets/Roads: Streets or roads that are owned, maintained, or restricted for the use by a person, group of people, or non-governmental entity.

3.2.3 Non-Maintained Streets/Roads in County ROW: Streets or roads that are owned by the County for public use, but are not constructed to a County public standard and are not County maintained.

### **3.3. Functional Classification**

Jefferson County has adopted a Major Thoroughfare Plan based on traffic volumes, existing and/or zoned land use, and anticipated growth. The Major Thoroughfare Plan designates streets/roads as freeway, parkway, principal arterial, minor arterial, major collector, or collector.

3.3.1. Freeway: A freeway serves major regional traffic movements and carries the highest traffic volume of all classifications. A freeway is planned to have four to six through lanes and may have frontage roads. The movement of traffic takes precedence over access. Access is fully controlled and is allowed only to other freeways or to arterials by grade separated interchanges. Opposing movements on a freeway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes. A freeway may be developed as a parkway with at-grade intersections as a first phase. Freeways are typically in State jurisdiction.

Design Speed: Special Design Required

3.3.2. Parkway: A parkway serves major regional traffic movements and carries high traffic volumes. A parkway is planned to have four to six through lanes. The movement of traffic takes precedence over access. Access is fully controlled and allowed only to major collector classifications or higher. Grade separation at major intersections is preferred over traffic signals. Opposing movements on a parkway are separated by a raised or depressed median. Pedestrians and bicycle traffic are physically separated from the travel lanes unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 40 - 50 MPH

3.3.3. Arterial.

3.3.3.1. Principal Arterial: A principal arterial serves major regional traffic movements and carries high traffic volumes. A principal

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arterial is planned to have four to six through lanes in the Plains and four through lanes in the Mountains. The movement of traffic takes precedence over access. Access is controlled and allowed to collectors and higher class facilities is preferred, but some restricted access to major developments may be allowed. Opposing movements are usually separated by a raised, depressed, or painted median. Pedestrians and bicycle traffic may be carried on detached walks and trails unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle Plan as amended.

Design Speed: 35 - 45 MPH

3.3.3.2. Minor Arterial: A minor arterial serves intracommunity traffic and carries moderate traffic volumes. Minor arterials are planned to have four lanes in the Plains. In the Mountains, minor arterials are planned to have two lanes, plus turn lanes and passing or climbing lanes where warranted. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally separated by a raised, depressed, or painted median in the Plains. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40 MPH

3.3.4. Major Collector: A major collector serves intracommunity traffic and carries moderate traffic volumes. Major collectors are planned to have two lanes, plus turn lanes where warranted, in the Plains and the Mountains. Neither the movement of traffic nor access takes precedence. Reasonable access is allowed except for private residential driveways. Opposing movements are generally separated by a median/turn lane. Pedestrians and bicycle traffic are usually carried on a detached walk or an adjacent trail unless a bicycle lane or paved shoulder is designated per the Jefferson County Bicycle and Pedestrian Plan, as amended.

Design Speed: 30 - 40MPH

3.3.5. Collector: A collector serves neighborhood traffic movements over short distances, generally accessing arterials and major collectors. A collector has two lanes, plus turn lanes where warranted, in the Plains and two lanes in the Mountains. Access takes precedence over the movement of traffic. Reasonable access is allowed except for private residential driveways. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 25 - 30 MPH

3.3.5. Local: A local street or road serves neighborhood traffic over very short distances to higher class roadways. A local street or road has two travel lanes. It is always paved in the Plains and usually paved in the Mountains. Access to adjacent land is its primary purpose. All types of access are allowed. Opposing movements are not physically separated. Pedestrian traffic is handled on attached or detached sidewalks in the Plains. No special accommodation is made for bicycle traffic.

Design Speed: 15 - 25 MPH

3.4. Standard Templates

The following templates reflect the minimum section for each street/road classification and for cul-de-sacs. Any additional requirements including, but not limited to, acceleration/deceleration lanes and left turn lanes are not shown.

Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
1	Principal Arterial Street	Greater than 25,000	<del>40-109-127'</del>
2	Minor Arterial Street	15,000 to 25,000	<del>40-87-101'</del>

3	Major Collector Street	8,000 to 15,000	<del>78'-77'-91'</del>
4	Collector Street (36' FL to FL) with Attached Sidewalks	1,000 to 8,000	<del>60'-46'-54'</del>
5	Collector Street (36' FL to FL) with Detached Sidewalks	1,000 to 8,000	<del>37'-32'-40'</del> + 20' easement for sidewalks, maintenance and traffic signs
6	Local Street (34' FL to FL) with Attached Sidewalks	Less than 1,000	50'
7	Local Street (34' FL to FL) with Detached Sidewalks	Less than 1,000	35' + 20' easement for sidewalks, maintenance and traffic signs
8	Local Street (28' FL to FL) with Attached Sidewalks	Less than 350	45'
9	Local Street (28' FL to FL) with Detached Sidewalks	Less than 350	30' + 18' easement for sidewalks, maintenance and traffic signs
Template Number	Description	Typical Volume Range in Average Daily Traffic (ADT)	Right-of-Way Width (Feet)
Public Street/Road Templates			
10	Minor Arterial Road	Greater than 8,000	70'
11	Major Collector Road	2,000 to 8,000	50', 60' for turn lanes
12	Collector Road	1,000 to 2,000	50'
13	Local Road	Less than 1,000	50'
14	Street Cul-de-sac – Option 1 Street Cul-de-sac – Option 2 Street Cul-de-sac – Option 3	See LDR, Section 15	90' 100' 112'
15	Partial Cul-de-sac for Local Streets	See LDR, Section 15	45'R
16	Offset Cul-de-sac for Local Streets	See LDR, Section 15	90'
17	Cul-de-sac for Local Roads	See LDR, Section 15	90'
Private street/road templates and Non-maintained streets/roads in County ROW templates *			
<del>18</del>	<del>Driveway/Private Street/Road &amp; Non-maintained Street/Road in County ROW (No Parking)</del>	See LDR, Section 15	20' minimum
19	Pull Out for Private Road	N/A	n/a
20	Hammerhead Turnaround for Driveway/Private Road	See LDR, Section 15	varies
21	Hammerhead Turnaround for Private Street	See LDR, Section 15	varies

\* The "non-maintained streets/roads in County ROW" templates can only be used if the following provisions apply:

1. The County is not holding a guarantee a previous development process that would require the construction of a County public standard street/road in the ROW.
2. The County does not wish to have the street/road constructed to a County public standard.
3. The street/road is not identified on the Jefferson County Major Thoroughfare Plan.

**Commented [LW1]:** To split out and create separate templates for driveway, private street, and private road

3.5. Horizontal Alignment

3.5.1. Horizontal Curves: Minimum curve radii for a normal crown section based on design speed are summarized in the table below.

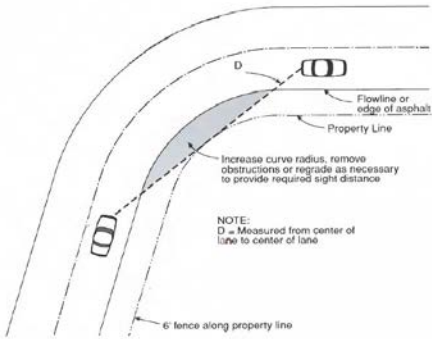
Design Speed (mph)	Minimum Curve Radius (feet)
15	50
20	107
25	198
30	333
35	510
40	762
45	1039
50	Special Design

3.5.1.1. For collector roads, the centerline line radius may be reduced to a minimum of one hundred (100) feet, provided, however, that on a curve with a centerline radius less than four hundred (400) feet, the maximum grade shall be reduced by one (1) percent for each one hundred (100) feet or fraction thereof the radius is reduced.

3.5.2. Super Elevation: Super elevation is required for curves on all principal and minor arterial streets/roads and selected collector streets/roads. Minimum horizontal curve radius, rate of super elevation, and lengths of tangent runout and super elevation runoff shall be in accordance with the recommendations of the current edition of AASHTO Geometric Design of Highways and Streets.

Super elevation shall not be used on local streets, but may be used on local roads.

3.5.3. Sight Distance: Horizontal alignment must provide at least the minimum stopping sight distance for the design speed at all points. This includes visibility at intersections, as well as around curves and roadside encroachments. Where an object off the traveled surface restricts sight distance, the minimum radius of curvature is determined by the stopping sight distance. A likely obstruction may be a bridge abutment, retaining wall, cut slope, landscaping, or side or corner of a building. In considering sight distance, it shall be assumed a 6'-0" fence (as measured from finished grade) exists along all property lines except in the sight distance triangles required at all intersections. Minimum stopping sight distance (measured from the centerline of the inside lane) shall be as follows for centerline grades equal or less than 3%:



Design Speed (mph)	Stopping Sight Distance (d) (feet)
15	80
20	115
25	150
30	200
35	250
40	325
45	400
50	475

For grades greater than 3%, stopping distance shall be in accordance with the recommendations of the current edition of AASHTO Geometric Design of Highways and Streets.

### 3.6. Vertical Alignment

3.6.1. Grades: The minimum grade for all new streets and roads is 2%, except within a sag. A minimum flowline grade of 1.5% shall be maintained around all full and partial cul-de-sac bulbs, except within a sag. Planning and Zoning may approve grades as low as 1% if existing conditions make it infeasible to construct a minimum of 1.5%. The maximum grade for all public streets is 6.0% and for public roads is 8.0%. The maximum grade for public roads may be increased to 10% where the dip of the natural terrain bears between South 60° East and South 45° West.

3.6.2. Intersection Grades: The maximum grade at intersections shall be in accordance with the following figure and table. Grades and lengths apply to the street/road controlled by a stop sign. At signalized and uncontrolled intersections, grades and lengths apply to all legs of the intersection.

	Through Street / Road		
Intersection Street/Road	Local	Collector	Major Collector/Arterial
Local	50' @ 4%	100' @ 4%	100' @ 4%
Collector	-	100' @ 3%	200' @ 2%
Major Collector/Arterial	-	-	200' @ 2%

3.6.3. Changing Grades. Continuous grade changes shall not be permitted. The use of grade breaks in lieu of vertical curves is discouraged; however, if a grade break is necessary and the algebraic difference in grade (A) does not exceed four-tenths (0.40) of a percent along the street/road, the grade break will be permitted.

The maximum grade break allowed at the point of tangency at a curb return for local and collector streets shall be two (2) percent and a maximum of one (1) percent for arterial streets.

3.6.4. Vertical Curves. All vertical curves shall be symmetrical. A vertical curve shall be used when the algebraic difference in grade (A)

equals or is greater than four-tenths (0.40) of a percent. The minimum grade within a sag (sump) vertical curve is five-tenths (0.50) of a percent. All vertical curves shall be labeled, in the profile with curve length (L) and K value ( $= L/A$ ). The minimum K values for crest and sag vertical curves shall be in accordance with the following table:

Design Speed (mph)	Minimum K Value	
	Crest	Sag
30	30	40
35	50	50
40	80	70
45	120	90
50	160	110

3.6.5. Connection with Existing Streets/Roads

3.6.5.1. Connection with existing roadways shall be smooth transitions conforming to normal vertical curve criteria (see Section 3.6.4. of these standards) if the algebraic difference in grade (A) between the existing and proposed grade exceeds four-tenths (0.40) of a percent. When a vertical curve is used to make this transition, it shall be fully accomplished prior to the connection with the existing improvement, and comply with the grade requirements at intersection approaches.

3.6.5.2. Existing grade shall be shown for at least three hundred (300) feet with field verified as-builts showing stations and elevations at twenty-five (25) foot intervals. In the case of connection with an existing intersection, these as-builts are to be shown within a three hundred (300) foot radius of the intersection. This information will be included in the plan and profile that show the proposed roadway.

3.6.5.3. Previously approved designs for the existing improvement are not an acceptable means of establishing existing grades; however, they are to be referenced on the construction plan where they occur.

3.6.5.4. The basis of the as-built elevations shall be the same as the design elevations (both flowline or top of curb, etc.) unless otherwise approved by Planning and Zoning.

3.7. Intersection Spacing, Vision Clearance Triangle, ~~and Sight Distance~~, Driveways and Private Streets/Roads

3.7.1. Intersection Spacing: Spacing of intersections (measured centerline to centerline) shall be in accordance with the following table:

Proposed Street/Road: Existing Street/Road	Minimum Separation (feet)
Local: Local or Collector	175
Local: Arterial or Major Collector	500
Collector: Collector	230
Collector: Major Collector or higher	1000
Major Collector: Major Collector	660
Major Collector: Arterial or higher	1320
Arterial: Arterial or higher	5,280'

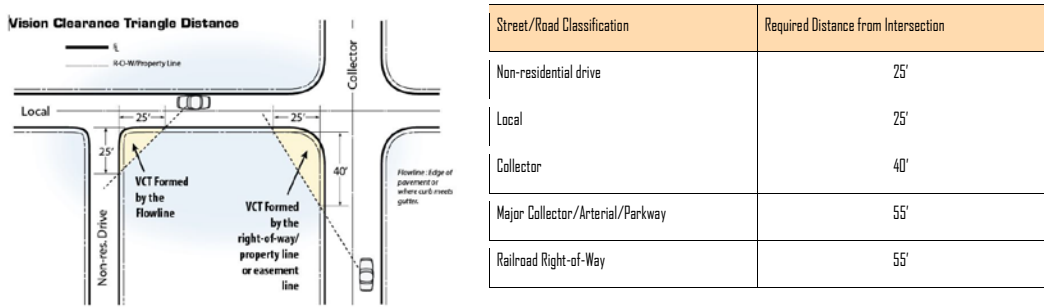
3.7.2. Vision Clearance Triangle: The table below shows where a vision clearance triangle must be provided.

Required	Not Required
Street/Road Intersections	Intersection of internal drive isles in non-residential*
Intersections of non-residential driveways with streets/roads	Multi-family and townhome developments*
Intersections of multifamily and/or townhome residential drive isles with streets/roads	
Intersections of street/roads and railroad Right-of-Way	

\* Layout of these types of developments should not impede a driver's ability to see on-coming vehicles and pedestrians at intersections

As illustrated below, the vision clearance triangle must provide an unobstructed view across the triangle formed by the Right-of-Way/property line or easement line adjacent to a street or road as illustrated. The vision clearance triangle may also be formed by the flowline adjacent to a street or road as illustrated below subject to approval by Planning and Zoning. The approval of the vision clearance triangle formed by a flowline is predicated on a fully built-out street or road and existing Right-of-Way that exceeds the Right-of-Way requirements in the Land Development Regulation. Within the area of the triangle, there shall be no fence, wall, landscaping, structure or other obstruction to view more than ~~forty-two~~thirty-six (4236) inches in height, ~~or trees with foliage or signs lower than eight (8) feet in height~~ (measured from the flowline or edge of pavement on the street/road surface). The allowable height of ~~forty-two~~thirty-six (4236) inches is determined by measuring from the flowline or edge of pavement, as applicable. For example, the grade on a lot within the triangle is 12" higher than the flow line of a gutter, the allowable height of landscaping would be 30" on the property.

Note that if there is any conflict between this provision (3.7.2) and the Sight Distance provision (3.7.2.1) of this MANUAL, the Sight Distance provision shall take precedence. Note that if a physical median exists or is proposed at an access point restricting or eliminating a conflict point, the Vision Clearance Triangle requirements will not apply where no conflict points exist.



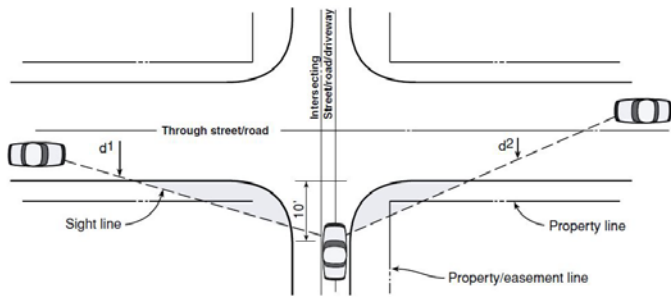
3.7.2.1. Sight Distance: At any street/road intersections or multifamily residential, commercial and industrial site driveways, an unobstructed view as defined above must be provided across the area formed by the flowline or edge of pavement on one street/road and the flowline or edge of pavement of the intersecting street/road (or edge of driveway) and lines (labeled d1 or d2 on the Sight Distance figure) connecting them at ten (10) feet from their point of intersection. This area will be used to ensure that drivers of vehicles exiting from the stopped approach have the minimum required sight distance available. The minimum required sight distance shall be in accordance with the Minimum Sight Distance Requirements table for two lane streets/roads.



**Minimum Sight Distance Requirements**  
*(in feet) for vehicles entering onto two-lane streets/roads:*

Operating Speed (mph)	Left Sight Distance d1 *	Right Sight Distance d2 **
20	220	130
25	260	170
30	350	260
35	430	350
40	530	440
45	610	570
50	740	700

*\* Measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the outside lane.*  
*\*\* Measured from the driver's eye ten feet back of the flowline or pavement edge to the vehicle approaching in the median lane.*



1. Requirements assume that the vehicle is stopped on the proposed public or private street/road or driveway.
2. Requirements are based on a 3.5-foot driver eye height in the stopped vehicle and a 4.25-foot height of the approaching vehicle.
3. The operating speed of the approaching vehicle is assumed to be the posted speed limit.
4. Sight distance requirements as shown in the Minimum Sight Distance Requirements table are designed to enable vehicles entering the street/road to accelerate to the operating speed of approaching vehicles without causing the approaching vehicles to reduce speed by more than 10 mph.
5. Truck traffic (WB30 or larger) entering onto streets/roads requires longer sight distances than shown in Table. Any proposed public or private street/road or driveway regularly used by truck traffic may require an individual analysis.
6. When the criteria for sight distances cannot be met, the County may deny the access, prohibit left turns by vehicles entering the street/road or require speed change lanes.

3.7.3. Right Turn Lanes

3.7.3.1. Right Turn Acceleration Lanes: Right turn acceleration lanes may be required based on an approved transportation study. Right turn acceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, Transportation Design and Construction Manual – Amended ~~12-17-19XX-XX-XX~~

as determined by Planning and Zoning.

3.7.3.2. Right Turn Deceleration Lanes: Right turn deceleration lanes are required at arterial and major collector street/road intersections and at driveways on arterial streets/ roads as needed based on required transportation study/analysis. Transportation study/analysis shall address storage, as applicable. Right turn deceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning.

3.7.3.3. If the proposed street/road intersection or driveway is within two different speed zones, the criteria for the higher speed zone apply.

3.7.3.4. Where there are three or more through lanes in the direction of travel, right turn acceleration and deceleration lanes will be required only when determined necessary by Planning and Zoning due to high traffic volume or other site specific safety considerations.

3.7.3.5. Taper and lane lengths shall be in accordance with the following criteria.

Deceleration Right Turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length* (Taper Length + Lane Length)
25	80'	120'	200'
30	100'	150'	250'
35	120'	190'	310'
40	140'	230'	370'
45	160'	280'	440'
50	180'	320'	500'

*\*At signalized intersections, where storage is needed for right-turning vehicles, additional length shall be provided to accommodate the average number of vehicles anticipated.*

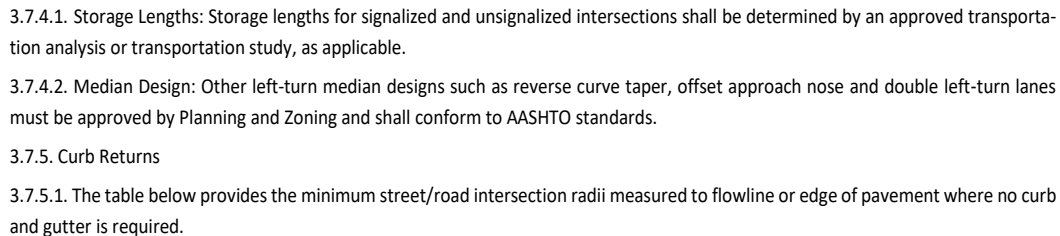
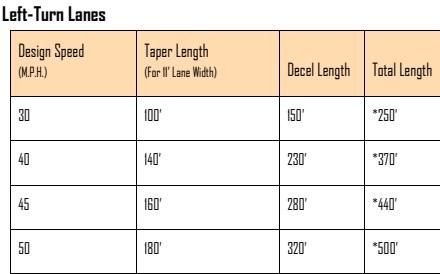
Acceleration Right turn Lanes

Design Speed (M.P.H.)	Taper Length (For 11' Lane Width)	Lane Length	Total Length (Taper Length + Lane Length)
30	120'	190'	310'
35	120'	270'	390'
40	180'	380'	560'
45	180'	550'	730'
50	240'	760'	1000'

3.7.3.6. A continuous accel/decel lane may be required if the acceleration lane for one access and the deceleration lane for another access overlap or are in close proximity to each other.

3.7.3.7. The minimum pavement width for acceleration and deceleration lanes shall be eleven (11) feet, excluding gutter pan or shoulder.

3.7.3.8. Grade correction factors are required where street/road grades are steeper than three (3) percent.



Intersecting Street	Principal Arterial	Minor Arterial	Major Collector	Collector	Local
Principal Arterial	Special Design*	Special Design*	40'	40'	30'
Minor Arterial	Special Design*	Special Design*	30'	30'	25'
Major Collector	40'	30'	30'	30'	25'
Collector	40'	30'	30'	25'	20'
Local	30'	25'	25'	20'	20' /15'

3.7.5.1.1. At driveway locations where curb returns are used, the minimum radii allowed on arterials and major collectors shall be twenty-five (25) feet.

3.7.5.1.2. At driveway or private access locations where there is no curb and gutter, the minimum radii (measured to edge of pavement) allowed on arterials and major collectors shall be twenty-five (25).

3.7.5.2. The minimum elevation difference (fall) around curb returns (PCR to PCR) for flow along the curb line shall be as follows:

Radius	Minimum Fall
15'	0.3'
20'	0.4'
25'	0.5'
All Others	1.27% of length from PCR to PCR

3.7.5.3. The maximum fall around curb returns shall be equal to the steepest grade coming into or out of the return multiplied by the return length, + 0.2 feet.

3.7.5.4. Curb Return Profiles: Curb return profiles are required for radii equal to or greater than thirty (30) feet within the public Right-of-Way. A midpoint elevation along the arc length of the curb return shall be shown in plan view for radii equal to or greater than twenty-five (25) feet. Curb return design shall be set in accordance with the following design procedure. General standards for flowline control and profiles within the curb returns shall be as follows:

3.7.5.4.1. The point of tangency at each curb return shall be determined by the projected tangent grade beginning at the point of intersection (P.I.) of the flowlines.

3.7.5.4.2. The arc length and external distance of the curb return shall be computed and indicated on the drawing.

3.7.5.4.3. Show the corresponding flowline (or top of curb) grade for each roadway beyond the P.C.R.

3.7.5.4.4. Design of the curb return flowline shall be such that the maximum cross slope between the midpoint of the curve and the PICR (external distance) does not exceed +5 percent. Grade breaks at the PCR's will not exceed two (2) percent for local and collector streets and one (1) percent for arterials. The flowline design of the curb return will be accomplished within the return without affecting street grades beyond the PCR. Maximum vertical curves will equal the arc length of the curb return. The elevation and location of the high or low point within the return, if applicable, is to be called out in the profile.

3.7.5.4.5. Scale for the curb return profile is 1" = 10' horizontally and 1" = 1' vertically. See Section 2.4.6.

3.7.6. Driveway Spacing

Opposing and adjacent driveway locations shall be in accordance with the following figure and table. The minimum spacing shall be increased as necessary to accommodate left turn storage bays. Offset of opposing driveway locations is not required if driveways are physically constrained to right-in, right-out.

NOTE: Flowline of curb/gutter or edge of asphalt if curb/gutter does not exist or edge of shoulder if asphalt does not exist.

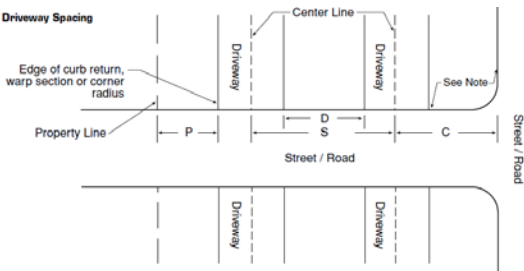


	Figure Reference	Distance
Residential Driveways		
From property lines	P	0'
From streets/roads	C	30'
Between driveways	N/A	0'
On local streets/roads	D	10'
On collector streets/roads	S	80'***
On major collector/arterial streets/roads	S	325'
Non-Residential Driveways on Locals/Collectors		
From property lines	P	0'
From major collectors/arterial streets/roads	C	300' *
From collector streets/roads	C	200' *
From local streets/roads	C	125'
Between driveways		
30 MPH design speed	S	180'
35 MPH design speed	S	200'
Non-Residential Driveways on Major Collectors/Arterials/Parkways		
From property lines	P	0'
From streets/roads	C	500' **
Between driveways		
40 MPH design speed	S	275'

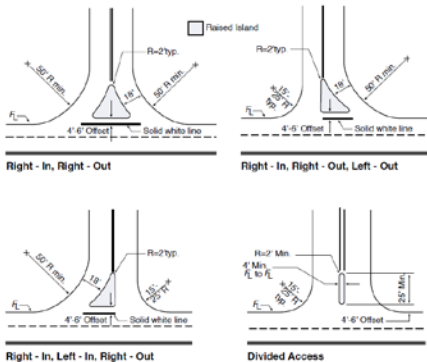
45 MPH design speed	S	325'
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*\*The C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. The minimum distance shall be no less than 150 feet.*

*\*\* If the proposed driveway is restricted to right turn movements or if it is not aligned with an existing or planned left turn lane, the C dimension may be reduced if approved by Planning & Zoning Division due to the existence of limiting factors. If signalization is proposed, the minimum C distance shall be increased to 660 feet.*

*\*\*\*May be reduced for circular driveways or driveways with a standard hammerhead turnaround If approved by Planning and Zoning.*

3.7.7. Channelizing Islands The following figures illustrate the minimum design for channelizing islands for site accesses with various turn movement restrictions.



- 3.7.7.1. Non-rigid post mounted delineators are required on raised islands.
- 3.7.7.2. Curb ramps four (4) feet wide, with a maximum slope of 12:1, are required and shall be shown on the plans.
- 3.7.8. ~~Non-Maintained Roads in County Right-of-Way, Driveways, and Private Street/Roads, and Non-Maintained Roads in County Right-of-Way~~ Standards. \_\_\_\_\_
- 3.7.8.1. Driveways serving one dwelling unit shall meet the following standards [\(Template 18\)](#):\_
- Exception: [If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.4. do not apply.](#)
- 3.7.8.1.1. [Curve Radius](#): Minimum horizontal curve radius of 30 feet at centerline.
- 3.7.8.1.2. [Width](#): A total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side [in accordance with Template 18.](#)
- ~~or if the length of the driveway in the Mountains exceeds 150-500 feet in length, and is a total width of 14 feet, including a 10-foot all-weather travel surface and two-foot shoulders on either side, then pullouts shall be required at 200-foot intervals in accordance with Template 19. Due to site constraints, this 200-foot interval could be modified by 50 feet in either direction. Alternatively, if pullouts are not desired, a total width of 16 ft, including a 12-foot all-weather travel surface and two-foot shoulders on either side is required in accordance with Template 18 allowed.~~
- 3.7.8.1.3. [Grade](#): Maximum grade of ten (10) percent on straight sections and [twelve \(12\) percent](#) ~~grade~~ where the dip of the natural terrain bears between South 60° East and South 45° West. Maximum grade of eight (8) percent for curves with radius of less than or equal to 50 feet at centerline.\_
- [Exceptions](#): ~~In the Mountains, a maximum grade of fifteen (15) percent on straight sections for a maximum length of one hundred (100)~~

feet is allowed provided the appropriate fire sprinkler systems are installed per [the National Fire Protection Association \(NFPA\) 13D - Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes](#). There may be more than one section up to 15% provided [if it is separated they are separated by a distance of 1000 feet](#).

~~3.7.8.1.4. If the length of the driveway in the Plains is less than or equal to 50 feet, Sections 3.7.8.1.1. through 3.7.8.1.34 do not apply.~~

3.7.8.1.54. Turnaround: If the length of the driveway exceeds 150 feet, a hammerhead turnaround shall be provided in accordance with Template 20, ~~and the~~ [The location of the turnarounds shall be approved by the appropriate fire protection district](#).

**Commented [NS2]:** I don't think we want this included any longer.

3.7.8.2. Private [streets/roads](#) serving more than one dwelling unit and non-maintained [streets/roads](#) in county Right of Way shall meet the following standards:

3.7.8.2.1. [Curve Radius](#): Minimum horizontal curve radius of 30 feet at centerline.

3.7.8.2.2. [Width \(For a street/road serving up to 15 dwelling units\)](#): A total width of 20 feet, including a 16-foot all-weather travel surface and two-foot shoulders on either side in accordance with Template 18 ~~for roads serving up to 15 dwelling units~~. Alternatively, ~~for a private road~~ a total width of 14 feet, including a 10-foot traveled surface, two-foot shoulders on either side, and pullouts at ~~±50-200~~ foot intervals in accordance with Template 19. [Due to site constraints, this 200 foot interval could be modified by 50 feet in either direction.](#)

3.7.8.2.2.13. [Width \(For a street/road serving 16 or more dwelling units or one or more non-residential units\)](#): A total width of 24 feet, including an 18-foot paved surface and three-foot shoulders on either side in accordance with Template 18. ~~for roads serving 16 or more dwelling units or one or more non-residential units~~.

3.7.8.2.34. [Grade](#): Maximum grade of ten percent on straight sections; Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West. Maximum grade of eight percent for curves with radius of less than or equal to 50 feet at centerline.

[Exceptions: In the Mountains, 3.7.8.2.5 a maximum grade of fifteen \(15\) percent on straight sections for a maximum length of one hundred \(100\) feet is allowed provided the appropriate fire sprinkler systems are installed per NFPA 13D, for all new dwellings the street/road serves. There may be more than one section up to 15% provided it is separated by a distance of 1000 feet.](#)

3.7.8.3. ~~The appropriate fire protection district may approve alternative standards for driveways and private roads. Plans shall be submitted that bear the written approval of the appropriate fire protection district. The off-site driveway or private road shall meet the requirements as described in this section. If the off-site driveway or private road does not cannot meet the requirements of this section, the following shall be submitted to Planning and Zoning:~~

~~1) A letter with a written description of the existing conditions and documentation of why the off-site driveway or private road cannot meet the requirements,~~

~~2) Plans showing the existing conditions of the off-site driveway or private road and/or proposed design,~~

~~3) A certified statement by a qualified Colorado-registered professional engineer indicating that the off-site driveway or private road will be able to serve the residents effectively and safely. This statement shall include a detailed explanation of how an emergency apparatus within the appropriate Fire Protection District will be able to serve a residence safely and effectively, and will be safe for fire apparatus. Such statement shall bear the professional engineer's seal, signature and date, and~~

~~4) A written statement from the property owner that a fire sprinkler system will be installed per NFPA 13D at the time of Building Permit. These submittal documents will be required to be reviewed and approved by Planning and Zoning prior to issuance of a building permit. Planning and Zoning may consult directly with the appropriate Fire District when evaluating offsite driveways or private roads which cannot meet the requirements of this section.-~~

**Commented [NS3]:** Should this include evidence that apparatus can make it up the road. Either with autoturn or turning radius templates.

3.7.8.4. Driveway approaches and private road intersections with public roads must comply with Standard 8 - Driveway and Private Transportation Design and Construction Manual – Amended ~~12-17-19~~ ~~XX-XX-XX~~

Road Approaches onto Roads.

3.7.8.5. Cattle guards shall conform to the current edition of the CDOT M&S Standard Plans and approved by the appropriate fire protection district.

3.7.8.6. All gates and entry-way structures shall be approved by the appropriate fire protection district.

[3.7.8.7. All streets in the Plains are required to be paved.](#)

### **3.8. Drainage**

All storm drainage systems shall be designed in accordance with Jefferson County Storm Drainage Design and Technical Criteria (JCSDDTC). Safe and efficient conveyance of traffic is the primary function of streets/roads; therefore, design of the storm drainage function shall not exceed the limits (such as gutter capacity and street overtopping) set forth in the JCSDDTC. All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T", in accordance with Jefferson County Land Development Regulation Section 33.

3.8.1. Crosspans: Crosspans are not permitted across collector or arterial streets, nor are they allowed on streets with existing storm sewer systems. Crosspans may be used parallel to collector or arterial streets to convey storm runoff across local streets.

3.8.2. Inlets: Inlets shall be located to intercept gutter flow at the point gutter capacity is exceeded by the storm runoff (see Chapter 9 of the JCSDDTC for gutter capacity). Inlets shall also be installed to intercept cross-pavement flows at points of transition in superelevation. Due to the presence of curb ramps at intersections, inlets are not allowed within the curb return, but shall be located at the tangent points of the curb return.

3.8.3. Cross Slope: Except at intersections, or where superelevation is required, streets/roads shall be level from top of curb to top of curb (or flowline to flowline) and shall have a two (2) percent crown. At or within 150' of an intersection, the maximum elevation difference between flowlines is that dictated by the intersection grade (Section 3.5.2.) and the actual distance between flowlines.

3.8.3.1. Parabolic or curved crowns are not allowed. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street.

3.8.3.2. Carrying the crown at a side street into the through street is permitted only when drainage considerations warrant such a design.

3.8.3.3. The rate of change in pavement cross slope, when warping side streets at intersections, shall not exceed one (1) percent every twenty-five (25) feet horizontally on local streets/roads, one (1) percent every thirty-seven and one-half (37.5) feet horizontally on collector streets/roads, or one (1) percent every fifty-six and one-half (56.5) feet horizontally on arterial streets/roads.

3.8.4. Temporary Erosion Control: Temporary erosion control is required along and at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc., in accordance with the Jefferson County Zoning Resolution, Section 15.

3.8.5. Cross Culverts: Cross culverts shall be installed at locations where roads cross natural drainageways and/or where changes in road grade are greater than two (2) percent. The culvert slope shall match as nearly as possible that of the existing topography, but shall in no case be less than one (1.0) percent. Cross culverts for roads shall be spaced a maximum of five hundred (500) feet apart.

### **3.9. Traffic Control**

3.9.1. Construction Traffic Control: Traffic safety in construction zones should be an integral element of every project from planning through design and construction. Pedestrian, as well as vehicular traffic, should be considered in the design of a traffic control plan. A traffic control plan shall be submitted to and approved by Transportation and Engineering prior to issuance of a construction permit.

Design of all traffic control plans shall be in accordance with Part VI of the Manual on Uniform Traffic Control Devices, Standards for Work Zone Traffic Control. All necessary signs, pavement markings, barricades, etc. shall be shown on the plan.



3.9.2. Traffic Signals: Traffic signals shall be installed at street/road intersections or site accesses identified as meeting warrants in the traffic study submitted for a proposed development. If the proposed signal location is within twelve hundred (1,200) feet of any adjacent signal, a two-way progression analysis shall be included in the traffic study.

Design of all traffic signals shall be in accordance with the Manual on Uniform Traffic Control Devices and the Colorado Department of Transportation Standards and Specifications. Traffic signal plans shall be submitted to and approved by Planning and Zoning.

Traffic signal poles shall not be installed within sidewalks or curb ramps.

3.9.3. Signing and Striping: Plans are required for signing/ striping of new streets/roads and re-signing/stripping of existing streets/roads necessitated by development. All signing/stripping plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and shall be submitted as part of the construction plans.

3.9.3.1. The signing plan shall:

1. Show the general longitudinal location of each existing and proposed sign (by side of street/road and station).
2. Specify the sign legend and sign type (from the MUTCD).
3. Specify the sign size.
4. Include a typical detail of installation dimensions (height, distance from curb or edge of pavement).
5. Include a detail of post and base dimensions and installation plan (showing any wedges or sleeves, depth below surface, any materials used).
6. Specify the blank gauge and material of the sign(s).
7. Note the reflectorization provided.

3.9.3.2. The striping plan shall show:

1. Striping material (paint, thermoplastic, preformed tape, etc.).
2. Color designation and line width.
3. Lane width.
4. Proposed and existing lane striping including skip interval.
5. Typical treatments for accel/decel lanes, turning lanes, bike lanes and crosswalks.

3.9.3.1. Stop signs shall be placed at intersections in accordance with the MUTCD, unless otherwise approved by the Director of Planning and Zoning.

3.9.3.2. All street/road name signs shall be in accordance with the current edition of DRCOG "Guidelines for the Design and Placement of Street Signs in the Denver Region".

### **3.10. Miscellaneous**

3.10.1. Guardrail: In locations where guardrail is required, as determined by Planning and Zoning, design shall be in accordance with the Colorado Department of Transportation Standards and Specifications. Determination of guardrail requirements shall be based on Colorado Department of Transportation Roadway Design Manual, Section 702. Guardrail locations shall be shown on the construction plans.

3.10.2. Noise Attenuation: In locations where arterial streets/roads are adjacent to existing or planned residential areas, fencing and/or other noise attenuation measures are required. These measures may include, but are not limited to, earth beams, landscaping, walls, or a combination.

3.10.3. Street Lighting: Street lights shall be provided at all parkway/arterial/major collector street/road intersections. In addition, street lights shall be provided at all locations where multifamily residential, commercial or industrial site driveways intersect

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parkway/arterial/major collector streets/roads. Street lights shall be designed in accordance with the most recent ANTI/ICES Roadway Lighting Standards and installed in accordance with Public Service Company of Colorado standards. Light poles shall not be installed within sidewalks or curb ramps.

3.10.4. Roundabouts: Roundabouts may be constructed subject to an approved traffic study. Roundabouts shall be designed in accordance with the current edition of the Federal Highways Administration Publication, Roundabouts: An Informational Guide, and approved by Transportation and Engineering and the appropriate fire protection district.

3.10.5. Bridges: Bridges shall be designed in accordance with CDOT Bridge Manuals and approved by Transportation and Engineering and the appropriate fire protection district.

3.10.6. Curb Extensions (mid-block and corner) and Pedestrian Refuge Islands: Curb extensions and pedestrian refuge islands shall be designed in accordance with the current version of the Federal Highway Administration Bicycle and Pedestrian Report and approved by Transportation and Engineering and the appropriate fire protection district.

#### *Chapter 4*

## **Pavement Design and Technical Criteria**

### **4.1. General**

This section sets forth the minimum criteria and design procedures for **public and private roadway pavements**. Recommended design methodologies for asphalt are addressed and essentially follow the Colorado Department of Transportation (CDOT) and the Asphalt Institute methodology. Some standardization of criteria has been made in design procedures. Other design methodologies may be presented for comparison to the current County design method.

### **4.2. Pavement Design Report Submittal**

4.2.1 Preliminary Pavement Design: A Preliminary Pavement Design shall be used for estimating purposes only to determine the financial security "Exhibit A" associated with development projects. Three standardized Preliminary Pavement Designs corresponding to three zones of unique geotechnical characteristics within Jefferson County are presented in Construction Standard 16-18. Construction Standard 19 shows each of the three zones. Zone 1 corresponds with materials associated with decomposing granite in the higher elevation foothills and mountains. Zone 2 addresses highly expansive clay and claystone material within the Designated Dipping Bedrock Area with edge drains. Zone 3 involves non-cohesive soil and weathered bedrock along the Front Range. The Preliminary Pavement Design shall be replaced with the Final Pavement Design, and the associated "Exhibit A" financial security costs recalculated, after County approval of the Final Pavement Design Report.

#### 4.2.2 Final Pavement Design:

The final pavement design shall be completed and submitted after or in conjunction with County approval of the associated construction plans. All soil samples must be taken after overlot grading, or represent the "as-constructed" soil conditions after construction has been completed. Pavement design approval is required prior to placement of any concrete flatwork and/or paving within County Right-of-Way.

The report shall be prepared by or under the supervision of and signed by a Professional Engineer registered in the State of Colorado and shall include the following information:

A. Vicinity map to locate the investigated area.

- B. Scaled drawings showing the location of borings, and required information stated in 4.3.2.
- C. Scaled drawings showing the estimated extent of subgrade soil types and Equivalent Daily Load Application (EDLA) for each street.
- D. Pavement design alternatives for each street on a scaled drawing.
- E. Tabular listing of Sample Designation, Sample Depth, Composite Group Number, Liquid Limit, Plasticity Index, Percent Passing the No. 200 sieve, American Association of State Highway and Transportation Officials (AASHTO) Classification, Group Index, Percent Swell from Swell Consolidation tests, and Soil Description.
- F. California Bearing Ratio (CBR) or R-value test results and calculations for each soil type used in the design. Include natural moisture content and natural density.
- G. Pavement design nomographs supplied by Jefferson County properly drawn to show Soil Support, EDLA and Structural Number (SN).
- H. Design calculations for pavement thickness.
- I. Percentage water soluble sulfates, sampled at a minimum of every other boring.
- J. A discussion regarding potential subgrade soil problems including, but not limited to:
  - 1. heave or settlement prone soils
  - 2. frost susceptible soils
  - 3. ground water
  - 4. drainage considerations (surface and subsurface)
  - 5. cold weather construction (if appropriate)
  - 6. other factors or properties which could affect the design or performance of the pavement system
- K. Recommendations to alleviate or mitigate the impact of problems discussed in Item J above.

#### **4.3. Subgrade Investigation**

4.3.1 Field Investigation: The field investigation shall consist of boring soils to a depth of at least five feet below the bottom of the proposed asphalt pavement layer elevation for roads classified as Local or Collector. Borings shall extend 10 feet below the bottom of the proposed asphalt pavement layer elevation on Major Collector / Minor Arterial and Major Arterial roadways. In all cases borings shall be spaced no more than 250 feet apart, or a minimum of one boring for each section of street, unless otherwise required by Transportation and Engineering. The borings shall be checked for ground water at the time of drilling, and then 24-hours after the borings are completed. Samples shall be taken after overlot grading is completed and the subgrade is "rough cut" (1 to 2 feet of proposed elevation). Soil classifications shall be verified after installation of utilities.

Geological features within five feet of the existing ground surface, and all new roadways proposed in the Dipping Bedrock Area, require more detailed investigation including drilling and/or trenching. Every third bore hole shall be a minimum of 10 feet deep, regardless of the road classification.

California Drive samples shall be obtained from each boring within 12-18 inches of the final subgrade elevation.

4.3.2. Boring Profiles: Boring logs shall include the following:

- a. Date, Strata Elevations, Depth of Boring.
- b. Natural moisture content, Blow Count and Dry Density of each undisturbed sample.
- c. Water table elevation.

4.3.3. Classification Testing: Each soil sample shall be tested according to AASHTO and/or the American Society for Testing Materials (ASTM) criteria to determine: Liquid Limit, Plastic Limit, Plasticity Index, and Percentage passing the U.S. Standard No. 200 sieve. Samples of sands and gravels shall require gradation analysis for classification determination.

These data shall be determined using the following methods:

- a. Liquid Limit - AASHTO T 89 (ASTM D 4318)
- b. Plastic Limit - AASHTO T 90 (ASTM D 4318)
- c. Passing No. 200 - AASHTO T 11 (ASTM C 117)
- d. Gradation - AASHTO T 27 (ASTM D 422)

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

4.3.4. Soil Grouping: Soil samples collected in the field investigation can be combined to form soil groups. These groups shall be based upon the AASHTO Classification, Group Index and location within the area investigated. Groupings shall not consist of samples with different AASHTO Classifications (Note: There may be more than one group index within a given classification). Composite samples can be manufactured by combining representative, equal portions of each sample contained within the group and mixing to provide a uniform composite sample of the soil group. This shall be limited to group indices within the range of 7. Composite samples shall be subjected to Classification Testing as outlined in Section 4.3.3. Moisture-Density curves must be included for groups used in the design.

4.3.5. Subbase Support Testing: Individual subbase or composite samples shall be tested to determine the support value using either CBR (California Bearing Ratio) or Hveem Stabilometer (R-value) testing. These values shall be used in the design of pavement sections in accordance with the procedures outlined in Section 4.5. Tests shall be conducted in accordance with the following procedures:

4.3.5.1. CBR Tests: California Bearing Ratio tests shall be conducted in accordance with AASHTO T 193 with the following modifications:

- a. Note 4 of AASHTO T 193 shall not apply. A 3- point CBR evaluation is required.
- b. The compaction method used for the CBR test shall be determined by the soil classification.
- c. Surcharge shall be calculated using a unit weight of 140 pcf for bituminous pavement and 135 pcf for untreated aggregate base course.
- d. The design CBR value shall be determined from the CBR - Dry Density Curve and shall be the CBR value at 95 percent compaction.
- e. In addition to the values requested in AASHTO T 193, Stress-Penetration curves for each sample, a CBR - Dry Density curve and Proctor Compaction test results shall be reported.

4.3.5.2. R-Value Tests: Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

- a. Dry density and moisture content for each sample.
- b. Expansion pressure for each sample.
- c. Exudation Pressure - corrected R-value curve showing the 300 psi design R-value.

#### **4.4. Pavement Design Criteria**

This section sets forth the parametric input data to be used for the design of pavements of various roadway classifications. If cohesive soil mitigation is required, the soil treatment shall extend from back of sidewalk to back of sidewalk.

4.4.1. Equivalent (18 Kip) Daily Load Applications (EDLA): The pavement design procedure in this chapter is intended to provide for a 20-year service life of pavement, given that normal maintenance is provided to keep roadway surface in an acceptable condition. EDLA and Design Traffic Number (DTN) are considered equivalent units based on 20-year design criteria and an 18 kip axle loading. All data and design nomographs in this chapter use EDLA units for pavement loading repetitions. Calculations shall be included, where applicable.

EDLA criteria for each Jefferson County roadway classification are given in Table 4.1.

Table 4.1 Recommended Equivalent (18 Kip) - Daily Load Applications (EDLA)

Classification	Class Modifier	EDLA Values
Local	Serving <50 D.U.	8
	Serving >50 D.U.	10
Collector	Residential	30
	Other	100
Major Collector/Minor Arterial	All	200
Principal Arterial	All	200

NOTE: Alternative EDLA values may be considered with justification provided by the Transportation Study, proposed land uses, and traffic analysis that defines proportion of truck vehicles, including construction truck traffic.

4.4.2. Design Serviceability: The following criteria shall be used for all Jefferson County roadways to be dedicated for public use.

Table 4.2 Serviceability Index

Roadway Classification	SI
Arterials	2.5
Collectors	2.5
Local	2.0

4.4.3. Minimum Pavement Layers: This paragraph provides the minimum acceptable pavement layers for public roadways in Jefferson County. These pavement layer thicknesses may be used for preliminary planning purposes. Final pavement designs must be based on actual subbase support test results. Table 4.3 lists these minimum thicknesses for each roadway classification.

Table 4.3 Minimum Pavement Sections

Road Classification	EDLA	Composite Section (inches)			Full Depth Asphalt (inches)
		Asphalt	Subbase		
			Base Course	Stabilized	
<50 D.U.	8	4	6	12	5
=>50 D.U.	10	4	6	12	5
Residential	30	4	6	12	5
Other	100	5	6	12	6
Major Collec- tor	200	5	6	12	7
Minor Arterial	200	5	6	12	7
Major Arterial	200	5	6	12	8

Regardless of the pavement layer design, all soils with an R-value less than 10, or PI greater than 15, shall be stabilized to a minimum of 12 inches below the bottom of the asphalt pavement layer, and shall be included in the depth of treatment.

Cohesive soil subbases shall be overexcavated and replaced with moisture conditioned fill. Minimum requirements for overexcavation are listed below in Table 4.3a.

Table 4.3a Minimum Overexcavation Requirement for Cohesive Soils

Plasticity Index	Depth of Overburden/Fill Treatment	
	Locals/Collectors	Major Collectors/Arterials
15-20	1 foot	2 feet
21-30	2 feet	3 feet
31-40	3 feet	4 feet

- NOTES:
1. Road segments with isolated soil types may be designed separately for that individual segment.
  2. Soil with (PI) over 40 shall be removed and wasted to a depth of five feet for any type of street.
  3. In the Designated Dipping Bedrock Area, all bedrock shall be overexcavated to a depth of at least five (5) feet below the bottom of the proposed pavement layer. Where the bedrock is claystone, the top of the weathered claystone shall be considered as the top of bedrock. Should soil other than bedrock be found throughout the five (5) foot zone, it shall be overexcavated as shown in Table 4.3a.
  4. The overexcavation areas shall be recompact to 95% of maximum Standard Proctor Density (ASTM D-698) at U to +4% above optimum moisture content. There shall be a minimum of 12 inches of soil stabilization below the bottom of the asphalt layer that is included in the total depth of overexcavation.
  5. Overexcavation of overburden/fill below the stabilization section may be waived by Transportation and Engineering in areas where either previous overexcavation work during overlot grading has been validated or in cases where a thorough geotechnical investigation determines overexcavation is not warranted. Previous overexcavation work must be validated by compaction reports provided by the developer's geotechnical firm and in accordance with the Land Development Regulation (LDR).

4.4.4. Flexible Pavement Strength Coefficients: Table 4.4. contains standard design coefficients for various pavement materials. Non-standard design coefficients may be used only if approved in advance by Transportation and Engineering. In addition, design values must be verified by predesign mix test data and supported by daily construction tests; or, redesign values will be required.

Table 4.4 Strength Coefficients

Pavement Structure Component*	Strength Coefficients	(Limiting Test Criteria)
Conventional Materials		
Hot Mix Asphalt	0.40	1800 Lbs. Marshall Or R 90+)
Exist. Asphalt Pavement	0.30	(9-15 Yr)
	0.24	(>15 Yr)
Aggregate Base Course	0.12	(Cbr 80+ Or R 78+)
Exist. Aggregate Base Course	0.10	(Cbr 50+ Or R 69+)
Granular Subbase Course	0.07	(Cbr 15 Or R 50+)
Treated Materials		
Cement Treated Aggregate Base	0.23	(7 day, 650-1000 psi)
Lime Stabilized Subbase	0.14	(PI.<6, net swell <.5%, PH >12.3) Compressive Strength >/200 psi, per ASTM 5102-04, Procedure B
All Stabilized Subbase	0.14	Compressive Strength >/200 psi, per ASTM 5102-04, Procedure B

\* The combination of one or more of the following courses placed on a subgrade to support the traffic load and distribute it to the roadbed.

Structural Layers of a conventional flexible pavement design are defined below.

- a) Surface Course: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists
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skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course.”.

- b) Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course. The use of base course is not accepted in areas that base course does not adequately drain from roadway system.
- c) Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course, surface course or both.
- d) Subgrade: Prepared and compacted soil extending to such a depth as to affect the structural design.

#### 4.5. Pavement Design Procedure

4.5.1. Flexible Pavements: The following procedure should be used in determining the Structural Number (SN) of the pavement being designed:

4.5.1.1. Using the appropriate roadway classification, determine the corresponding EDLA (Table 4.1).

4.5.1.2. Determine the Serviceability Index (SI) of the roadway classification (Table 4.2).

4.5.1.3. Select the proper nomograph:

Example: Figure 4.1 Flexible Pavements with SI = 2.0

Example: Figure 4.2 Flexible Pavements with SI = 2.5

NOTE: Original nomographs required are available from Transportation and Engineering.

4.5.1.4. Using subgrade CBR or R-Value test results and EDLA, determine the SN from the appropriate design nomograph.

4.5.1.5. Once the Structural Number (SN) has been determined, the design thicknesses of the pavement structure can be determined by the general equation:

$$SN = a_1D_1 + a_2D_2 + a_3D_3 + \dots$$

where

$a_1$  = Hot Mix Asphalt (HMA) strength coefficients

$a_2, a_3, a_n$  = strength coefficients of additional pavement components

$D_1$  = thickness of Hot Mix Asphalt (HMA) (inches)

$D_2, D_3, D_n$  = thickness of additional pavement component sections

The strength coefficients for various components of the pavement structure are given in Table 4.4.

The component thickness selected must meet two conditions:

- a. Total HMA thickness selected cannot be less than the minimum specified in Table 4.3. for the roadway classification.
- b. The base course thickness selected cannot exceed 2.5 times the HMA thickness selected, with a maximum thickness of eight (8) inches.

4.5.1.6. The design must reference any mitigative measures required when the subbase and / or subgrade contains cohesive or expansive soils. Design reports recommending permeable layers such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the fine-grained soils. If cohesive or expansive soil mitigation is required, the soil stabilization shall extend from back of sidewalk to back of sidewalk. It is required that soils with R-values less than 10 or Plasticity Index greater than 15 be stabilized. Stabilization is for a minimum of the upper twelve (12) inches below the bottom asphalt pavement layer, and shall be included in the depth of treatment.

4.5.2 Rigid Pavements: This procedure has been deleted.

4.6. Material Specifications

The Specifications presented in this section are performance oriented. The County’s objective in setting forth these Specifications is to achieve an acceptable quality of roadway structures. All sources for the mined or manufactured materials must be annually approved by Transportation and Engineering as having met the appropriate materials performance specifications. This approval is a condition of using those material sources for public improvement construction. For the purpose of these Standards, public improvements are all roadway improvements, sidewalks, curbs and gutters, appurtenant drainage basins or structures, storm sewer and their access ways, other public works within Jefferson County Right-of-Way, and required stormwater detention structures built on private property and maintained by the property owner(s).

4.6.1. Violations of Approval Conditions

4.6.1.1. Random Testing. Transportation and Engineering may order random tests of materials used in County public improvements to verify compliance with material specifications. These tests are in addition to the requirements of the roadway inspection and testing procedures.

4.6.1.2. Any and all material used to construct public improvements that is not from a certified source, or that is from a certified source and fails one or more random material test, may be subject to complete removal as a condition of County acceptance of that public improvement. Additional tests will be required to confirm the existence and extent of the sub-standard material prior to the initiation of remedial action. The extent of the material to be removed will be at the discretion of Transportation and Engineering.

4.6.2. Use of Materials Not Listed in Section 4.6. Materials in this section and provided with a set of specifications are those deemed to be the primary structural materials commonly or typically used in public improvements. Ancillary public improvement materials such as manufactured paints and coatings, bonding agents, sealers, fabrics or gaskets, insulating materials, etc., should be in compliance with CDOT material specifications for the appropriate material employed. Alternative materials for construction may be proposed for use. Decisions on acceptability of alternative materials will be made by Transportation and Engineering.

4.6.3. Material Specifications

4.6.3.1. Hot Mix Asphalt: This shall comply with material specifications for PG Binders and asphalt mixes in accordance with CDOT’s most recent edition of Standard Specifications for Road and Bridge Construction, 702 and 703. This is hereby referred to as "CDOT Standard Specifications".

4.6.3.2. Aggregate Base Course Material. This material shall consist of hard, durable particles or fragments of stone or gravel, crushed to required sizes, containing an appropriate quantity of sand or other finely-divided mineral matter which conforms to the requirements of AASHTO M 147, and to Section 703.03, CDOT Standard Specifications.

Specifications. In addition, the material must have an R-value of 78 or greater, or a CBR of 80+, and must be moisture stabilized. Moisture stability is determined by R-value testing which shows a drop of 12 points or less in R-value between exudation pressures of 300 psi and 100 psi.

Only aggregate from sources approved by the Transportation and Engineering shall be used.

Table 4.5 Aggregate Base Course Materials

Sieve Size	Mass Percent Passing Square Mesh Sieves	
	Class 5	Class 6
2"	100	
1"	95 - 100	100
3/4"	—	95



#4	30 - 70	30 - 65**
#8	—	25 - 55
#200*	03 - 15	03 - 12**
Liquid Limit (LL)	30 Max.	30 Max.

\*ASTM (C117)

\*\*For gravel shoulders, No. 200 shall be 9-12 and No. 4 shall be 30-50.

Base course may be used only where the base can daylight in barrow ditches or where the subgrade consists of material classifying as GM, GW, GP, SM, SW, or SP using the Unified Soil Classification System.

4.6.3.3. Cement Treated Aggregate Base Course. This material shall consist of a mixture of aggregate materials, Portland cement and water as outlined in Section 304 of the CDOT Standard Specifications. Acceptable aggregates include CDOT Classes 5 and 6. Other aggregates may be used, if previously approved by Transportation and Engineering.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering. As a minimum, the mix design report shall contain a description of material sources, gradations and Atterberg limits of aggregates, cement type, Proctor compaction curves and unconfined compressive strength results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO specifications. Minimum in-place thickness for cement treated aggregate base course shall be twelve (12) inches.

To be approved, the mix shall have a seven-day compressive strength of at least 650 psi and no more than 1,000 psi. The minimum acceptable cement content shall be five percent by weight. Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis, or an annual basis for suppliers, prior to issuing construction permits.

4.6.3.4. Lime Treated Subgrade: This Material consists of a mixture of native or imported soils, hydrated or quick lime and water as outlined by ASTM Specification C977, CDOT Standard Specification 307.

The materials to be used in construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five day, 100°F cure unconfined compressive test results for each mix, strength versus lime content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

1. Minimum pH of 12.3 after completion of initial mixing.
2. Plasticity Index less than 6, per ASTM D4318.
3. Minimum hydrated lime of 5.0% dry weight, per ASTM D3.
4. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
5. Sulfate concentrations not to exceed .5%

Note: Field validation shall be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.5. Lime/Fly-Ash Stabilized: This material consists of a mixture of native or imported soils, hydrated or quick lime, Class "C" Fly-Ash, and water as outlined by ASTM Specification C977, CDOT Section 307.

The materials to be used in construction shall be tested and a mix design submitted to the Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus lime/fly-ash content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

- 1. Plasticity Index less than 6, per ASTM D4318.
- 2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
- 3. Sulfate concentrations not to exceed .5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

4.6.3.6. Cement Stabilized Subgrade. This material consists of a mixture of native or imported soils, Portland cement and water.

The materials to be used on construction shall be tested and a mix design submitted to Transportation and Engineering for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits, pH and five-day unconfined compressive test results for each mix, strength versus cement content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

To be approved, the mix shall meet the following requirements:

- 1. Minimum Portland cement of 3.0% dry weight per ASTM D3.
- 2. Minimum unconfined compressive strength shall be 200 psi, per ASTM D1633.
- 3. Sulfate concentrations not to exceed 0.5%.

NOTE: Field validation may be required after soil blending occurs during construction.

Only mix designs approved by Transportation and Engineering shall be used. Approvals are required on a project basis prior to issuing construction permits. Minimum in-place thickness for this material shall be twelve (12) inches.

*Chapter 5*

**Construction Specifications and Standards**

**5.1 Construction Specifications**

The Permittee agrees to adhere to all construction specifications set forth in the latest edition of the Jefferson County Land Development Regulation, the Jefferson County Transportation Design and Construction Manual and the Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction manuals.

5.1.1. Permits: All work performed within County Rights-of-Way and/or easements shall require the issuance of a street/road construction permit. Permits shall be obtained at the Jefferson County Transportation and Engineering office, located at 100 Jefferson County Parkway, Suite 3500, Golden, Colorado.

5.1.1.1. Any permit issued shall pertain only to construction within the County-owned Right-of-Way and is in no way considered a permit to enter on any private property adjacent to such Right-of-Way nor to alter or disturb any facilities or installations existing within the Right-of-Way which may have been installed, and are owned, by others.

5.1.1.2. Permits, when issued, shall be valid for a period of ninety (90) calendar days, and may be renewed for one (1) additional ninety (90) calendar day period, providing the renewal is obtained (renewal may be obtained by telephone) prior to the permit expiration date.

Failure to obtain a renewal as stated herein will require obtaining a new permit and payment of applicable fees.

5.1.1.3. Any permit determined to be without an adequate bond as required in Section 5.1.2. below, shall be subject to immediate revocation by Transportation and Engineering.

5.1.2. Bonds: A non-cancellable permit bond shall be required for Right-of-Way Use and Construction Permits and License Agreements Section of the County Policies and Procedures for Streets and Roads.

5.1.3. General Specifications:

5.1.3.1. Any work done to a street/road or other County property under a permit shall result in the street/road or other property being returned to a condition equal to or better than original, within the limits of careful, diligent workmanship, good planning, and quality materials, with said work being accomplished in the least possible time and with the least disturbance to the normal functioning of the street/road or other property.

5.1.3.2. All backfill material, compaction, and resurfacing of any excavation made in the County property shall be done in accordance with specifications and standards approved by and on file with Transportation and Engineering.

5.1.4. Road Closures: Normally, only one side of a public street/road may be blocked at any given time. Should operating conditions require complete closure, advance approval of the closing of a public street/road must be obtained from Transportation and Engineering or advance approval of the closing of a private road must be obtained from Planning and Zoning. The permittee shall notify the appropriate fire protection district, the Jefferson County Sheriff's Department, and the Colorado State Patrol concerning exact location of barricades and dates traffic will be impeded. Barricades shall be maintained by the responsible contractor.

5.1.5. Utility Installations:

5.1.5.1. Underground: All utility lines, including Cable TV, shall be installed a minimum of two (2) feet below ground surface, or proposed roadway elevation, whichever is lower. This requirement is applicable throughout the Right-of-Way, including ditch lines and/or borrow pits. Exceptions may be granted by Transportation and Engineering where warranted and upon prior written request and approval.

5.1.5.2. Overhead: A minimum ground clearance of 18 feet 0 inches shall be provided where overhead utility lines cross public roads and streets. The clearance shall be measured at the lowest point where the line crosses the traveled portion of the road and/or street.

5.1.6. Base Course: All aggregate base course shall meet CDOT Class 6 Specifications, or an acceptable base course predicated on specific site conditions as approved by Transportation and Engineering. Native material is unacceptable as base course.

5.1.7. All concrete shall be in conformance with the appropriate class as specified in Section 601 of the CDOT Standard Specifications. A combination cure-sealer shall be used for concrete flatwork. Provide adequate texture by means of a moderately heavy broom finish to surfaces prior to applying the cure-sealer. The product shall be Dayton Superior Cure & Seal LV 25% J20 UV or approved equal. Apply two coats per manufacturer's instructions to all exposed surfaces, with the second coat applied at right angles to the first for complete coverage. The temperature range of application is 35 to 90 degrees F. Concrete shall not be left exposed for more than one hour between the time finishing is completed and commencement of curing treatment.

5.1.7.1. Concrete may be placed by machine methods provided that all finish lines are within 1/8" ± tolerance of the lines shown on the plans. The flowline must be free draining.

5.1.7.2. One-half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.

5.1.7.3. Median Cover Material and Median Edging Patterned Concrete: Median cover material and median edging patterned concrete shall be colored concrete that is Davis color #5084 "Harvest Gold" or approved equal. The release agent shall be Concrete Coatings Stamp-TEK™ liquid release or approved equal. The stamp pattern shall be Matcrete "UK Cobblestone" or equivalent. A combination cure-sealer containing silane shall be used for concrete flatwork. The cure-seal product shall be SpecChem Cure Shield EX or approved equal. Control joints are saw cut every 10 feet. Expansion joint material with a zip-strip shall be installed between the patterned concrete and the back of curb. Control joints and expansion joints shall be sealed with Sikaflex-2C or approved equal. Refer to STND-18 and STND-19 for details. Granular pre-emergent herbicide shall be placed in the areas that are to receive median cover.

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5.1.7.4. Detectable Warnings on Concrete Curb Ramps: Detectable Warnings on concrete curb ramps shall be truncated domes of the dimensions shown on the plans. Domes shall be BRICK RED in color. Domes shall be prefabricated by the manufacturer as a pattern on embeddable surface plates. Dome plates shall be set into wet concrete and shall not be glue or spray-on varieties. Detectable warning plates shall not be concrete pavers, masonry pavers, or cast-iron plates. Refer to STND-16 for details.

5.1.7.5. Waterproofing Membranes: Waterproofing membrane shall be placed on concrete bridge deck surfaces, and concrete box culverts per the waterproofing membrane detail. Surfaces to receive waterproofing membrane shall be thoroughly cleaned via sand-blasting or high pressure water. The waterproofing membrane shall be a hot pour asphaltic material, with 55 pound (#55) minimum asphaltic based roll material immediately placed on top. Refer to STND-17 for details.

**5.1.8.1 Storm Sewer Pipe:** Within County Right-of-Way and/or easements, all storm sewer pipe shall be minimum Class II Reinforced Concrete Pipe (RCP) in accordance with ASTM C-76, C-506 or C-507. Actual depth of cover, live load, and field conditions may require structurally stronger pipe.

5.1.8.2 All new or repaired storm sewer pipe and associated structures within County Right-of-Way and/or easements shall be constructed with trace wire and test locations. Installation shall be tested for operation and documented with Form Letter "T" in accordance with Jefferson County Land Development Regulation Section 33.

5.1.9. Culverts: **Within County Right-of-Way and/or easements**, all culverts shall conform to the Storm Drainage Design and Technical Criteria.

#### 5.1.10. Traffic Control Devices

All traffic control devices shall conform to the MUTCD and be approved by Transportation and Engineering prior to installation. Conformance to the following minimum materials specifications or approved equal is required. Traffic signals shall conform to CDOT standards.

5.1.10.1. Signs, Sign Posts, and Anchors: Sign faces, posts and ~~bases-anchors~~ shall conform be in conformance with the following materials specifications. ~~All Nonstandard signs-faces, posts, and anchors-bases must be approved by Transportation and Engineering. Nonstandard signs~~ will not be maintained by the County. Post anchors for sign intallation after complete construction require approval by Transportation and Engineering.

5.1.10.1.1. Street Name Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy 0.100-080 inches thick. Polyethylene plates (Polyplate) is not allowed. (no polyplate allowed). Facing shall be green, electrocut HighHi-Intensity reflective sheeting with white HiHigh-Intensity Prismatic grade retroreflective sheeting letters and numerals. Refer to STND-12 for details.

5.1.10.1.2. Regulatory and Warning Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy 10-0.100 inches thick. High-Intensity prismatic grade retroreflective sheeting shall be used for the background color, and letters and numerals for on-all regulatory (i.e. stop, speed limit)-and warning signs. Refer to STND-12 for details.

5.1.10.1.3. Sign Posts: All sign posts shall be two (2) inch by two (2) inch galvanized telespar tube with 120 inch wall thickness, and three eighths (3/8) inch holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length. U posts are not allowed. All sign posts shall be two (2) inch by two (2) inch galvanized TELESPEAR® telespar tube with 12 Gauge (0.105-120 inch wall thickness), and three eighths (3/8) 7/16 inch pre-punched holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length. U-posts are not allowed.

5.1.10.1.4. Sign Post Bases: All sign post bases shall be twist resistant mounting for telespar type post consisting of a steel angle (1/4" x 2 1/2" x 2 1/2" x 24") with a formed and welded steel plate (1/8" x 10" x 15"), used with a compression fit V lock wedge of 1/8 inch galvanized steel. The wedge must have a one half (1/2) inch hole drilled in one side for removal. All sign post anchors shall be anchored securely in the soil or concrete to create a breakaway system. All sign post anchors shall be 2.25 inch x 2.25 inch perforated

square tubing, galvanized steel, TELES PAR ® (or equivalent), a minimum of 3 feet in length. Each tube section shall be 12 Gauge (0.105 inch wall thickness) with 7/16 inch diameter pre-punched holes on 1-inch centers, all sides over full length. The anchor tubing shall be twist resistant and allow mounting of a one-size smaller TELES PAR ® sign post. The anchor shall be driven into the soil no less than 30 inches. The sign post shall be inserted 8 inches inside the anchor tubing and double bolted in place prior to covering. Each bolt shall be a Hex Head with a Washer and matching Hex Nut. Bolts shall be secured at the exposed top of the anchor base and placed at opposite tube sides, 90 degrees apart. Signs to be placed in concrete medians or islands shall have the anchor driven inside of a 6-inch Schedule 40 PVC sleeve, with the sleeve measuring the thickness of the concrete plus 1-inch, and secured to the post in the same fashion as described in 5.1.10.1.3. The PVC sleeve shall be embedded in the surrounding concrete when the concrete is placed. Sign post anchors driven in soil not within concrete medians or islands shall be anchored in the same fashion without the PVC sleeve. Refer to STND-13 for details.

5.1.10.2. Pavement Marking: ~~Specified~~ Pavement marking materials shall be used as specified for the service life, type, and at locations as identified below.

5.1.10.2.1. Temporary Application, Construction, or Detours: Waterborne paint (High Build) shall be used for short duration striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. The same waterborne paint may be used for crosswalks and stop (bar) lines as deemed necessary. Stencil markings, such as symbols or arrows, shall not be placed for temporary use unless approved by the engineer. ~~3M Stamark 5730 preformed plastic marking material or an approved equivalent shall be used for crosswalks, stop bars, symbols (i.e. turn arrows) and striping for separation of turn and through lanes.~~

5.1.10.2.2. Permanent Application: Epoxy paint shall be used for striping of lane lines, channelizing lines, edge (fog) lines, and centerlines. Preformed Thermoplastic Pavement Markings shall be used for crosswalk and stop (bar) line markings, railroad (RR) crossings, words, symbols, and arrows. The thickness of all Preformed Thermoplastic Pavement Markings shall be 125 mils. Preformed Plastic Marking Tape (Type I), may be used in lieu of Preformed Thermoplastic Pavement Markings, if approved by Transportation and Engineering prior to installation. Preformed Plastic Marking Tape shall be 3M™ Stamark™ 5730 (White), 3M™ Stamark™ A270ES (White), ~~or approved equivalent. Preformed plastic marking material or reflectorized paint shall be used for all other pavement marking. Use of thermoplastic pavement marking is not permitted.~~

5.1.10.3. Curb Ramps: All required curb ramps shall conform to current CDOT M&S Standard Plans and be approved by Transportation and Engineering.

5.1.10.4. Bike Racks: All required bike racks shall conform to Association of Pedestrian and Bicycle Professionals “Essentials of Bike Parking: Selecting and Installing Bike Parking that Works”.

5.2 Construction Standards

All construction within County Right-of-Way and/or easements shall be in conformance with current CDOT M & S Standards and the following County construction standards.

Standard Number	Description
1	Curb and Gutter
2	Combination Curb, Gutter and Sidewalk
3	6" Vertical Curb, Gutter and Attached Sidewalk
4	6" Vertical Curb, Gutter and Detached Sidewalk
5	Typical Intersection Crossspan

6	Driveway Section for 6" Vertical Curb and Gutter
7	Optional Driveway Section for Combination Curb, Gutter and Sidewalk
8	Driveway Approaches for Roads
9	Typical Median Designs
10	Concrete Joint Details
11	Asphalt Street/Road Patchback
12	Road and Street Name Signs
13	Sign Posts and Bases
14	Typical Arterial Street Lighting
15	Street Name Sign and Bracket on Traffic Signal Pole
<a href="#">16</a>	<a href="#">Detectable Warnings on Concrete Curb Ramps</a>
<a href="#">17</a>	<a href="#">Waterproofing Membranes</a>
<a href="#">18</a>	<a href="#">Median Cover Material Patterned Concrete</a>
<a href="#">19</a>	<a href="#">Median Edging Patterned Concrete</a>
<a href="#">20</a> <a href="#">16</a>	Zone 1 Foothills / Mountain Area Preliminary Pavement Design
<a href="#">21</a> <a href="#">17</a>	Zone 2 Dipping Bedrock Area Preliminary Pavement Design
<a href="#">22</a> <a href="#">18</a>	Zone 3 Front Range Area Preliminary Pavement Design
<a href="#">23</a> <a href="#">19</a>	Design Zone Preliminary Pavement Sections

## Definitions

**AASHTO**  
American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, current edition.

**ADT**  
Average Daily Traffic

**Axle Load**  
The total load transmitted by all wheels on a single axle extending across the full width of the vehicle. Tandem axles 40 inches or less apart shall be considered as a single axle.

**California Bearing Ratio**  
A measure of the ability of a soil or aggregate to resist the transmission of a vertical load in a lateral direction.

**CDOT**  
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## Colorado Department of Transportation

### Emulsified Asphalt Treated Base

A base consisting of a mixture of mineral aggregate and emulsified asphalt spread on a prepared surface to support a surface course.

### Equivalent Single Axle Loads (ESAL)

A numerical factor that expresses the relationship of a given axle load to another axle load in terms of their effect on a serviceability of a pavement structure. All axle loads are equated in terms of the equivalent number of repetitions of an 18,000 pound single axle.

### 18k EDLA

18,000 pound single axle Equivalent Daily Load Applications (explained in “Axle Load” and “ESAL” above).

### Flexible Pavement

A pavement structure which maintains contact with and distributes loads to the subgrade and depends upon aggregate interlock, particle friction, and cohesion for stability.

### Flowline

The transition point between the gutter and the face of the curb. For a cross or valley pan, it is the center of the pan. Where no curb exists, the flowline will be considered the edge of the outside traveled lane.

### Grade

Rate or percent of change in slope, either ascending or descending from or along the highway. It is measured along the centerline of the highway or access.

### Lime Treated Subgrade

Subgrade consisting of a mixture of soil, hydrated lime and water, usually mixed in place and placed to support a pavement structure.

### MUTCD

The Manual on Uniform Traffic Control Devices and the Colorado Supplement, current editions.

### Mountains

See “Mountains” definition in the Zoning Resolution.

### Passing Sight Distance

The visibility distance required to allow drivers to execute safe passing maneuvers in the opposing traffic lane of a two-lane, two-way highway.

### Pavement Structure

The combination of subbase, base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

- a. Subbase: The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course.
- b. Base Course: The layer or layers of specified or selected material of designed thickness placed on a subbase or subgrade to support a surface course.
- c. Surface Course: The uppermost component of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course”.

### Plains

See “Plains” definition in the Zoning Resolution.

### Plant Mixed Bituminous Base

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A base consisting of mineral aggregate and bituminous material, mixed in a central plant, laid and compacted while hot, on a subbase or a subgrade, to support a surface course.

#### Plant Mixed Bituminous Pavement

A combination of mineral aggregate and bituminous material mixed in a central plant, laid and compacted while hot.

#### Regional Factor

A numerical factor expressed as a summation of the values assigned for precipitation, elevation, and drainage. This factor is used to adjust the structural number.

#### Roads

Public or private Rights-of-Way within the Mountain Area or as otherwise designated within this MANUAL.

#### Serviceability Index

A number indicative of the ability of the pavement to serve traffic at any particular time in its design life.

#### Signal Progression

Progressive movement of traffic at a planned rate of speed through adjacent signalized locations within a traffic control system without stopping.

#### Soil Support Value

A number which expresses the relative ability of a soil or aggregate mixture to support traffic loads through the pavement structure.

#### Speed Change Lane

A separate lane for the purpose of enabling a vehicle entering or leaving a roadway to increase (acceleration lane) or decrease (deceleration lane) its speed to a rate at which it can more safely merge or diverge with through traffic.

#### Stabilometer "R" Value

A numerical value expressing the ability of a soil or aggregate to resist the transmission of vertical load in a lateral or horizontal direction.

#### Stopping Sight Distance

The minimum sight distance necessary to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

#### Storage Lane

Additional lane footage added to a deceleration lane to store the maximum number of vehicles likely to accumulate during critical periods without interfering with the through lanes.

#### Streets

Public or private Rights-of-Way within the Plains Area or as otherwise designated within this MANUAL.

#### Strength Coefficient

A factor used for expressing the relative strength of each layer in a pavement structure.

#### Structural Number

A number derived from an analysis of roadbed and traffic conditions. A Weighted Structural Number is a Structural Number which has been adjusted for environmental conditions. A Weighted Structural Number may be converted to pavement structure thickness through the use of suitable factors related to the type of material being used in the pavement structure.

#### Traffic Analysis Period

A common analysis period (usually 20 years) used in geometric design.



Untreated Base Course  
A layer or layers of base course without treatment of any kind.

# Transportation Studies

## Table of Contents

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  - ~~— Improvement Analysis~~
  - ~~— Findings & Recommendations~~
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  - ~~— Bibliography~~

## 1. Requirements for Transportation Studies (TS)

~~General: In considering the transportation aspects of land development, it is important to determine early in the process if and when a Transportation Study (TS) will be required. The trip generation from a proposed development is the main quantitative threshold; however, existing transportation issues such as a high crash location, complex intersection geometries or other specific problems or deficiencies may also necessitate a TS. A TS shall be required in accordance with the Submittal Requirements Section of the Land Development Regulation.~~

The TS categories are as follows:

**Trip Generation Memorandum:** A Trip Generation Memorandum (TGM) is required when the land uses proposed with a development are expected to generate between 150 and 800 vehicle-trips per day. The TGM should show a computation of trips generated from the proposed use(s). The TGM for a proposed rezoning should also include a computational comparison of the maximum possible number of trips generated from the proposed uses and the maximum possible trips generated from existing and allowed uses. Include a table summarizing trip generation estimates.

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**Transportation Analysis:** A Transportation Analysis (TA) ~~may be~~ required ~~by Planning and Zoning~~ during a Rezoning to determine the amount and/or distribution of traffic generated from a proposed development ~~that is expected to generate 800 average daily vehicle-trips or more. The TA should show a computational comparison of the maximum possible trips generated from the proposed use(s) compared to the number of maximum possible trips generated from existing zoning. It should also include a percentage change in the average daily traffic (ADT) and peak hour traffic of adjacent roadways. A transportation analysis is a computation of the traffic that is generated from a proposed development that is expected to generate less than 1000 average daily trips. The analysis should conceptually address any potential onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development, including improvements that may already be required by County regulations. Required improvements may include the addition of turning lanes and bicycle/pedestrian facilities, including any other improvements which may be suggested by the analysis.~~

**Minor Transportation Study:** A Minor Transportation Study is required when a proposed development is expected to generate 1000 average daily trips per day or more, and the traffic impacts are localized as determined by Planning and Zoning. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

**Major Transportation Study:** A Major Transportation Study is required when a proposed development is expected to generate 1000 average daily trips or more, and the traffic impacts are regional as determined by Planning and Zoning. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the widening or realigning of existing streets; the addition of new intersections or interchanges; the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

**Transportation Impact Study:** A Transportation Impact Study (TIS) is required during a Site Development Plan (SDP) or Plat process when a proposed development is expected to generate 800 average daily vehicle-trips or more. While the trip generation from a proposed development is the main quantitative threshold, existing transportation issues such as a high crash location, complex intersection geometrics or other specific problems or deficiencies may also necessitate a TIS. The scope of the TIS should be agreed upon by the County and the applicant during the Preliminary Application process. The study should address any onsite and offsite improvements that may be necessary to mitigate traffic impacts from the proposed development. Required improvements may include the addition of traffic signals, turning lanes, and bicycle/pedestrian facilities, including any other improvements which may be suggested by the study.

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**Letter of Conformance with an Approved TIS:** If a development in the Site Development Plan process is expected to generate more than 800 new vehicle trips, and there is an approved TIS on file from the last 3 years for the overall or regional development, a letter of conformance describing that the uses proposed in the development match those assumed in the overall TIS and a copy of that TIS are required.

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## **2. Trip Generation Memoranda**

### **A. Responsibility**

**General:** The applicant is responsible for providing trip generation computation when proposing a development generating between 150 and 800 vehicle trips.

**Review Process:** The TGM for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the TGM with each re-submittal.

**Certification:** The TGM shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

### **B. Format**

Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

The TGM data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review.

Introduction and Summary

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The purpose of the TGM should be clearly stated. This section should concisely summarize findings and conclusions.

Proposed Development

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Provide a description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, and access roadways.

Existing Conditions

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Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected.

Trip Generation Comparison Table

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Provide a trip generation comparison table showing the traffic generated from existing land use(s) compared to the maximum potential trip generation for land uses associated with the proposed development. The latest edition of ITE’s Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE’s Trip Generation Handbook, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar uses are available, an analysis of the proposed use based on the site’s capacity may be considered.

Findings

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Provide a summary of findings, including the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed.

C. Example Outline

Trip Generation Memo

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[Development Title]

Case Number: XX-XXXXXX XX

Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

Report Author

[Name]

[Address]

[Phone Number]

[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

Purpose of Analysis

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Introduction

The purpose of this Trip Generation Memo is to evaluate the potential impacts of the proposed development to the surrounding transportation network.

Project Overview

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[[Description of the project site including size, location, current land use, intensity, existing zoning, proposed zoning, access roadways, and proposed development phasing. Site plan should not be included in this analysis.]]

Existing Roadway System

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[Include a description of the study area roadways and intersections including current traffic counts.]

Projected Transportation Impact

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Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable]

Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											
Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
Comparison Table											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

Findings

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[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the transportation network]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

Appendix

[Insert any data used in analysis:]

Trip Generation Calculations

Traffic Counts

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## 2. Responsibility for Transportation Studies

*General:* The impacts from a proposed development as assessed in the TS are the primary responsibility of the applicant and their engineer.

*Review Process:* The TS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study, if applicable.

*Certification:* The TS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TS shall be signed and sealed by a registered professional engineer in the State of Colorado.

## 3. Transportation ~~Study Format~~Analyses

### A. Responsibility

General: The applicant is responsible to demonstrate how transportation systems can accommodate the traffic generated by a proposed development or how the system can be improved to accommodate the traffic generated by the development.

Review Process: The TA for a proposed rezone will undergo an iterative review process in accordance with the Zoning Resolution. The applicant shall provide a letter identifying changes to the TA with each re-submittal.

Certification: The TA shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering or planning.

### B. Format

Throughout the TA, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review.

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### Introduction and Summary

The purpose of the ~~TS~~TA should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, ~~conclusions~~conclusions, and recommendations of the ~~TS~~TA.

### Proposed Development

Provide a description of the land, parcel size, ~~general terrain features~~ and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site specific development should be described. This includes a discussion of location, proposed zoning, land use and intensity. A site plan is not necessary within a TA, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

## Existing Area Conditions

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County. Roadways that provide access to the site ~~as well as future roadways included in the study area~~ are included in this section. ~~Existing intersections within the study area as well as geometries and traffic signals should be identified. The existing and proposed uses of the site should be identified in terms of various zoning categories of the County. The land use generating the most trips should be used for the analysis.~~ Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts ~~may should~~ include ~~those for street-average daily traffic and for intersection peak hour turning movements~~within the study area.

## Projected Traffic

~~The main component of the TA~~One of the most critical elements of the TS is estimating the amount of traffic being generated from a proposed development. A trip generation comparison table showing computational comparison of the maximum possible trips generated from the proposed uses and the maximum possible trips generated from existing and allowed uses shall be provided. The latest addition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar uses are available, an analysis of the proposed use based on the site's capacity may be considered. Include a table summarizing trip generation estimates. Calculate the percentage increase in average daily traffic with the proposed development over the existing traffic.

~~Computer Software:~~ A number of computer software packages are available that are designed to either produce trip generation data or accept trip generation data for further analysis.

~~Trip Distribution:~~ The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

~~Trip Assignment:~~ The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3-year projected and 20-year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

~~Internal Trips:~~ Trips captured internally by a proposed development may be applicable depending on the use. The internal capture rates used should be based on the current version of the ITE's *Trip Generation Handbook*.

~~Pass-by trips:~~ Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass-by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway. Findings and Recommendations

Summarize the proposed development, its impacts, and the possible mitigation strategies.

## C. Example Outline

## Rezoning Transportation Analysis

[Development Title]

Case Number: XX-XXXXXX RZ

Applicant Information

[Name]  
[Address]  
[Phone Number]  
[Email]

Report Author

[Name]  
[Address]  
[Phone Number]  
[Email]

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

[Cert Number/Seal and Signature of Certified Transportation Professional (PE, AICP-CTP, ITE-PTP) (If applicable)]

Purpose of Analysis

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Introduction

The purpose of this Transportation Analysis is to evaluate the potential impacts of the proposed zoning to the surrounding transportation network. If the proposed zoning is approved, the Applicant will be required to submit a Transportation Impact Study to determine specific mitigation measures and must satisfy County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates at the time of Site Development Plan (SDP) and/or Preliminary and Final Plat (PF).

Project Overview

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[Description of the project site including size, location, current land use, intensity, existing zoning, and proposed zoning. Site plan should not be included in this analysis.]

Study Area

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[Description of the study area and impacted roadways and intersections. The study area limits should be described and mutually agreed to between the applicant and the county. The study area should not include roadways proposed interior to the development.]

Existing Roadway System

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[Include a description of the study area roadways and intersections including existing traffic counts, lane geometry, posted speed limits, current traffic control at intersections, presence of pedestrian and bicycle infrastructure, availability of on-street parking, and whether a roadway is private or public.]

Projected Transportation Impact

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Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development; trip reduction and internal trip capture rates and pass-by trips not applicable during rezoning]

**Trip Generation Summary Table**

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Trip Generation Summary Table											
Land Use Type /Zoning (Type)	Land Use Type	ITE Code	Unit	Size	Vehicles per day	AM Peak			PM Peak		
						In	Out	Total	In	Out	Total
Existing Land Use											
Total											
Existing Maximum* Zoning											
Total											
Proposed Maximum* Zoning											
Total											
Comparison Table											
Zoning Additional Trips (Proposed Zoning Total minus Existing Zoning Total)											

\*Maximum potential trip generation based on the existing and proposed zoning

**Analysis**

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[Summarize existing land use/proposed intended land use and existing/proposed zoning trip generation and potential impacts to the transportation network. Provide the percentage increase in average daily traffic (ADT) on adjacent roadways from existing conditions to proposed. Level of Service (LOS) calculations are not required with a TA.]

Existing Land Use/Proposed Intended Land Use

Existing Zoning/Proposed Zoning

**Recommendations**

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[Summarize the anticipated public improvements and strategies and/or recommendations to mitigate potential negative impacts to the transportation network in the study area]

**Table 2: Anticipated Public Improvements**

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Summary of the anticipated public improvements per County Land Development Regulations (LDR) and Transportation Design and Construction Manual Roadway Templates (shoulders, sidewalks, curb and gutter, bicycle infrastructure, etc.) if the zoning is approved and the applicant proceeds to subsequent development processes.

Location	Improvements

**Table 3: Potential Mitigation Strategies**

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Summary of potential strategies and/or recommendations that show an ability to mitigate traffic impacts from the proposed rezoning to the study area.

[List strategies that can address potential impacts of increased trip generation from the proposed zoning. Impacts should be those that are common for the location type and the level of trip generation increase. Recommendations should generally indicate if strategy is feasible at the location indicated.]

<u>Location</u>	<u>Strategy</u>	<u>Recommendation</u>

\_\_\_\_\_  
\_\_\_\_\_  
-  
-

**Appendix**

[Insert any data used in analysis]

**Trip Generation Calculations**

**Traffic Counts**

**4. Transportation Impact Studies**

**A. Responsibility**

General: The applicant and their engineer are responsible for mitigating the impacts from a proposed development as assessed in the TIS.

Review Process: The TIS for a proposed development will undergo an iterative review process in accordance with the Land Development Regulation. The applicant shall provide a letter identifying changes to the Transportation Study with each re-submittal of the TIS.

Certification: The TIS shall be prepared under the supervision of a qualified and experienced transportation professional who has specific training in traffic and transportation engineering and planning. All transportation operations and design work shall be completed under the supervision of an experienced professional in conformance with the State of Colorado requirements. The TIS shall be signed and sealed by a registered Professional Engineer in the State of Colorado.

**B. Format**

Throughout the TIS, data should be presented in tables, graphs, maps, and diagrams in lieu of a narrative, for clarity and ease of review.

**Introduction and Summary**

The purpose of the TIS should be clearly stated. This section should contain an Executive Summary that concisely summarizes the principal findings, conclusions, and recommendations of the TIS.

**Proposed Development**

Provide a description of the land parcel size, general terrain features and location within the county. Include a vicinity map showing the location of the project site in relation to the surrounding transportation network. The offsite as well as site-specific development should be described. This includes a discussion of land use and intensity, location, site plan and zoning. As required, primary and secondary access to existing streets should be proposed. Construction phasing should be introduced and addressed in this section.

**Existing Area Conditions**

Limits of the study area should be described in this section. The limits shall be mutually agreed to between the applicant and the County.  
Transportation Design and Construction Manual – Amended 12-17-19XX-XX-XX

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during the Preliminary Application process. Roadways that provide access to the site as well as future roadways included in the study area are included in this section. Existing intersections within the study area as well as geometrics and traffic signals should be identified. The existing and proposed uses of the site should be identified. Current traffic volume counts should be collected to determine existing traffic conditions in the study area. If the most recent traffic counts available are 3 years old or older, new traffic counts shall be collected. These counts should include average daily traffic and intersection peak hour turning movements within the study area.

#### Background Traffic

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Background traffic growth estimates should be based on the most recent regional Travel Demand Model available. Overly conservative projections of background growth will not be accepted. If a growth model is not available for the study area, a reasonable growth rate considering area development potential shall be agreed upon by the applicant and the County during the Preliminary Application process. Growth rates above 2% per year will not be considered.

Trips generated by other approved developments within the study area, that were not included in the traffic counts collected, may be added to the background growth and referenced in the TIS. However, the combined background growth rate from area development and growth modelling shall not exceed an average of 2% per year.

#### Projected Traffic

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One of the most critical elements of the TIS is estimating the amount of traffic being generated. The latest edition of ITE's Trip Generation Handbook provides guidance on how to select between rates and equations when both are available. The national published data provided by ITE should be used as starting points in estimating the amount of traffic by a specific building type or land use. If no trip generation rates nor equations are available from ITE's Trip Generation Manual, traffic counts from similar site(s) should be provided as a basis for trip generation estimates. If no site(s) with similar uses are available, an analysis of the proposed use based on the site's capacity may be considered. Include a table summarizing trip generation estimates.

Trip Distribution: The direction from which traffic will access the site can vary depending on many factors such as the type of proposed development and the area which it will attract traffic, surrounding land uses and population and conditions of the surrounding street system. Document the methods and assumptions made in this section.

Trip Assignment: The final product of this process is total project generated trips, by direction and turning movement, on each segment of the TIS area roadway network. The assignment should reflect the horizon years and consider future conditions of the roadway. Typically, the County uses a 3-year projected and 20-year projected traffic volume. Additional horizon years may be necessary depending on proposed phasing.

Internal Trips: Trips captured internally by a proposed development may be applicable depending on the use. The internal capture rates used should be based on the current version of the ITE's Trip Generation Handbook.

Pass-by trips: Trip generation analysis yields the number of vehicle trips that a site is expected to generate at its driveways. A percentage of their trips are simply diverted from trips already passing by on the adjacent roadway system. Pass by trips diverted from a roadway should be rechecked if they represent more than 15% of the traffic volume on that roadway. Pass-by trips shall still be applied to the site's driveways and any local roadways between the site and the roadway from which the trips are diverted. Pass-by trip reductions should not be made to the overall trip generation prior to trip assignment.

#### Transportation Analysis

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Capacity analysis is required for each of the major street and site access locations (signalized and un-signalized) within the TS-study area. A clearer understanding of both the transportation related implications of the project and the necessary improvements to ensure acceptable operating conditions should result from this section of the TS. In addition, the following County ~~Plans-plans~~ and ~~Program program~~ and ~~Factors-factors~~ shall be considered in the transportation analysis: ~~County Plans and Program~~, Major Thoroughfare Plan, Bicycle ~~and Pedestrian~~ Plan and Traffic Impact Fee Program.

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Factors:

- Safety
- Neighborhood Impacts
- School Zone Traffic Control
- Traffic Control Needs
- Transit Needs or Impacts
- Transportation Demand Management
- Circulation Patterns
- On-site Parking Adequacy and Off-site Parking Facilities
- Pedestrian and Bicycle Movements/Continuity of Facilities
- Service and Delivery Vehicle Access
- Emergency and Fire Apparatus Access

*Transportation Safety:* The initial review of existing conditions within the TIS area ~~should-shall~~ include analysis of crash data from the 3 most recent years available. Any intersection experiencing Level of Service of Safety (LOSS) III or IV, or above average crashes on the state-specific Safety Performance Functions, a crash rate of over 1 per million entering vehicles will need additional analysis. The proposed site plan should ensure that the internal circulation system and external access points improve pedestrian and bicyclists safety and minimize vehicle/pedestrian and vehicle/bicyclists conflict points.

*Transportation Operations:* Impacts on transportation operations shall be measured based on the definitions contained in the current version of the *Highway Capacity Manual (Transportation Research Board)*. For each analysis period studied (typically 3 and 20 year periods) and for each phase of the project a projected total traffic volume must be estimated for each critical intersection and roadway segment being analyzed. The projected total traffic volumes (consisting of the summation of existing traffic, background growth traffic, background development traffic and site traffic) will be used in the next step-capacity analysis of future conditions.

*Signalized Intersections:* Level of Service (LOS) is based on roadway system characteristics that include:

- traffic volume
- lane geometry
- percentage of trucks
- peak hour factor
- number of lanes
- signal progression
- ratio of green time to cycle time (G/C)
- roadway grades
- parking conditions
- bicycle and pedestrian flows

The LOS categories are established in the *Highway Capacity Manual*. In general, LOS ratings of A to D are acceptable while E & F ratings must be mitigated. There are a number of software programs that can determine highway capacity.

*Unsignalized Intersections:* LOS for multi-way stop controlled intersections and driveway intersections must be determined by computing or measuring control delay. Where capacity analysis shows a LOS of D or worse, an analysis should be completed to determine if a signal, roundabout, or turn restriction might be needed. Any proposed all-way stop intersection must be justified using MUTCD's guidance on multi-way stop applications. Any newly signalized intersections must be justified using MUTCD Warrant 2 (Four-Hour Vehicular Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

Volume). Alternatively, Warrant 3 (Peak Hour Volume) may be evaluated only if the unusual cases as defined in the MUTCD apply.

*Roundabouts:* In cases where LOS analysis indicates that an unsignalized intersection is expected to be LOS D or worse, a roundabout will be assessed before consideration will be given to a proposed signalized or multiway stop intersection. Factors for consideration of a roundabout include:

- availability of right-of-way
- crash history or potential
- traffic volume
- lane geometry
- number of lanes
- roadway grades
- parking conditions
- bicycle and pedestrian flows
- level of service

Each proposed location for a roundabout will be evaluated on a case by case basis. The capacity of a roundabout must be evaluated, and appropriate analytical software programs shall be utilized.

Parking: Utilizing ITE's Parking Generation Manual as a starting point, provide an estimate of how much parking the proposed development will generate. Parking utilization rates from similar sites may aid in this analysis.

Queueing: Provide an analysis of projected 95th percentile queues to determine adequacy of existing and proposed turn lane storage lengths, and whether any through-queues block adjacent intersections.

#### **Improvement Analysis**

The improvements required to accommodate existing, background and site generated traffic are summarized in this section. Intersections serving the development should be analyzed first. The analysis should include the following steps:

- Identification of critical movements and corresponding intersection approaches.
- Determine if the intersection needs new types of traffic control such as roundabout, signalization or multi-way stop control. ~~The Transportation Study indicates that an intersection internal, adjacent or within 500 feet of the development will satisfy the MUTCD Peak Hour Warrant or Four-Hour Warrant within 20 years.~~
- Evaluation of each critical movement under potential scenarios of adding lanes, altering signal phasing, signal timing or lane use.
- Evaluation of signal locations, phasing and timing, with particular emphasis on corridor signal progression.
- Evaluation of queue lengths for both turn and through lanes to ensure adequate storage space.
- Identification of potential improvements within the contexts of Right-of-Way availability, intersection spacing, signal progression, County design standards and practical feasibility.

#### **Findings & Recommendations**

~~Summarize the proposed development, its impacts, and the proposed mitigation measures. Throughout the TS, data should be presented in tables, graphs, maps and diagrams in lieu of a narrative, for clarity and ease of review. The examples contained in ITE's current version of Publication No. RP-020C Transportation Impact Analysis of Site Development is an excellent source of information.~~

#### C. Example Transportation Impact Study Outline

#### Transportation Study

Transportation Design and Construction Manual – Amended ~~12-17-19~~XX-XX-XX

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[Development Title]

Case Number: XX-XXXXXX SD/PF

-

Applicant Information

[Name]

[Address]

[Phone Number]

[Email]

-

Report Author

[Name]

[Address]

[Phone Number]

[Email]

-

Date of Original Report: XX-XX-XXXX

Date of Revision: XX-XX-XXXX

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[Seal and Signature of Colorado Professional Engineer]

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**Executive Summary**

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**Table of Contents**

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List of Figures

List of Tables

**Purpose of Analysis**

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-

**Proposed Development**

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Project Location

[Insert vicinity map showing the location of the project site in relation to the surrounding transportation network]

Project Overview

[Description of the site including size, location, land use, intensity, existing zoning, proposed zoning, access locations and proposed development phasing.]

**Existing Area Conditions**

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[Include diagrams and narrative of traffic counts collected]

**Background Traffic**

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[Include reference to source Travel Demand Model, any nearby developments considered, and diagrams of 3-year and 20-year projections]

**Projected Traffic**

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Trip Generation

[Description of publication or methodology used to generate daily and peak hour traffic volumes for the proposed development including any trip reduction considerations, internal trip capture rates and pass-by trips as applicable]

Trip Generation Summary

[Table including land use, intensity, ITE Code, daily traffic volume, peak hour: in, out and total traffic volumes.]

Trip Distribution

Pass-by Trips (if applicable)

Trip Assignment

3-Year Horizon

20-Year Horizon

**Transportation Analysis**

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Level of Service

[LOS diagrams at all study area intersections]

Safety

[LOSS Analysis]

Intersection Controls

[Roundabout analysis, signal- or all-way-stop-warrant analysis]

Parking

[Include parking generation and availability]

Queueing

[Queueing analysis at study area intersections]

**Improvement Analysis**

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[Describe any improvements needed to mitigate impacts]

–

**Conclusion and Recommendations**

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[Summarize the proposed development including site location, proposed accesses, and trip generation.]

**Appendices**

- Site Plan
- Traffic Counts
- Growth Calculations
- Nearby Development Trip Estimates\*
- Trip Generation Sheets
- LOS Worksheets (Synchro or equivalent)
- Roundabout Analysis\*
- Signal and/or All-Way Stop Warrants\*
- LOSS Worksheets
- Parking Generation Sheets
- Queueing Analysis Worksheets
- Signal Progression Analysis\*

\*as applicable

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**Right of Way & Permits**

1123 West 3<sup>rd</sup> Avenue  
Denver, Colorado 80223  
Telephone: **303.571.3306**  
Facsimile: 303. 571. 3284  
donna.l.george@xcelenergy.com

November 27, 2022

Jefferson County Planning and Zoning  
100 Jefferson County Parkway, Suite 3550  
Golden, CO 80419

Attn: Lindsey Wire

**Re: Regulation Amendment - Transportation Design and Construction Manual  
Case # 22-122945AM**

Public Service Company of Colorado's (PSCo) Right of Way & Permits Referral Desk has reviewed the regulation amendment documentation for **Transportation Design and Construction Manual**. Please be aware PSCo owns and operates existing natural gas and electric distribution and transmission facilities within and throughout Jefferson County and has no objection to these proposals, contingent upon the following:

1. PSCo's ability to maintain all existing rights and these changes should not hinder our ability for future expansion. This includes all present and any future accommodations for natural gas transmission and electric transmission related facilities.
2. Please note that no structures are allowed within utility easements, and the widening of roadways in no way changes the standard required width of utility easements on private property.
3. Bear in mind that per the National Electric Safety Code, a minimum 10-foot radial clearance must be maintained at all times from all overhead electric facilities including, but not limited to, construction activities and permanent structures.

Donna George  
Right of Way and Permits  
Public Service Company of Colorado dba Xcel Energy  
Office: 303-571-3306 – Email: donna.l.george@xcelenergy.com



# **2<sup>ND</sup> REFERRAL COMMENTS**

2nd Referral Comments and Response Log		
Source of Comment	Comment	Staff Response
CORE	No comments.	Acknowledged.
Evergreen Fire	It is specified in the main body of this section that an increase to twelve (12) percent grade is allowed when the terrain is on a southern facing aspect. However, in the exception section that allows an increase to fifteen (15) percent grade with installation of an approved automatic fire sprinkler section it is not specified that the exception applies only on terrain that has a southern facing aspect. Clarification is necessary as to if the exception applies only to southern facing aspects.	This applies to all aspects and clarification will be added.
	As a general question, as modifications to grade and other specifications may be granted based upon terrain that has a southern facing aspect; is there any consideration applied to the roadway being shaded or not?	Currently no. This could be a consideration when not meeting the standard and relief is being requested.
	Template 18a indicates a 2-foot and 3-foot shoulder dimension on the left side but only a 2-foot on the right side. Could this be clarified or corrected if it is an error?	To remove the 3'. 2' shoulders apply to driveways.

<b>Arvada Fire</b>	Thank you for the opportunity to review and provide comments on this document. Overall, I do not have any technical recommendations or requests. I just want to clarify one section, 3.7.8.8. I understand that it is difficult to make a standard that works for everyone, especially fire departments. Although we do not have much development within our areas of unincorporated Jeffco, we do get a fair amount of new single-family dwellings on existing lots. We have run into challenges from time to time and required fire apparatus access based on the fire code and not this manual (an example would be a driveway longer than 50 feet, of which we do not allow driveways to be used for fire access). Does this section (3.7.8.8) provide us to enforce our department's fire apparatus access requirements?	Yes 3.7.8.8 allows the requirements of the applicable Fire Protection District to overrule any less restrictive requirements in the Transportation Manual. However, the County would only require a permit for a new driveway if it was associated with a new start building permit or if it exceeds 1/2 acre of land disturbance.
<b>Building Safety</b>	No comments.	Acknowledged.
<b>Planning Engineering</b>	No additional comments at this time. Pending comments received by internal and external agencies modifications may be required.	Acknowledged.
<b>Open Space</b>	Change flagmen to flaggers on page 8	To make change.
	Ensure the Minimum Sight Distance Requirements Table on page 17 is on 1 page and don't let the header get cut off on a different page. General comment for all tables.	To verify.
	Number/Label figures and tables	To verify.
	5.1.7.1 and 5.1.7.3 are almost identical. Can one be removed, or can they be combined?	T&E supports combining 5.1.7.1 and 5.1.7.3.
	STND numbers in the document don't match the drawings.	To verify.
<b>Road and Bridge</b>	Road & Bridge is requesting the expansion or addition of language to Section 5.1.8.1 to include tracer wires to curb drains. Installation details would also have to be included. I believe the T&E group is currently working on the installation details.	T&E has an updated detail that has not previously been included in the TDCM. The detail will be incorporated as part of Together Jeffco regulation update.

<b>RTD</b>	No comments.	Acknowledged.
<b>Transportation and Engineering</b>	No comments.	Acknowledged.
<b>Xcel Energy</b>	PSCo's ability to maintain all existing rights and this amendment should not hinder our ability for future expansion, including all present and any future accommodations for natural gas transmission and electric transmission related facilities, and that our current use/enjoyment of the area would continue to be an accepted use on the property and that it be "grandfathered" into these changes.	Acknowledged.
	Please note that no structures are allowed within utility easements, and the widening of roadways in no way changes the standard required width of utility easements on private property.	Acknowledged.
	Bear in mind that per the National Electric Safety Code, a minimum 10-foot radial clearance must be maintained at all times from all overhead electric facilities including, but not limited to, construction activities and permanent structures.	Acknowledged.
	Note that proper clearances must be maintained including ground cover that should not be modified from original depths. Contact Colorado 811 before excavating. Use caution and hand dig when excavating within 18-inches of each side of the marked facilities. Please be aware that all risk and responsibility for this request are unilaterally that of the Applicant/Requestor.	Acknowledged.
<b>Mainero</b>	I received the following from our HOA (MSI) who thought this might be part of my outreach to CDOT and City of Lakewood for a crosswalk, light and turning lane into our community, Red Rocks Ranch, Morrison Road and Girton (Rooney Road). Please let me know.	This is not associated with this regulation update.

	<p>As I read this document several significant changes in response to our June 2023 comments have been made, yet many have not yet been addressed. As matter of professional engineering protocol the document writer should reply to the commentor indicating the disposition of every comment. To date the county has failed to respond to my comments to the two previous versions of this document.</p>	<p>Acknowledged. The County is working to respond to all comments received.</p>
	<p>As a general matter, the Transportation Design and Construction Manual (TDCM) defines engineering standards; therefore, it is appropriate that the TDCM is under the strict authorship control of the Jefferson County Director of Traffic &amp; Engineering engineer NOT the Director of Planning &amp; Zoning. There is actually very little in the document that provides guidance with respect to planning and/or zoning. Similar documents authored by other cities, counties, and state departments of transportation are the domain of the engineering staff within the agency.</p>	<p>While Planning and Zoning is coordinating the referral of these proposed updates, these changes are a coordinate effort between all of Development and Transportation Districts as well as the Fire Protection Districts. The ultimate decision and approval of these proposed changes is by the Board of County Commissioners.</p>
	<p>Additionally, many of the sections of the document are a jumble of clauses taken from other sources and assembled into this document. As a result, of our previous comments regarding, Templates 18,19,20, 21 and Standard 8 — only Standard 8 remains. The others should have been modified to remove the conflicts. For example, the Hammer Head emergency vehicle turn around has been deleted.</p>	<p>These templates are included. Template 18 has been split into Templates 18a through 18d.</p>

Moreover, the design standards, construction templates, and other guidance presented in the TDCM should also be reviewed and approved then sealed by a professional engineer. This section should contain a description of why these specifications are here and what the county hopes to achieve. Should also include statements of how any submittal will be judged by staff.	A PE Stamp will not be added to the Transportation Design and Construction Manual.
The word "should" is used throughout the document. This is not an appropriate word to use in a regulatory document, as it is legally unenforceable. The correct words to use are Shall or Must.	The word "should" was only found once in the document and has been replaced.
The document should include discussion and presentation of the requirements for a "Clear Zone" where errant vehicles can safely recover without striking a hard impediment. <a href="https://highways.dot.gov/safety/rwd/provide-safe-recovery/clearzones/clear-zones">https://highways.dot.gov/safety/rwd/provide-safe-recovery/clearzones/clear-zones</a> This will impact design requirements for roadway construction and reconstruction. This is also included in the CDOT Roadway Design Guide, Chapter 7 section 7.1.1.1.2, 7.2.1.16 and Chapter 13, 13.5.5.1. It also has a significant presence in the AASHTO Roadside Design Guide and the FHWA/AASHTO Highway Safety Manual. This is particularly important for the safety of motorists traveling on Jefferson County rural roads.	For most roadways in the County, especially in rural areas, the FHWA - following the AASHTO Design Guide - recommends a clear zone of 7-10 feet. Jefferson County standards require a minimum of a 3-foot shoulder (4 ft on Collectors), plus an additional 4 feet in which the outside slope can not exceed 4:1, creating a clear zone of a minimum of 7 feet. In areas where this is not possible due to extreme geometric conditions, the County uses other strategies such as Guardrail, rumble strips, and advanced warning signage.

In general, the Traffic Study portion of the document is greatly improved. It still needs work to clarify specific portions. My professional opinion is that it is headed in the right direction.	Acknowledged.
Section 3.7.8 Non-Maintained Roads in County Right-of-Way, Driveways, and Private Street/Roads, and Non-Maintained Roads in County Right-of-Way Standards: Template 18 only addresses the cross section, it does not address the plan view. This template has been removed and should be corrected and returned to the document.	Template 18 has been split into 4 templates for clarity.
Section 3.7.8.1.2 Width: The Committee has determined that 500' is too long a distance; therefore, the width specification should be based and justified by the length of hose that the firefighting apparatus carries.	This modification was reviewed and coordinated with the Fire Protection Districts and is applicable to access in and out of the site rather than access to the structure.
Section 3.7.8.1.3 Grade: Grade limitations are generally positive; however, the TDCM also needs to address the maximum change of grade from one roadway section to another. In many scenarios, going from 12% down to 12% up or 12% up to 12% down in a short distance will be a safety hazard and a problem for large vehicles. Additionally, there should be an explanation for this statement reading, for example: "Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West". Moreover, all other possible orientations should also be specified.	The vertical curve requirements of chapter 3 apply to public and private streets/roads. For driveways, we will specify a maximum grade change allowable. Discuss to see if commentor has any recommendations. An explanation of dip of the natural terrain will be added to the definitions.

<p>Section 3.7.8.2.1 Curve Radius: What is this 30' curve radius based upon? There needs to be a reference or justification for this specification: It could be that a 30' radius is not sufficient in many scenarios. Then how will conformance to this be judged? This revision simply dumps this on to the fire departments, to me this is unacceptable guidance, ask them what the minimum should be and/or use the truck turning templates.</p>	<p>This was coordinated with the Fire Protection Districts and it was determined that the 30' radius was acceptable for the regulations. Since there are different apparatus for each District this will allow stricter requirements to be enforced. In addition, the Fire Districts plan to each prepare a hand out.</p>
<p>Section 3.7.8.2.2 Width (For a street/road serving up to 15 dwelling units): Will parking be allowed on these roadways? What about horizontal and vertical obstructions? This width specification should situationally based?</p>	<p>On street/road parking is not permitted, however templates 18c and 18d do specify that if on street parking is desired the template must be widened as approved by Planning and Zoning and the Fire District. Agreed that horizontal and vertical obstructions are situationally based and depend on the Fire District and their apparatus. This is the reason for 3.7.8.8.</p>



<p>Section 3.7.8.3: The use of the clause, "The off-site driveway or private road shall meet requirements of this section" is ambiguous. This specifically must clearly state, in detail, the requirements that the roadway design and construction is required to meet. As this section is written, it is not clear what would constitute an unacceptable roadway or driveway design! There are no details or drawings to clearly show what the minimum acceptable roadway and driveway consists of. The ones that used to exist conflict and have simply been removed. This section must include a statement similar to the following, "The documentation shall include scale drawings upon which fire protection district approved turning templates are overlaid". Additionally, my reaction to the following statement, "Such statement shall bear the professional engineer's seal, signature and date,..." is that, as a professional engineer, I (Paul R. Olson, P.E., T.E.) would not risk my professional engineer's licenses to approve plans for an on-site driveway or private roadway in a circumstance where the actual requirements are so illdefined. In addition, the county engineers should review the National Society of Professional Engineers (NSPE) code of ethics, <a href="https://www.nspe.org/resources/ethics/code-ethics">https://www.nspe.org/resources/ethics/code-ethics</a> . In signing such waiver that engineer would be in violation of engineering ethics codes. Moreover, if the driveway can't safely accommodate a fire protection district apparatus, then there is NO condition where an exception should be granted. This requirement should be deleted. It is not clear how Jefferson County Staff will judge any requested exemption under this clause. In my opinion, this clause will only cause Staff and the public significant, ongoing difficulties that are unnecessary. Again, there are no templates or drawings that detail the minimum requirements for driveways as they intersection with the county roadway! It should be the task of the applicant to prove their proposal meets standards set by the county and the fire departments.</p>	<p>Discussed further with commentor. Staff has created updated templates to more clearly define requirements for private streets/roads and driveways. Staff agrees with the commentor that it is the responsibility of the applicant's engineer to show that the on and offsite access meets County standards.</p>
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<p>Templates 18, 19, 20 and 21 and Standard 8 conflict. Standard 8 As shown in the above table this standard conflicts with the templates. Also, Section 3.7.8.1.1 and Section 3.7.8.2.1 which specify a 30' radius at the roadway centerline. It is my opinion that a driveway conforming to this standard will not allow safe and efficient fire truck access, particularly with a 10' edge radius and 10' roadway width. In addition, Standard 8 only addresses right angle intersections. These templates should have been corrected to agree with one another rather than simply removed. This standard should also detail the minimum public roadway dimensions. A narrow public road will also impact fire truck access to a private road. This standard would also allow a tight turn with short radius very close (15') to the intersection which would also restrict fire truck access. This situation shall also be subject to Autoturn or turning template analysis. This standard also references "see templates" but doesn't say which ones, would this be templates 18 to 21?</p>	<p>Staff verified with the Fire Protection districts that the 30 foot radius is acceptable.</p>
<p>Section 4.4. What are the reference documents for the design of the pavement? Is this in the CDOT publications? This should also address the current existing pavement structure. Will it hold up to major construction activity, and if so what will be the reduction in the pavement life?</p>	<p>This is not a pavement design, but rather a table showing how EDLA values are established for different roads. Existing pavement structures are rarely evaluated.</p>
<p>Section 5.1.10.1.1. Good job to eliminate plastic sign usage.</p>	<p>Acknowledged.</p>
<p>Section 5.1.10.1.4. Rather than (or equivalent) I would suggest (or ACCEPTED equivalent). Plus you need to clearly state how equivalency will be judged. Will it be judged by physical tests or a simple review of catalog cuts?</p>	<p>Section 5.1.10.1.4 refers to Sign Post Bases. Staff is willing to change to "or approved equal". However, generally "or equivalent" is sufficient because if Material A meets the standard and Material B is equivalent then it would be acceptable.</p>

**CoSECC (Olson)**

Section 6.1.1. There are number of things that should be included in all four levels of analysis, Limits of the area to be analyzed Identification of the main access routes to the site Identification and analysis of all emergency access routes I would only accept the "Letter of Conformance" if it covers all of the regulations currently in force. I have seen some really poor TIS documents submitted to the county and I would not accept them under this clause. Add a table summarizing the requirements for each of the 4 levels. This would include the count thresholds etc. Add a section to clearly state the requirements for data collection. This would include the following: o Areas covered (project limits) o Timing of the counts, o Count types, o Origin and destination of potential development users, o Count durations, o Days when counts shall not be taken unless approved in writing by the County Traffic Engineer. o Acceptable counting technology and accuracy levels. o I should also include data (trip tables, O&Ds, growth rates at a minimum) from the DRCOG traffic models. o Counts shall be continuous for the period specified, gaps in count data shall cause new counts to be taken.

Staff supports only allowing a Letter of Conformance if regulations currently in force are met. Staff also supports adding additional clarification language on data collection requirements (count duration, days, weather) for each traffic analysis option, but certain requests for what is to be included is too contextual and is covered with applicants at the pre-application phase (project limits, count types, duration (weekends)). Additional data requests, while they may be within industry best practices, are unattainable for applicants and for formal staff review (O&Ds, count technology, etc). Futher, the DRCOG growth model does not always reflect true projections and therefore OTIS is acceptable in various circumstances.

<p>A table summarizing the analysis for each level should also be considered. Traffic counts younger than 3 years may not be stale based upon the surrounding land use changes/developments.</p>	<p>T&amp;E is supportive of adding a table describing what level of analysis is required for each application type. Staff will not consider studies older than three years due to significant changes seen in the region and the infeasible request for staff to determine what land uses have changed in the area over the past three years.</p>
<p>The volume thresholds for both a “Transportation Analysis” and a “Traffic Impact Study” are 800 vpd. The “Transportation Analysis” should be eliminated and the TIS shall be completed as a part of the planning process not during the site development process. There isn’t enough rigor to the proposed analysis in the “Transportation Analysis” to identify the true impact and the infrastructure improvements needed to be included in the site development process. Waiting until the site development process weakens the county ability to control the project. Particularly since the volume threshold is the same for each.</p>	<p>The Transportation Analysis is for rezones only and the Traffic Impact Study is for site development. These studies are similar, but Transportation Analysis deliberately includes conceptual mitigation and less intense analysis, since much is unknown at rezone (site access(es), number of units proposed, size of commercial building, etc.). A site will first submit a TA when they rezone and then submit a more rigorous TIS when they go through site development, when proposed uses and intensities are solidified.</p>

<p>The "Trip Generation Summary Tables" should be numbered. They should also include Saturday and Sunday as many land uses peak on the weekend.</p>	<p>Staff agrees Trip Generation Summary Tables be numbered appropriately. T&amp;E requests weekend volumes for land uses that peak on weekends, if not already provided based on ITE trip generation codes.</p>
<p>If the Trip Generation Manual doesn't include the subject land use, there shall be at least 3 similar sites studied as required in the manual. The specific requirements for this in the Trip Generation Manual should be cited. You should specify the data to be collected. There shall also be a succinct description of each site as well as identification of who collected the data and when. It is currently suggested that the sites' capacity be used if no similar sites exist. Then who and how will the sites capacity be determined and documented? The number of parking spaces is not a good independent variable.</p>	<p>Staff agrees similar sites studied should be required if the ITE Trip Generation Manual does not have an applicable land use. Based on these experiences, staff will require at least 2 similar sites be studied as 3 can be challenging depending on the context. If similar land uses/contexts do not exist, staff will work with the applicant to determine the best approach to achieve accurate trip generation.</p>

<p>The use of the Level of Service (LOS) is rather crude indicator of traffic operations. The origins of LOS was as a public relations tool not for quantitative analysis. The Volume Capacity Ratio (V/C) is more illustrative of the actual impacts. Consider a facility that operates at a V/C of 0.89 which would map to LOS D yet is just below LOS E. Would that be acceptable? How many hours during the day will the facility operate in the V/C regime? If it is 15 minutes it may be acceptable but 4 hours would clearly not be.</p>	<p>LOS provides a great enough indication of traffic operations in Jefferson County. <b>For unique circumstances, language will be added stating staff reserves the right to request additional Measures of Effectiveness as identified in CDOT's Traffic Analysis and Forecasting Guidelines.</b> Applicants may submit an Alternatives Standard Request in situations where a failing LOS is not indicative of adverse traffic operations and provide justification at a higher level of analysis.</p>
<p>A Traffic Impact Study shall include analysis using the DRCOG models. A simple HCM analysis won't tell the full regional impact of such a large development. For example, large developments with major traffic destinations in the Denver metro area have a significant impact on US 285 traffic in Turkey Creek Canyon and currently is not assessed for traffic impacts.</p>	<p>"Background traffic growth estimates should be based on the most recent regional Travel Demand Model available" is currently stated in the Transportation Impact Studies portion of the Transportation Studies section. DRCOG is generally the most recent regional model available, but the current model misrepresents existing and projected growth on certain corridors and CDOT's OTIS projections are therefore accepted in some circumstances.</p>

Evacuation Study. An Evacuation Study shall be included. The recent fires such as the Marshall and the Paradise Fires clearly indicate that evacuation is a major problem. It shall clearly delineate the tributary areas being evacuated and the capacity of each of the evacuation routes. In the mountains and rural areas of the county it should include large vehicles, vehicles evacuating livestock and other large animals as well as recreational vehicles.	Staff is discussing how an Evacuation Study could be implemented into cases as needed.
Appendices. Appendices to this document should include suggested consultant work scopes for these tasks. Otherwise, there will be no uniformity in the documents submitted to the county. This will require more county staff time to review.	Transportation Studies provides outlines for each study type, ensuring the County receives consistent/uniform formats for review.
Template 5 shows a single curb ramp on each corner. The ramps are oriented such that a sight impaired person would be directed into the center of the intersection. This is not a safe design according to the sight impaired community, particularly at signalized intersections. Federal Highways guidance is for two ramps on each corner oriented to a corresponding ramp across the intersection.	Staff understands this comment intended to state Standard 5. The purpose of this standard is to show the crossspan. It is not intended as a standard design for sidewalk ramps.
Template 8 does not indicate the width of the public road which may not be wide enough to accommodate fire truck access. This was a previous issue that has yet to be resolved.	This has been reviewed with the Fire Protection Districts. Any Fire District may require a wider standard than our regulations. To be discussed further with commentor.

<p>Templates 16-1 and 16-2 are not included in the table in Section 5.2. They should also be relocated with templates 26-.*.</p>	<p>Staff understands this comment intended to state Standard 16-1 and 16-2. These are for street lights. Street lights are separate structures from traffic signals and therefore should not be included in the Standard 26 series.</p>
<p>Template 16-2 is clearly a sole source item. To me this is a pretty generic lighting fixture it should not be sole source</p>	<p>These details have been taken directly from Xcel's Outdoor Lighting Manual. Xcel maintains the street lights in Jefferson County; the County follows Xcel's standards.</p>
<p>Template 16-1 shows several different styles of lighting fixtures therefore there is a conflict with Template 16-2.</p>	<p>These details have been taken directly from Xcel's Outdoor Lighting Manual. Xcel maintains the street lights in Jefferson County; the County follows Xcel's standards.</p>
<p>Template 26-6 appears to be a direct copy from vendor supplied materials therefore sole source. If another manufacture supplied a pole with the same dimensions as those shown would it be accepted and what would be that process?</p>	<p>The County's standards are based on a joint standard development with the Cities of Lakewood and Westminster. The County will coordinate with these Cities and determine if future changes need to be made</p>



	<p>Templates 26-1 and 26-9 need to be updated to reference the 2020 Interim Revisions to the LEFD specifications. The changes are significant.</p>	<p>The County's standards are based on a joint standard development with the Cities of Lakewood and Westminster. The County will coordinate with these Cities and determine if future changes need to be made</p>
City of Golden	No Comments	Acknowledged.
David Duncan	<p>3.7.8.1.3 Exception for Mountains - 15% grade, spaced by 1,000' and allowance if fire sprinklers are installed - where did these numbers come from? 1,000' separation seems arbitrary, was this input from the Fire Districts? I object to requiring fire sprinklers, why not just grant the exception without that requirement?</p>	<p>Came from the Fire Protection Districts. Most new structures in the mountains require sprinklers. To discuss with Fire Marshalls. Adding the sprinklers to the home provides additional response time of the district to get to the structure. This is especially needed for homes where width and grade may not comply with standards.</p>
	<p>3.7.8.1.4 Turnaround - should read "or sufficient space to turn around meeting the same dimensions...." If room is present for the fire truck to turn around nothing further should be required.</p>	<p>This requirement came from the Fire Protection Districts. To discuss with the Districts to determine what *if any alternative standards they would be comfortable granting such as cul-de-sac template, turnaround location and size, pullouts.</p>
	<p>3.7.8.2.2 Width - Template 18b allows for width smaller than stated total of 20'. I believe a total width of 18' incl shoulders is sufficient, does not need to be 20', and there are numerous places in the mountains with private drives smaller than 20'. Template 18d is min total width 14'?</p>	<p>Staff to discuss these templates with the commentor in a meeting.</p>

	<p>3.7.8.3 Offsite Driveways - BIG OBJECTION, the way this is written for relief of any of the standard dimensions:</p> <ol style="list-style-type: none"> <li>1. Submit survey and plan from registered PE - this will cost someone \$5-20K to get done.</li> <li>2. Agree to install sprinklers - est \$25K cost</li> </ol> <p>This will create the same situation as when the requirement to prove defensible space for ANY building permit was passed - people stopped applying for building permits. I GUARANTEE you the same will happen with this regulation change.</p> <p>Suggestion: give P&amp;Z Chair the option to administratively waive requirements, and in doing so he MAY require survey and/or evaluation from an Engineer. Requiring sprinklers is a terrible idea! Let the insurance companies handle that!</p>	<p>Staff to discuss this plan change with the commentor.</p>
	<p>Construction Stds - if the County does not already have it they should include stds for:</p> <ul style="list-style-type: none"> <li>-Spill (reverse) curb - see attached CDOT Std</li> <li>-Curb Openings for Drainage - see attached std from CO Springs</li> </ul>	<p><b>Staff agrees to include a 6" Spill curb with 1' gutter and existing detail will be included.</b> Coordination with Road &amp; Bridge will be required for approval of the Curb Openings for Drainage standard to ensure staff has the ability to maintain such infrastructure.</p>

Jefferson County Horse Council	<p>Sections 3.7.3.1 and Section 3.7.3.2 regarding right turn acceleration lanes. JCHC would like to recommend that these 'lanes' be required for entrances to and from Equestrian Centers and medium to large boarding stables and equine farms.</p> <p>Comment: Slowing down sufficiently when trailering live animals to enter these types of facilities poses a traffic hazard and slows traffic down. Having a horse trailer rear ended is an ugly accident often resulting the serious injury to animals in the trailer. Also exiting these facilities without an acceleration lane poses a significant problem for a driver pulling a trailer requiring a significantly larger gap in traffic to safely enter the flow of traffic, thus creating a potential safety issue. A good example is entering and exiting the Arvada Indiana Equestrian Center on 75th and Indiana. We are suggesting this for all road classifications with the possible exemption of 'Local.'</p>	<p>As defined in the TDCM, "Right Turn Acceleration Lanes: Right turn acceleration lanes may be required based on an approved transportation study. Right turn acceleration lanes may also be required where necessary for public safety and traffic operations based upon site specific conditions, as determined by Planning and Zoning. "</p> <p>This existing language is broad enough to cover the scenario described.</p> <p>Further, if an accel/decel lane benefits an equestrian center, it would be in the applicants own best interest to propose the installation of an accel/decel lane. The county can approve this without having to require it.</p>
	<p>Section 6.4 Transportation Analysis</p> <p>Section 6.4.2. Format, subparagraph "Projected Traffic" (pg 46) Insert after the 6th sentence: Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.</p>	<p>A Transportation Analysis is a high-level study that involves a lesser level of analysis with a rezone application. Size of vehicle expected would not be a consideration with rezone-related studies.</p>

<p>Section 6.4 Transportation Analysis</p> <p>Section 6.4.2. Format, subparagraph “Analysis” (pg 48) Insert after the 2nd sentence: Consideration should be given to site-specific safety issues for vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict.</p>	<p>A Transportation Analysis is a high-level study that involves a lesser level of analysis with a rezone application. The current Transportation Analysis language does not specify analysis for separate modes of transportation intentionally, as too many variables are unknown until site development.</p>
<p>Section 6.5 Transportation Impact Studies</p> <p>Section 6.5.2. Format, subparagraph “Projected Traffic” (pg. 49) Insert after the 5th sentence: Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.</p>	<p>Projected traffic is based solely on the site and uses ITE Trip Generation Methodolgy, which does not specify the types of vehicles projected.</p>
<p>Section 6.5 Transportation Impact Studies</p> <p>Section 6.5.2. Format, subparagraph “Transportation Safety” (pg 50) modify the third sentence of the section to (modified areas in italics): “...improve pedestrian and bicyclist safety and minimize vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict points.”</p>	<p>Pedestrians and bicyclists are considered active modes of transportation in the transportation industry and more commonly need analysis. <b>A sentence will be added following "...conflict points" that states other vulnerable roadway users shall be considered in the safety analysis if applicable to the development's context. A definition for vulnerable roadway users will be added, including those walking, wheeling, horseback riding, etc.</b></p>

<p>Section 6.5.2 Format&gt;Factors – Add Equestrian to bullet point 9: ‘Pedestrian, Equestrian and Bicycle Movements/Continuity of Factors.’</p> <p>Comment: The presence and movement of equines within a certain area of a proposed development should be considered just as it is for pedestrians and bicycles. The traditional ‘paths’ used by equestrians have vanished over the past 30 years in the more populated areas of Jefferson County such as Lakewood, Arvada, Littleton and Golden disallowing equestrian the ability to safely ride from the location where their animal is kept to a park or trail. This was tragically brought home in the accident that occurred in Arvada requiring Griffin to be euthanized at the sight of the accident and injuring his heartbroken owner. JCHC along with other area horse associations and clubs would be more than willing to participate in helping to define areas in Jefferson County that have an equine presence.</p>	<p>Pedestrians and bicyclists are considered active modes of transportation in the transportation industry and more commonly need analysis. <b>A bullet point will be added to account for any other roadway user anticipated in the context of the area.</b></p>
<p>Section 6.5.2 Format&gt;Signalized Intersection: Level of Service – Add Equestrian to bullet point 10: ‘Bicycle, pedestrian and equine flows’</p> <p>Comment: Same as Format&gt;Factors comment above.</p>	<p>Level of service is a traffic engineering metric defined by the Highway Capacity Manual methodology. Equine flows are not defined in this methodology.</p>
<p>Section 6.5.2 Format&gt;Roundabouts – Add Equestrian to bullet point 10: “bicycle, pedestrian and equestrian flows.’</p> <p>Comment: Same as Format&gt;Factors comment above.</p>	<p>Industry standard roundabout analysis procedures were not developed to account for equestrian flows.</p>
<p>General Comment: We recommend adding ‘equestrian’ to any place in this regulation that has ‘bicycle and pedestrian.’</p>	<p>"Other roadway users anticipated in the context of the area" will be added where context applies (e.g. some areas reference "traffic" which is approve by FHWA and CDOT, whereas equestrians are not a form of federal transportation standards.</p>

<p>Section 3. Transportation Analysis</p> <p>Subparagraph “Projected Traffic” (pg 62) Insert after the 5th sentence: Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.</p>	<p>Projected traffic is based solely on the site development and requires the use of the ITE Trip Generation Methodology, which does not specify the types of vehicles projected.</p>
<p>Section 3. Transportation Analysis</p> <p>Example Outline</p> <p>Subparagraph “Analysis” (pg 65) Insert after last existing sentence of the section: Consideration should be given to site-specific safety issues for vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict.</p>	<p>"Other roadway users anticipated in the context of the area" will be added.</p>
<p>Section 4. Transportation Impact Studies</p> <p>SubSection B. Format</p> <p>Subparagraph “Projected Traffic” (pg 66 &amp; 67) Insert after 4th sentence of the section: Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.</p>	<p>Projected traffic is based solely on the site and uses ITE Trip Generation Methodology, which does not specify the types of vehicles projected.</p>
<p>Section 4. Transportation Impact Studies</p> <p>SubSection B. Format</p> <p>Subparagraph “Transportation Safety” (pg 68) modify the third sentence of the section to (modified areas in italics): “...improve pedestrian and bicyclist safety and minimize vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict points.”</p>	<p>Pedestrians and bicyclists are considered active modes of transportation in the transportation industry and more commonly need analysis. <b>A sentence will be added following "...conflict points" that states other vulnerable roadway users shall be considered in the safety analysis if applicable to the development's context. A definition for vulnerable roadway users will be added, including those walking, wheeling, horseback riding, etc.</b></p>

<p>Traffic Counts&gt; 4. Transportation Impact Study&gt;Transportation Analysis&gt;Factors – Add Equestrians to bullet point 9: ‘Pedestrian, Equine and Bicycle Movement/Continuity of Facilities.</p> <p>Comment: Same as Format&gt;Factors comment above</p>	<p>"Other roadway users anticipated in the context of the area" will be added.</p>
<p>Transportation Analysis&gt;Signalized Intersections – Add equestrians to bullet point 10: bicycles, pedestrian and equine flows.’ Also if there is a manual pedestrian ‘control button’ to stop traffic, an equestrian rider height manual ‘control button’ should be made available to accommodate mounted equestrians.</p> <p>Comment: Same as Format&gt;Factor comment above. Also, having a ‘control button’ that is equestrian rider height provides a much safer way for an equestrian to pause traffic. Reaching over to push a button designed for pedestrians especially pedestrians confined to wheelchairs/scooters while controlling a 1000# plus animal can be challenging. Dismounting, leading the equine across the road and mounting on the other side of the road also poses a safety issue as an equestrian is in the most dangerous position when mounting and dismounting. Allowing equestrians to safely and quickly cross a road while mounted is the safest solution for both the rider and the traffic.</p>	<p>Equine flows are not a metric used in traffic signal design and this cannot be accommodated. Installation of a push button at rider height may be requested through the Transportation &amp; Engineering division.</p>
<p>Transportation Analysis&gt;Roundabouts – Add equestrian to bullet point 8: ‘bicycle, pedestrian and equine flows.’</p> <p>Comment: Same as Format&gt;Factor comment above.</p>	<p>Industry standard roundabout analysis procedures were not developed to account for equestrian flows.</p>

	<p>Our reviewers had a few additional comments and we're not quite sure where they should be placed as recommendations in this document. They are as follows:</p> <p>Consider defining and adding 'Equestrian Infrastructure' similar to 'Bicycle Infrastructure.' JCHC would be willing to provide input this.</p> <p>Consider developing road design standards for street crossings utilized by equestrians. JCHC could provide design recommendations on this. Equine depth perception is quite different than human depth perception. Horses can perceive the white stripes across a road that are often used to indicate a pedestrian or game crossing as a 'cattle guard' or something dangerous and refuse to walk across the lines possibly shying into traffic.</p> <p>Consider additional signage to alert drivers that equestrians may be in the area. We understand signage is expensive and some criteria would need to be established for the placement of this type of signage if such criteria does not already exist. We do see some of these types of signs throughout the county which is appreciated. JCHC would be willing to provide input and recommendations including possible locations.</p>	<p>Because Jefferson County does not restrict any active mode from the sidewalk network, <b>staff will better define that pedestrian infrastructure is inclusive of those walking, wheeling, horseback riding, etc.</b> Specific facilities for equestrian use that are not inclusive of other modes will not be considered.</p> <p>Jefferson County abides by the FHWA's MUTCD which determines what signs and on-street markings are allowed to be implemented in public rights-of-way. <b>In areas where equestrian use is high, staff will coordinate with the equestrian community to implement treatments in line with MUTCD.</b></p>
	<p>Consider adding rumble strips around stop signs and along roads that don't have sidewalks or shoulders to alert drivers and help keep pedestrians and equestrian safe. The tragic equine/auto accident mentioned above might have been prevented had rumble strips been present at the stop sign. It is our understanding that the driver was distracted in some way and ran the stop sign thus hitting the horse and rider. Rumble strips might have drawn his attention back to the road and the upcoming stop sign.</p>	<p>Perpendicular rumble strips are not supported by the County as they result in greater long-term maintenance costs and can create icing issues during winter, increasing hazards in public right-of-way. Additionally, they are only recommended by MUTCD to alert motorists of unusual vehicular traffic conditions; distracted driving is not the outcome of unusual traffic conditions.</p>



United Power	No Comments	Acknowledged.
WUI	Establish maximum grades for roads not to exceed 10%; proposed roads steeper than 10% must be evaluated by and approved by a qualified professional engineer, taking into account climate, traffic load, environmental conditions, number of turns that would affect traffic flow, and the ability of fire apparatus to operate. See NFPA 1140, Sec. 11.16 for additional guidance on mitigation standards.	To make this change in the TDCM. It would be beneficial if this relief could be requested prior to applying for the Land Disturbance Permit. Could create a separate online permit.
	Establish a maximum angle of approach and departure of eight degrees for any point on a road or its intersection with another road, fire lane, or driveway. Approaches that exceed eight degrees must be evaluated by a qualified professional engineer to determine if emergency apparatus can accommodate such angles. See NFPA 1140 Sec. 11.16 for additional guidance on mitigation standards.	To clarify that this applies at intersections but not at any point along the driveway. Reference Standard 8 in the text. Update standard 8 to include private road intersections.
	Establish maximum grade for driveways not to exceed 12%; proposed driveways steeper than 12% must be evaluated by and approved by a qualified professional engineer, taking into account climate, traffic load, environmental conditions, number of turns that would affect traffic flow, and the ability of fire apparatus to operate. Driveways that are 15% in grade (if approved) can only serve one dwelling unit. Driveways cannot exceed 15% in grade.	To be incorporated in the TDCM Updates.
	Require pullouts for driveways exceeding 500 feet or a total driveway width of 16 ft, including a 12-foot all-weather travel surface and minimum two-foot shoulders on either side of the driveway.	Already applies
	Require a hammerhead turnaround for any driveway that exceed 150 feet in length.	Already applies

Revise the maximum number of habitable structures that any road serves in the WUI to include projections of ADUs. (LDR Section 15 states that cul-de-sacs cannot exceed one mile and serve no more than 30 existing plus proposed single family residential units or 100 multi-family units or meet alternative compliance mitigation measures. However, these do not account for ADUs)	To be incorporated into the ULUC updates.
Require at least 13 ft 6 in of vertical clearance over the full width of the road and driveway. See NFPA 1140, Sec. 11.2 for additional guidance on mitigation standards.	To be incorporated into the ULUC updates.
Require non-combustible signage and addressing for all roadways, bridges, and residences (including ADUs). See NFPA 1140, Section 11.2.18 for additional guidance on mitigation standards.	To be incorporated into the ULUC updates.
Require bridges and culverts to meet loading requirements of a minimum of 75,000 lbs. Gross Vehicle Weight (GVW); require maximum capacity to be posted on both approaches (per signage recommendations). See NFPA 1140, Sec. 11.2.10 and 11.3.12 for additional guidance on mitigation standards.	To be incorporated into the ULUC updates.
Revise any other requirements that currently require decision-making authority from the fire protection districts to a) ensure criteria is objective and clear in the TDCM, b) requires fire protection districts consultation, c) places decision-making authority with the County (with additional reliance on professional engineers, as applicable).	To be incorporated into the ULUC updates.

## Lindsey Wire

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**From:** Steven Parker <steven.parker@arvadafireco.gov>  
**Sent:** Tuesday, December 19, 2023 9:41 AM  
**To:** PZ-Regulation-Revisions  
**Subject:** --{EXTERNAL}-- Transportation Design and Construction Manual

### This Message Is From an External Sender

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Thank you for the opportunity to review and provide comments on this document. Overall, I do not have any technical recommendations or requests. I just want to clarify one section, 3.7.8.8. I understand that it is difficult to make a standard that works for everyone, especially fire departments. Although we do not have much development within our areas of unincorporated Jeffco, we do get a fair amount of new single-family dwellings on existing lots. We have run into challenges from time to time and required fire apparatus access based on the fire code and not this manual (an example would be a driveway longer than 50 feet, of which we do not allow driveways to be used for fire access). Does this section (3.7.8.8) provide us to enforce our department's fire apparatus access requirements? Thank you.



Steven Parker EFO, FM, MS  
Fire Marshal  
7903 Allison Way Arvada, CO 80005  
Desk:303-403-0477  
Mobile:303-263-9778  
[\[arvadafireco.gov\]](mailto:arvadafireco.gov) [www.ArvidaFireCO.gov](http://www.ArvidaFireCO.gov) [\[arvadafireco.gov\]](http://arvadafireco.gov)

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## Lindsey Wire

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**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Tuesday, December 19, 2023 3:34 PM  
**To:** Lindsey Wire  
**Cc:** Troy Jones  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

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**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Building Division

**Results: No Comment (no further review)**

**Review Comments:**

**Scheduled End Date: 19-DEC-23**

**Reviewer: Troy Jones**

**Description: Regulations Amendment to the Transportation and Construction Manual**

## Lindsey Wire

---

**From:** Planning Shared Mailbox <planningshared@cityofgolden.net>  
**Sent:** Friday, December 29, 2023 4:36 PM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

**Follow Up Flag:** Follow up  
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Good afternoon,

The City of Golden does not have any comments on the revised manual. Happy new year.

Regards,

**Karl Onsager, AICP (he/him)**

Current Planning Supervisor  
Community Development  
City of Golden  
p: 303.277.8772


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**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Monday, December 11, 2023 5:15 PM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

2<sup>nd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM)  [here](#) [[jeffcogov.sharepoint.com](https://jeffcogov.sharepoint.com)].

If you have trouble using the link. Please access the files by navigating to the [Jefferson County Citizen Portal](#), select “Advanced” and search by the Case Number (22-122945) and Permit Type (Regulation Amendment). From there, select “Detail” => “View Public Documents” and navigate to 3. Review Process Agency Comments, 2<sup>nd</sup> Referral, 1 Referral Documents.

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Friday, December 29, 2023.

Sincerely,

Planning and Zoning Staff

**Lindsey Wire, P.E.**

Planning & Zoning  
Engineering Supervisor  
303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

## TOGETHER JEFFCO 2023

County Plans and Regulations Update

*Help us shape the future of Jefferson County! Click this image to visit the Together Jeffco Website or type the URL into your browser: <https://togetherjeffco.com>. From there, you will find ways to provide comments through maps, an idea wall and questionnaires.*

[\[togetherjeffco.com\]](https://togetherjeffco.com)

**JEFFERSON**  
COUNTY COLORADO

We encourage scheduling an appointment to see staff during our office hours Monday - Thursday. Please schedule [appointments \[outlook.office365.com\]](https://outlook.office365.com) and submit [applications](#) online. Go to [planning.jeffco.us](http://planning.jeffco.us) for more information.

## Lindsey Wire

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**From:** Brooks Kaufman <BKaufman@core.coop>  
**Sent:** Sunday, December 17, 2023 11:52 AM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

**Follow Up Flag:** Follow up  
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Lindsey

CORE Electric Cooperative has no comments.

Respectfully

**Brooks Kaufman**  
Lands and Rights of Way Manager

800.332.9540 MAIN  
720.733.5493 DIRECT  
303.912.0765 MOBILE

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---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Monday, December 11, 2023 5:16 PM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

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Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

2<sup>nd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#) [\[us01.z.antigena.com\]](#).

If you have trouble using the link. Please access the files by navigating to the [Jefferson County Citizen Portal](#), select “Advanced” and search by the Case Number (22-122945) and Permit Type (Regulation Amendment). From there, select “Detail” => “View Public Documents” and navigate to 3. Review Process Agency Comments, 2<sup>nd</sup> Referral, 1 Referral Documents.

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Friday, December 29, 2023.

Sincerely,

Planning and Zoning Staff

**Lindsey Wire, P.E.**

Planning & Zoning  
Engineering Supervisor  
303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

## TOGETHER JEFFCO 2023

County Plans and Regulations Update

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**Jefferson County Planning & Zoning**  
**100 Jefferson County Parkway**  
**Golden CO 80419**

VIA EMAIL

December 27, 2023

**To:** Lindsey Wire, P.E., Planning & Zoning Engineering Supervisor

**Cc:** Chris O'Keefe, Director of Planning & Zoning.

**From:** Paul R. Olson, P.E., T.E. for the *Conifer & South Evergreen Community Committee*.

**Subject:** Review comments regarding the proposed updates to the Transportation Design and Construction Manual "Redline\_TDCM\_DRAFT\_12112023 distributed December 11, 2023

**GENERAL COMMENTS**

As I read this document several significant changes in response to our June 2023 comments have been made, yet many have not yet been addressed.

As matter of professional engineering protocol the document writer should reply to the commentor indicating the disposition of every comment. To date the county has failed to respond to my comments to the two previous versions of this document.

As a general matter, the Transportation Design and Construction Manual (TDCM) defines engineering standards; therefore, it is appropriate that the TDCM is under the strict authorship control of the Jefferson County Director of Traffic & Engineering engineer NOT the Director of Planning & Zoning. There is actually very little in the document that provides guidance with respect to planning and/or zoning. Similar documents authored by other cities, counties, and state departments of transportation are the domain of the engineering staff within the agency.

Additionally, many of the sections of the document are a jumble of clauses taken from other sources and assembled into this document. As a result, of our previous comments regarding, Templates 18,19,20, 21 and Standard 8 — only Standard 8 remains. The others should have been modified to remove the conflicts. For example, the Hammer Head emergency vehicle turn around has been deleted.

Moreover, the design standards, construction templates, and other guidance presented in the TDCM should also be reviewed and approved then sealed by a professional engineer.

*Conifer & South Evergreen*  
*Community Committee*  
[cosecc.co@gmail.com](mailto:cosecc.co@gmail.com)

This section should contain a description of why these specifications are here and what the county hopes to achieve. Should also include statements of how any submittal will be judged by staff.

The word “should” is used throughout the document. This is not an appropriate word to use in a regulatory document, as it is legally unenforceable. The correct words to use are Shall or Must.

There are a good number of items that are sole source, is this appropriate or allowed? Particularly if Federal funding is used. Sole source procurements may not provide the best value to the county.

The document should include discussion and presentation of the requirements for a “Clear Zone” where errant vehicles can safely recover without striking a hard impediment. <https://highways.dot.gov/safety/rwd/provide-safe-recovery/clear-zones/clear-zones> This will impact design requirements for roadway construction and reconstruction. This is also included in the CDOT Roadway Design Guide, Chapter 7 section 7.1.1.1.2, 7.2.1.16 and Chapter 13, 13.5.5.1. It also has a significant presence in the AASHTO Roadside Design Guide and the FHWA/AASHTO Highway Safety Manual. This is particularly important for the safety of motorists traveling on Jefferson County rural roads.

In general, the Traffic Study portion of the document is greatly improved. It still needs work to clarify specific portions. My professional opinion is that it is headed in the right direction.

#### **SPECIFIC COMMENTS**

The following are our specific comments with respect to the **TDCM Design and Technical Criteria**:

1. **Section 3.7.8 Non-Maintained Roads in County Right-of-Way, Driveways, and Private Street/Roads, and Non-Maintained Roads in County Right-of-Way Standards:** *Template 18 only addresses the cross section, it does not address the plan view. This template has been removed and should be corrected and returned to the document.*
2. **Section 3.7.8.1.2 Width:** *The Committee has determined that 500' is too long a distance; therefore, the **width** specification should be based and justified by the length of hose that the firefighting apparatus carries.*
3. **Section 3.7.8.1.3 Grade:** *Grade limitations are generally positive; however, the TDCM also needs to address the maximum change of grade from one roadway section to another. In many scenarios, going from 12% down to 12% up or 12% up to 12% down in a short distance will be a safety hazard and a problem for large vehicles*

*Additionally, there should be an explanation for this statement reading, for example: “**Maximum 12 percent grade where the dip of the natural terrain bears between South 60° East and South 45° West**”. Moreover, all other possible orientations should also be specified.*

4. **Section 3.7.8.2.1 Curve Radius:** *What is this 30’ curve radius based upon? There needs to be a reference or justification for this specification: It could be that a 30’ radius is not sufficient in many scenarios. Then how will conformance to this be judged? This revision simply dumps this on to the fire departments, to me this is unacceptable guidance, ask them what the minimum should be and/or use the truck turning templates.*
5. **Section 3.7.8.2.2 Width (For a street/road serving up to 15 dwelling units):** *Will parking be allowed on these roadways? What about horizontal and vertical obstructions? This **width** specification should situationally based?*
6. **Section 3.7.8.3:** *The use of the clause, “**The off-site driveway or private road shall meet requirements of this section**” is ambiguous. This specifically must clearly state, in detail, the **requirements** that the roadway design and construction is required to meet. As this section is written, it is not clear what would constitute an unacceptable roadway or driveway design! There are no details or drawings to clearly show what the minimum acceptable roadway and driveway consists of. The ones that used to exist conflict and have simply been removed. This section must include a statement similar to the following, “**The documentation shall include scale drawings upon which fire protection district approved turning templates are overlaid**”.*

*Additionally, my reaction to the following statement, “**Such statement shall bear the professional engineer’s seal, signature and date,...**” is that, as a professional engineer, I (Paul R. Olson, P.E., T.E.) would not risk my professional engineer’s licenses to approve plans for an on-site driveway or private roadway in a circumstance where the actual requirements are so ill-defined.*

*In addition, the county engineers should review the National Society of Professional Engineers (NSPE) code of ethics, <https://www.nspe.org/resources/ethics/code-ethics> . In signing such waiver that engineer would be in violation of engineering ethics codes.*

*Moreover, if the driveway can’t safely accommodate a fire protection district apparatus, then there is NO condition where an exception should be granted. This requirement should be deleted. It is not clear how Jefferson County Staff will judge any requested exemption under this clause. In my opinion, this clause will only cause Staff and the public significant, ongoing difficulties that*

are unnecessary. Again, there are no templates or drawings that detail the minimum requirements for driveways as they intersection with the county roadway! It should be the task of the applicant to prove their proposal meets standards set by the county and the fire departments.

**7. Templates 18, 19, 20 and 21 and Standard 8 conflict. See table:**

Template	Road surface width, minimum	Right of way/easement width
18	10	20
19	12	16
20	12	24
21	16	25
Standard 8	10/16-18	??

Standard 8 As shown in the above table this standard conflicts with the templates. Also, Section 3.7.8.1.1 and Section 3.7.8.2.1 which specify a 30' radius at the roadway centerline. It is my opinion that a driveway conforming to this standard will not allow safe and efficient fire truck access, particularly with a 10' edge radius and 10' roadway width. In addition, Standard 8 only addresses right angle intersections.

These templates should have been corrected to agree with one another rather than simply removed.

This standard should also detail the minimum public roadway dimensions. A narrow public road will also impact fire truck access to a private road.

This standard would also allow a tight turn with short radius very close (15') to the intersection which would also restrict fire truck access. This situation shall also be subject to Autoturn or turning template analysis.

This standard also references "see templates" but doesn't say which ones, would this be templates 18 to 21?

**8. Section 4.4. What are the reference documents for the design of the pavement? Is this in the CDOT publications?**

This should also address the current existing pavement structure. Will it hold up to major construction activity, and if so what will be the reduction in the pavement life?

9. **Section 5.1.10.1.1.** Good job to eliminate plastic sign usage.
10. **Section 5.1.10.1.4.** Rather than (or equivalent) I would suggest (or ACCEPTED equivalent). Plus you need to clearly state how equivalency will be judged. Will it be judged by physical tests or a simple review of catalog cuts?

- **Section 6.1.1.** There are number of things that should be included in all four levels of analysis,

*Limits of the area to be analyzed*

*Identification of the main access routes to the site*

*Identification and analysis of all emergency access routes*

*I would only accept the “Letter of Conformance” if it covers all of the regulations currently in force. I have seen some really poor TIS documents submitted to the county and I would not accept them under this clause.*

*Add a table summarizing the requirements for each of the 4 levels. This would include the count thresholds etc.*

*Add a section to clearly state the requirements for data collection. This would include the following:*

- *Areas covered (project limits)*
  - *Timing of the counts,*
  - *Count types,*
  - *Origin and destination of potential development users,*
  - *Count durations,*
  - *Days when counts shall not be taken unless approved in writing by the County Traffic Engineer.*
  - *Acceptable counting technology and accuracy levels.*
  - *I should also include data (trip tables, O&Ds, growth rates at a minimum) from the DRCOG traffic models.*
  - *Counts shall be continuous for the period specified, gaps in count data shall cause new counts to be taken.*
11. *A table summarizing the analysis for each level should also be considered. Traffic counts younger than 3 years may not be stale based upon the surrounding land use changes/developments.*
12. *The volume thresholds for both a “Transportation Analysis” and a “Traffic Impact Study” are 800 vpd. The “Transportation Analysis” should be eliminated and the TIS shall be completed as a part of the planning process not during the site development process. There isn’t enough rigor to the proposed analysis in the*

*“Transportation Analysis” to identify the true impact and the infrastructure improvements needed to be included in the site development process. Waiting until the site development process weakens the county ability to control the project. Particularly since the volume threshold is the same for each.*

13. **The “Trip Generation Summary Tables”** should be numbered. They should also include Saturday and Sunday as many land uses peak on the weekend.
14. If the Trip Generation Manual doesn’t include the subject land use, there shall be at least 3 similar sites studied as required in the manual. The specific requirements for this in the Trip Generation Manual should be cited. You should specify the data to be collected. There shall also be a succinct description of each site as well as identification of who collected the data and when.

*It is currently suggested that the sites’ capacity be used if no similar sites exist. Then who and how will the sites capacity be determined and documented? The number of parking spaces is not a good independent variable.*

15. The use of the Level of Service (LOS) is rather crude indicator of traffic operations.  
*The origins of LOS was as a public relations tool not for quantitative analysis. The Volume Capacity Ratio (V/C) is more illustrative of the actual impacts.*

*Consider a facility that operates at a V/C of 0.89 which would map to LOS D yet is just below LOS E. Would that be acceptable? How many hours during the day will the facility operate in the V/C regime? If it is 15 minutes it may be acceptable but 4 hours would clearly not be.*

16. A Traffic Impact Study shall include analysis using the DRCOG models. A simple HCM analysis won’t tell the full regional impact of such a large development. For example, large developments with major traffic destinations in the Denver metro area have a significant impact on US 285 traffic in Turkey Creek Canyon and currently is not assessed for traffic impacts.
17. **Evacuation Study.** An Evacuation Study shall be included. The recent fires such as the Marshall and the Paradise Fires clearly indicate that evacuation is a major problem. It shall clearly delineate the tributary areas being evacuated and the capacity of each of the evacuation routes. In the mountains and rural areas of the county it should include large vehicles, vehicles evacuating livestock and other large animals as well as recreational vehicles.
18. **Appendices.** Appendices to this document should include suggested consultant work scopes for these tasks. Otherwise, there will be no uniformity in the documents submitted to the county. This will require more county staff time to review.

## 19. ***Templates.***

- *Template 5 shows a single curb ramp on each corner. The ramps are oriented such that a sight impaired person would be directed into the center of the intersection. This is not a safe design according to the sight impaired community, particularly at signalized intersections. Federal Highways guidance is for two ramps on each corner oriented to a corresponding ramp across the intersection.*
- *Template 8 does not indicate the width of the public road which may not be wide enough to accommodate fire truck access. This was a previous issue that has yet to be resolved.*
- *Templates 16-1 and 16-2 are not included in the table in Section 5.2. They should also be relocated with templates 26-.\*.*
- *Template 16-2 is clearly a sole source item. To me this is a pretty generic lighting fixture it should not be sole source*
- *Template 16-1 shows several different styles of lighting fixtures therefore there is a conflict with Template 16-2.*
- *Template 26-6 appears to be a direct copy from vendor supplied materials therefore sole source. If another manufacture supplied a pole with the same dimensions as those shown would it be accepted and what would be that process?*
- *Templates 26-1 and 26-9 need to be updated to reference the 2020 Interim Revisions to the LEFD specifications. The changes are significant.*

## **CONCLUSION**

The Committee is hopeful that the above recommendations will help improve the future health, safety, and welfare of both residents, visitors, and travelers in the unincorporated areas of Jefferson County.

Respectfully submitted,

Paul R. Olson, P.E., T.E.

25587 Conifer Road

STE 105-611

Conifer CO 80433

***Conifer and South Evergreen Community Committee***



## Lindsey Wire

---

**From:** David Duncan <davidduncn@gmail.com>  
**Sent:** Friday, December 29, 2023 2:22 PM  
**To:** Lindsey Wire  
**Cc:** Chris OKeefe  
**Subject:** --{EXTERNAL}-- Re: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral  
**Attachments:** d21\_curb\_opening\_details.pdf; m-609-1-curb-gutters-and-sidewalks.pdf  
**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

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Lindsey,

Hope that you had a great Holiday! Here are my comments on the proposed regulation changes:

3.7.8.1.3 Exception for Mountains - 15% grade, spaced by 1,000' and allowance if fire sprinklers are installed - where did these numbers come from? 1,000' separation seems arbitrary, was this input from the Fire Districts? I object to requiring fire sprinklers, why not just grant the exception without that requirement?

3.7.8.1.4 Turnaround - should read "or sufficient space to turn around meeting the same dimensions...." If room is present for the fire truck to turn around nothing further should be required.

3.7.8.2.2 Width - Template 18b allows for width smaller than stated total of 20'. I believe a total width of 18' incl shoulders is sufficient, does not need to be 20', and there are numerous places in the mountains with private drives smaller than 20'.

Template 18d is min total width 14'?

3.7.8.3 Offsite Driveways - BIG OBJECTION, the way this is written for relief of any of the standard dimensions:

1. Submit survey and plan from registered PE - this will cost someone \$5-20K to get done.
2. Agree to install sprinklers - est \$25K cost

This will create the same situation as when the requirement to prove defensible space for ANY building permit was passed - people stopped applying for building permits. I GUARANTEE you the same will happen with this regulation change.

Suggestion: give P&Z Chair the option to administratively waive requirements, and in doing so he MAY require survey and/or evaluation from an Engineer. Requiring sprinklers is a terrible idea! Let the insurance companies handle that!

Construction Stds - if the County does not already have it they should include stds for:

- Spill (reverse) curb - see attached CDOT Std
- Curb Openings for Drainage - see attached std from CO Springs



Thanks and Happy New year!

David Duncan

On Mon, Dec 11, 2023 at 5:15 PM Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)> wrote:

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

2<sup>nd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here \[jeffcogov.sharepoint.com\]](#).

If you have trouble using the link. Please access the files by navigating to the [Jefferson County Citizen Portal](#), select "Advanced" and search by the Case Number (22-122945) and Permit Type (Regulation Amendment). From there, select "Detail" => "View Public Documents" and navigate to 3. Review Process Agency Comments, 2<sup>nd</sup> Referral, 1 Referral Documents.

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Friday, December 29, 2023.

Sincerely,

Planning and Zoning Staff

**Lindsey Wire, P.E.**

Planning & Zoning

Engineering Supervisor

303.271.8717

## TOGETHER JEFFCO 2023

### County Plans and Regulations Update

*Help us shape the future of Jefferson County! Click this image to visit the Together Jeffco Website or type the URL into your browser: <https://togetherjeffco.com>. From there, you will find ways to provide comments through maps, an idea wall and questionnaires.*

[\[togetherjeffco.com\]](https://togetherjeffco.com)



We encourage scheduling an appointment to see staff during our office hours Monday - Thursday. Please schedule [appointments \[outlook.office365.com\]](https://outlook.office365.com) and submit [applications](#) online. Go to [planning.jeffco.us](http://planning.jeffco.us) for more information.

## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Tuesday, December 19, 2023 2:34 PM  
**To:** Lindsey Wire  
**Cc:** Nathan Seymour  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Engineer (Development Review)

**Results: Comments Sent (no further review)**

**Review Comments: No additional comments at this time. Pending comments received by internal and external agencies modifications may be required.**

**Scheduled End Date: 19-DEC-23**

**Reviewer: Nathan Seymour**

**Description: Regulations Amendment to the Transportation and Construction Manual**



# Evergreen Fire/Rescue

1802 Bergen Parkway • Evergreen, Colorado 80439  
Phone: 303-674-3145 • Fax: 303-674-8701

December 21, 2023

Lindsey Wire, P.E.  
Jefferson County Planning & Zoning  
100 Jefferson County Parkway  
Golden, CO 80401

Re: Transportation Design and Construction Manual Case# 22-122945AM

Ms. Wire:

The 2<sup>nd</sup> referral redline amendments to the Transportation Design and Construction Manual dated 12/11/2023 were reviewed for by the Evergreen Fire Protection District (the District). The District has the following comments and/or requests for clarification.

## 1. Section 3.1.8.7.3 Grade

It is specified in the main body of this section that an increase to twelve (12) percent grade is allowed when the terrain is on a southern facing aspect. However, in the exception section that allows an increase to fifteen (15) percent grade with installation of an approved automatic fire sprinkler section it is not specified that the exception applies only on terrain that has a southern facing aspect. Clarification is necessary as to if the exception applies only to southern facing aspects.

## 2. Southern facing aspects (general)

As a general question, as modifications to grade and other specifications may be granted based upon terrain that has a southern facing aspect; is there any consideration applied to the roadway being shaded or not?

## 3. Template 18a

Template 18a indicates a 2-foot and 3-foot shoulder dimension on the left side but only a 2-foot on the right side. Could this be clarified or corrected if it is an error?

Please contact me at (303) 679-4746 or via e-mail at [kferry@evergreenfirerescue.com](mailto:kferry@evergreenfirerescue.com) if you should have any questions or need further information.

Sincerely,

Kevin Ferry  
Fire Marshal

Date: December 29, 2023

To: Lindsey Wire, Jefferson County Planning & Zoning

From: Fran Evers, Jefferson County Horse Council

Subject: Regulation Amendment Case 22-122945AM – Transportation  
Design and Construction Manual - 2nd Referral



Jefferson County Horse Council is respectfully submitting the following comment regarding Regulation Amendment Case 22-122945AM reference above.

Sections 3.7.3.1 and Section 3.7.3.2 regarding right turn acceleration lanes. JCHC would like to recommend that these 'lanes' be required for entrances to and from Equestrian Centers and medium to large boarding stables and equine farms.

Comment: Slowing down sufficiently when trailering live animals to enter these types of facilities poses a traffic hazard and slows traffic down. Having a horse trailer rear ended is an ugly accident often resulting the serious injury to animals in the trailer. Also exiting these facilities without an acceleration lane poses a significant problem for a driver pulling a trailer requiring a significantly larger gap in traffic to safely enter the flow of traffic, thus creating a potential safety issue. A good example is entering and exiting the Arvada Indiana Equestrian Center on 75<sup>th</sup> and Indiana. We are suggesting this for all road classifications with the possible exemption of 'Local.'

#### Section 6.4 Transportation Analysis

Section 6.4.2. Format, subparagraph "Projected Traffic" (pg 46) Insert after the 6<sup>th</sup> sentence:  
*Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.*

#### Section 6.4 Transportation Analysis

Section 6.4.2. Format, subparagraph "Analysis" (pg 48) Insert after the 2<sup>nd</sup> sentence:  
*Consideration should be given to site-specific safety issues for vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict.*

#### Section 6.5 Transportation Impact Studies

Section 6.5.2. Format, subparagraph "Projected Traffic" (pg. 49) Insert after the 5<sup>th</sup> sentence:

*Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.*

## Section 6.5 Transportation Impact Studies

Section 6.5.2. Format, subparagraph “Transportation Safety” (pg 50) modify the third sentence of the section to (modified areas in italics): “...improve pedestrian and bicyclist safety and minimize *vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict points.*”

Section 6.5.2 Format>Factors – Add Equestrian to bullet point 9: ‘Pedestrian, Equestrian and Bicycle Movements/Continuity of Factors.’

Comment: The presence and movement of equines within a certain area of a proposed development should be considered just as it is for pedestrians and bicycles. The traditional ‘paths’ used by equestrians have vanished over the past 30 years in the more populated areas of Jefferson County such as Lakewood, Arvada, Littleton and Golden disallowing equestrian the ability to safely ride from the location where their animal is kept to a park or trail. This was tragically brought home in the accident that occurred in Arvada requiring Griffin to be euthanized at the sight of the accident and injuring his heartbroken owner. JCHC along with other area horse associations and clubs would be more than willing to participate in helping to define areas in Jefferson County that have an equine presence.

Section 6.5.2 Format>Signalized Intersection: Level of Service – Add Equestrian to bullet point 10: ‘Bicycle, pedestrian and equine flows’

Comment: Same as Format>Factors comment above.

Section 6.5.2 Format>Roundabouts – Add Equestrian to bullet point 10: “bicycle, pedestrian and equestrian flows.’

Comment: Same as Format>Factors comment above.

General Comment: We recommend adding ‘equestrian’ to any place in this regulation that has ‘bicycle and pedestrian.’

## **Appendix**

### Section 3. Transportation Analysis

Subparagraph “Projected Traffic” (pg 62) Insert after the 5<sup>th</sup> sentence: *Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.*

### Section 3. Transportation Analysis

#### Example Outline

Subparagraph “Analysis” (pg 65) Insert after last existing sentence of the section: *Consideration should be given to site-specific safety issues for vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict.*

#### Section 4. Transportation Impact Studies

##### SubSection B. Format

Subparagraph “Projected Traffic” (pg 66 & 67) Insert after 4<sup>th</sup> sentence of the section: *Consideration should be given to site-specific uses that may result in the need for acceleration or deceleration lanes due to vehicle trips frequently involving larger vehicles or vehicles pulling trailers.*

#### Section 4. Transportation Impact Studies

##### SubSection B. Format

Subparagraph “Transportation Safety” (pg 68) modify the third sentence of the section to (modified areas in italics): “...improve pedestrian and bicyclist safety and minimize *vehicle/pedestrian, vehicle/bicyclist, and vehicle/equestrian conflict points.*”

Traffic Counts> 4. Transportation Impact Study>Transportation Analysis>Factors – Add Equestrians to bullet point 9: ‘Pedestrian, Equine and Bicycle Movement/Continuity of Facilities.

Comment: Same as Format>Factors comment above

Transportation Analysis>Signalized Intersections – Add equestrians to bullet point 10: bicycles, pedestrian and equine flows.’ Also if there is a manual pedestrian ‘control button’ to stop traffic, an equestrian rider height manual ‘control button’ should be made available to accommodate mounted equestrians.

Comment: Same as Format>Factor comment above. Also, having a ‘control button’ that is equestrian rider height provides a much safer way for an equestrian to pause traffic. Reaching over to push a button designed for pedestrians especially pedestrians confined to wheelchairs/scooters while controlling a 1000# plus animal can be challenging. Dismounting, leading the equine across the road and mounting on the other side of the road also poses a safety issue as an equestrian is in the most dangerous position when mounting and dismounting. Allowing equestrians to safely and quickly cross a road while mounted is the safest solution for both the rider and the traffic.

Transportation Analysis>Roundabouts – Add equestrian to bullet point 8: ‘bicycle, pedestrian and equine flows.’

Comment: Same as Format>Factor comment above.

Our reviewers had a few additional comments and we’re not quite sure where they should be placed as recommendations in this document. They are as follows:

Consider defining and adding ‘Equestrian Infrastructure’ similar to ‘Bicycle Infrastructure.’ JCHC would be willing to provide input this.

Consider developing road design standards for street crossings utilized by equestrians. JCHC could provide design recommendations on this. Equine depth perception is quite different than human depth perception. Horses can perceive the white stripes across a road that are often used to indicate a pedestrian or game crossing as a 'cattle guard' or something dangerous and refuse to walk across the lines possibly shying into traffic.

Consider additional signage to alert drivers that equestrians may be in the area. We understand signage is expensive and some criteria would need to be established for the placement of this type of signage if such criteria does not already exist. We do see some of these types of signs throughout the county which is appreciated. JCHC would be willing to provide input and recommendations including possible locations.

Consider adding rumble strips around stop signs and along roads that don't have sidewalks or shoulders to alert drivers and help keep pedestrians and equestrian safe. The tragic equine/auto accident mentioned above might have been prevented had rumble strips been present at the stop sign. It is our understanding that the driver was distracted in some way and ran the stop sign thus hitting the horse and rider. Rumble strips might have drawn his attention back to the road and the upcoming stop sign.

Thank you for allowing JCHC to provide input into this regulation. If you have any questions, please feel free to contact us.

Frank Blaha, JCHC President  
[fjblaha@gmail.com](mailto:fjblaha@gmail.com) 303-895-7982

Fran Evers, JCHC Treasurer and Land Use Committee Chairperson  
[Franevers18@gmail.com](mailto:Franevers18@gmail.com) 303-817-4818

Respectively submitted,

Fran Evers



## Lindsey Wire

---

**From:** Mary Beth Mainero <marybethmainero@gmail.com>  
**Sent:** Thursday, December 14, 2023 6:56 PM  
**To:** PZ-Regulation-Revisions  
**Cc:** Jordan Wells; Lacombe - CDOT, Christiana; MikWhi@lakewood.org  
**Subject:** --{EXTERNAL}-- Case #2-122945AM Jeffco. Planning and Zoning  
**Attachments:** image001.png

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

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Report Suspicious

I received the following from our HOA (MSI) who thought this might be part of my outreach to CDOT and City of Lakewood for a crosswalk, light and turning lane into our community, Red Rocks Ranch, Morrison Road and Girton (Rooney Road).

Please let me know.

"Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

2<sup>nd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website \[linkprotect.cudasvc.com\]](https://linkprotect.cudasvc.com) and in the case folder (22-122945AM)  [here \[linkprotect.cudasvc.com\]](#).

If you have trouble using the link. Please access the files by navigating to the [Jefferson County Citizen Portal \[linkprotect.cudasvc.com\]](https://linkprotect.cudasvc.com), select "Advanced" and search by the Case Number (22-122945) and Permit Type (Regulation Amendment). From there, select "Detail" => "View Public Documents" and navigate to 3. Review Process Agency Comments, 2<sup>nd</sup> Referral, 1 Referral Documents.

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Friday, December 29, 2023.

Sincerely,

Planning and Zoning Staff"

Respectfully,

Mary Beth Mainero

Resident and Representative of Red Rocks Ranch, Morrison

## Lindsey Wire

**From:** Elizabeth Stoner  
**Sent:** Wednesday, December 20, 2023 1:17 PM  
**To:** Lindsey Wire  
**Subject:** RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Perfect! Here is what we have so far:

- Change flagmen to flaggers on page 8

TABLE	SAMPLE CROSS SECTION	AREA OF
Drawn By: DAB		TRANSPORTATION AND ENGINEERING
Designed By: STAFF		100 JEFFERSON CTRY. HWY., SUITE 3500
FILE: TypSec_04		COLORADO, CO. 80419 (303) 271-8495

### 2.6. Details

Jefferson County or CDOT standard details may be referenced as applicable. Where these standards cannot be used, a separate detail sheet shall be provided with an explanation detailing why these standard details are not being used.

### 2.7. Standard Notes

The following general notes shall appear on the cover sheet or the first sheet of the plans for all street/road construction plan packages.

1. A Construction Permit from Transportation and Engineering is required prior to commencing work within County Right-of-Way.
2. Any work within State Right-of-Way will require a State Construction Permit.
3. The contractor shall notify Transportation and Engineering at least 24 hours prior to starting construction within the Right-of-Way.
4. The contractor shall provide all signs, barricades, flagmen, lights, or other devices necessary for safe construction traffic control in accordance with the current edition of the MUTCD and as modified by the Colorado Supplement to the MUTCD. A construction traffic control plan shall be submitted to and approved by Transportation and Engineering prior to the issuance of any construction permit for

Transportation Design and Construction Manual – Amended ~~12-17-19XX-XX-XX~~

- Ensure the Minimum Sight Distance Requirements Table on page 17 is on 1 page and don't let the header get cut off on a different page. General comment for all tables.
- Number/Label figures and tables
- 5.1.7.1 and 5.1.7.3 are almost identical. Can one be removed, or can they be combined?
- STND numbers in the document don't match the drawings.

If there are additional questions or comments on this application while I'm out of office, they will likely come from Scot Grossman.

Thanks and Happy Holidays!

**Elizabeth Stoner**

Planner

Pronouns: She, her, hers

260.715.2047 cell, jeffco.us



---

**From:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>

**Sent:** Wednesday, December 20, 2023 1:08 PM

**To:** Elizabeth Stoner <[estoner@co.jefferson.co.us](mailto:estoner@co.jefferson.co.us)>

**Subject:** RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

If you can email them that is perfect!

Thanks,

**Lindsey Wire, P.E.**

Planning & Zoning

Engineering Supervisor

303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



## TOGETHER JEFFCO 2023

County Plans and Regulations Update

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We encourage scheduling an appointment to see staff during our office hours Monday - Thursday. Please schedule [appointments](#) and submit [applications](#) online. Go to [planning.jeffco.us](http://planning.jeffco.us) for more information.

---

**From:** Elizabeth Stoner <[estoner@co.jefferson.co.us](mailto:estoner@co.jefferson.co.us)>

**Sent:** Wednesday, December 20, 2023 1:07 PM

**To:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>

**Subject:** RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

In the meantime, we do have some comments / questions for the review. Would you like me to put these into AMANDA or email them to you directly?

**Elizabeth Stoner**

Planner

Pronouns: She, her, hers

260.715.2047 cell, [jeffco.us](http://jeffco.us)



---

**From:** Elizabeth Stoner  
**Sent:** Wednesday, December 20, 2023 12:50 PM  
**To:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>  
**Subject:** RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

Awesome -thanks, Lindsey!

**Elizabeth Stoner**  
Planner  
Pronouns: She, her, hers  
260.715.2047 cell, [jeffco.us](http://jeffco.us)



---

**From:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>  
**Sent:** Wednesday, December 20, 2023 12:01 PM  
**To:** Elizabeth Stoner <[estoner@co.jefferson.co.us](mailto:estoner@co.jefferson.co.us)>  
**Subject:** RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

Hi Elizabeth,

That works for me!

Thanks!

**Lindsey Wire, P.E.**  
Planning & Zoning  
Engineering Supervisor  
303.271.8717  
[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

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County Plans and Regulations Update

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We encourage scheduling an appointment to see staff during our office hours Monday - Thursday. Please schedule [appointments](#) and submit [applications](#) online. Go to [planning.jeffco.us](#) for more information.

---

**From:** Elizabeth Stoner <[estoner@co.jefferson.co.us](mailto:estoner@co.jefferson.co.us)>

**Sent:** Wednesday, December 20, 2023 9:34 AM

**To:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>

**Subject:** Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

Hey Lindsey,

I'm going to be out of the office starting tomorrow until the new year. Our Projects Team is still reviewing the proposed updates to the Transportation Design and Construction Manual and I know comments will be due before I get back to the office.

Can I have our Projects Team Supervisor email you directly once his team has had the chance to review the proposed changes?

Thanks!

**Elizabeth Stoner**

Planner

Pronouns: She, her, hers

260.715.2047 **cell**, [jeffco.us](#)



## Lindsey Wire

---

**From:** Carlos Atencio  
**Sent:** Friday, December 22, 2023 9:00 AM  
**To:** Lindsey Wire; Chris OKeefe; Cassidy Clements  
**Cc:** Nathan Seymour  
**Subject:** RE: DEVREV for Sign-off

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Yes, this is for edge drains, curb drains, or any other drainage systems that are proposed in new development for Road & Bridge to maintain in the future.

### Carlos Atencio

Operations Manager

o 303.271.5204 f 303.271.5222 w [jeffco.us](http://jeffco.us)

---

**From:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>  
**Sent:** Thursday, December 21, 2023 9:54 AM  
**To:** Chris OKeefe <[cokeefe@co.jefferson.co.us](mailto:cokeefe@co.jefferson.co.us)>; Cassidy Clements <[cclement@co.jefferson.co.us](mailto:cclement@co.jefferson.co.us)>  
**Cc:** Carlos Atencio <[catencio@co.jefferson.co.us](mailto:catencio@co.jefferson.co.us)>; Nathan Seymour <[nseymour@co.jefferson.co.us](mailto:nseymour@co.jefferson.co.us)>  
**Subject:** RE: DEVREV for Sign-off

Hi Carlos,

Would you mind providing us with a little more detail regarding this comment? Is this for edge drains? Another question would be if this is for ROW and private or just ROW? We can definitely get this added once T&E sends over the changes but we will need to get them in the next few weeks in order to meet our timeline for hearings.

Thanks!

**Lindsey Wire, P.E.**  
Planning & Zoning  
Engineering Supervisor  
303.271.8717  
[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

# TOGETHER JEFFCO 2023

## County Plans and Regulations Update

*Help us shape the future of Jefferson County! Click this image to visit the Together Jeffco Website or type the URL into your browser: <https://togetherjeffco.com>. From there, you will find ways to provide comments through maps, an idea wall and questionnaires.*



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**From:** Chris O'Keefe <[cokeefe@co.jefferson.co.us](mailto:cokeefe@co.jefferson.co.us)>  
**Sent:** Thursday, December 21, 2023 8:42 AM  
**To:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>; Cassidy Clements <[cclement@co.jefferson.co.us](mailto:cclement@co.jefferson.co.us)>  
**Cc:** Carlos Atencio <[catencio@co.jefferson.co.us](mailto:catencio@co.jefferson.co.us)>  
**Subject:** FW: DEVREV for Sign-off

Does this make sense? Please reach out to Carlos if we need more info.

Thanks,  
Chris

**Chris O'Keefe, AICP**  
(he, him, his)

Planning and Zoning Director

Jefferson County

o 303-271-8713

[cokeefe@jeffco.us](mailto:cokeefe@jeffco.us) | Find us on the web: [planning.jeffco.us](https://planning.jeffco.us)

# TOGETHER JEFFCO 2023

## County Plans and Regulations Update

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**From:** Carlos Atencio <[catencio@co.jefferson.co.us](mailto:catencio@co.jefferson.co.us)>

**Sent:** Thursday, December 21, 2023 7:54 AM

**To:** Lindsay Townsend <[ltownsen@co.jefferson.co.us](mailto:ltownsen@co.jefferson.co.us)>; Christina Lane <[clane@co.jefferson.co.us](mailto:clane@co.jefferson.co.us)>; Levi LaGuardia <[llaguard@co.jefferson.co.us](mailto:llaguard@co.jefferson.co.us)>; Kelly Dunne <[kdunne@co.jefferson.co.us](mailto:kdunne@co.jefferson.co.us)>; Mike Vanatta <[mvanatta@co.jefferson.co.us](mailto:mvanatta@co.jefferson.co.us)>; Ramey Fox <[rfox@co.jefferson.co.us](mailto:rfox@co.jefferson.co.us)>; Robert Taylor <[rbtaylor@co.jefferson.co.us](mailto:rbtaylor@co.jefferson.co.us)>; Stefi Szrek <[sszrek@co.jefferson.co.us](mailto:sszrek@co.jefferson.co.us)>

**Cc:** Domingo Lora <[dlora@co.jefferson.co.us](mailto:dlora@co.jefferson.co.us)>; Gene Bennetts <[gbennett@co.jefferson.co.us](mailto:gbennett@co.jefferson.co.us)>; Mike Secary <[msecary@co.jefferson.co.us](mailto:msecary@co.jefferson.co.us)>; Chris OKeefe <[cokeefe@co.jefferson.co.us](mailto:cokeefe@co.jefferson.co.us)>

**Subject:** RE: DEVREV for Sign-off

Good morning,

Road & Bridge is requesting the expansion or addition of language to Section 5.1.8.1 to include tracer wires to curb drains. Installation details would also have to be included. I believe the T&E group is currently working on the installation details.

Please let me know how we can help.

Thank you,

**Carlos Atencio**

Operations Manager

o 303.271.5204 f 303.271.5222 w [jeffco.us](http://jeffco.us)

---


**From:** Lindsay Townsend <[ltownsen@co.jefferson.co.us](mailto:ltownsen@co.jefferson.co.us)>

**Sent:** Wednesday, December 20, 2023 3:51 PM

**To:** Christina Lane <[clane@co.jefferson.co.us](mailto:clane@co.jefferson.co.us)>

**Subject:** DEVREV for Sign-off

Hi Christina,

Looks like there is only on DEVREV for sign-off today. It is  [TE 12-29-2023 22-122945 AM Transportation Design and Construction Manual.docx](#).

If you think everything looks good, please let me know and I'll send it to P&Z.

Thank you,

**Lindsay Townsend**

Administrative Coordinator Sr.

**Jefferson County**

100 Jefferson County Parkway, Suite 3500

Golden, CO 80419

o 303.271.8461

[ltownsen@jeffco.us](mailto:ltownsen@jeffco.us)

Find us on the web: [www.jeffco.us](http://www.jeffco.us)  
[Facebook](#) | [Twitter](#) | [Instagram](#)

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**From:** Levi LaGuardia <[llaguard@co.jefferson.co.us](mailto:llaguard@co.jefferson.co.us)>  
**Sent:** Wednesday, December 20, 2023 11:33 AM  
**To:** Lindsay Townsend <[ltownsen@co.jefferson.co.us](mailto:ltownsen@co.jefferson.co.us)>; Christina Lane <[clane@co.jefferson.co.us](mailto:clane@co.jefferson.co.us)>; Kelly Dunne <[kdunne@co.jefferson.co.us](mailto:kdunne@co.jefferson.co.us)>; Mike Vanatta <[mvanatta@co.jefferson.co.us](mailto:mvanatta@co.jefferson.co.us)>; Ramey Fox <[rfox@co.jefferson.co.us](mailto:rfox@co.jefferson.co.us)>; Robert Taylor <[rbtaylor@co.jefferson.co.us](mailto:rbtaylor@co.jefferson.co.us)>; Stefi Szrek <[sszrek@co.jefferson.co.us](mailto:sszrek@co.jefferson.co.us)>  
**Subject:** Re: DEVREV: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral - Due 12/29

TOP review is complete!

All the Best,

**Levi LaGuardia, EIT**

Associate Transportation Engineer  
Jefferson County Transportation and Engineering  
100 Jefferson County Pkwy, Suite 3500 | Golden, CO 80419  
(303) 271-8471 | [llaguard@jeffco.us](mailto:llaguard@jeffco.us)



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**From:** Lindsay Townsend <[ltownsen@co.jefferson.co.us](mailto:ltownsen@co.jefferson.co.us)>  
**Sent:** Tuesday, December 12, 2023 7:32 AM  
**To:** Christina Lane <[clane@co.jefferson.co.us](mailto:clane@co.jefferson.co.us)>; Kelly Dunne <[kdunne@co.jefferson.co.us](mailto:kdunne@co.jefferson.co.us)>; Levi LaGuardia <[llaguard@co.jefferson.co.us](mailto:llaguard@co.jefferson.co.us)>; Mike Vanatta <[mvanatta@co.jefferson.co.us](mailto:mvanatta@co.jefferson.co.us)>; Ramey Fox <[rfox@co.jefferson.co.us](mailto:rfox@co.jefferson.co.us)>; Robert Taylor <[rbtaylor@co.jefferson.co.us](mailto:rbtaylor@co.jefferson.co.us)>; Stefi Szrek <[sszrek@co.jefferson.co.us](mailto:sszrek@co.jefferson.co.us)>  
**Subject:** DEVREV: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral - Due 12/29

Good morning,

Please see Lindsey Wire's below email.

Here is the comment form:  [TE 12-29-2023 22-122945 AM Transportation Design and Construction Manual.docx](#)

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**From:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>  
**Sent:** Monday, December 11, 2023 5:15 PM  
**To:** PZ-Regulation-Revisions <[PZRegRev@co.jefferson.co.us](mailto:PZRegRev@co.jefferson.co.us)>  
**Subject:** Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

2<sup>nd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#).

If you have trouble using the link. Please access the files by navigating to the [Jefferson County Citizen Portal](#), select “Advanced” and search by the Case Number (22-122945) and Permit Type (Regulation Amendment). From there, select “Detail” => “View Public Documents” and navigate to 3. Review Process Agency Comments, 2<sup>nd</sup> Referral, 1 Referral Documents.

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Friday, December 29, 2023.

Sincerely,

Planning and Zoning Staff

**Lindsey Wire, P.E.**

Planning & Zoning  
Engineering Supervisor  
303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

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County Plans and Regulations Update

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## Lindsey Wire

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**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Tuesday, December 12, 2023 10:24 AM  
**To:** Lindsey Wire  
**Cc:** Mark Weiden  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

**Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Road & Bridge

**Results: No Comment (no further review)**

**Review Comments:**

**Scheduled End Date: 19-DEC-23**

**Reviewer: Mark Weiden**

**Description: Regulations Amendment to the Transportation and Construction Manual**

## Lindsey Wire

---

**From:** Steve Smith <Steven.Smith@RTD-Denver.com>  
**Sent:** Wednesday, December 27, 2023 10:23 AM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

This message came from outside your organization.

Report Suspicious

Lindsey,

RTD staff have reviewed this proposal and have no comments at this time.

Thanks,

### Steve Smith

Engineer III  
Capital Programs, Engineering Design  
he | him | his [\[mypronouns.org\]](https://mypronouns.org)  
o 303.299.6946 m 720.296.4929  
[steven.smith@rtd-denver.com](mailto:steven.smith@rtd-denver.com)  
[rtd-denver.com](https://rtd-denver.com) [\[rtd-denver.com\]](https://rtd-denver.com)



Regional Transportation District  
1660 Blake Street, BLK-21  
Denver, CO 80202

***We make lives better through connections.***

---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Monday, December 11, 2023 5:15 PM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** Regulation Amendment Case 22-122945AM – Transportation Design and Construction Manual - 2nd Referral

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual. This regulation update includes updates to Chapters 3 and 5 as well as updates to the Transportation Studies Appendix, Standard Details, and Templates.

2<sup>nd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here \[jeffcogov.sharepoint.com\]](#).

If you have trouble using the link. Please access the files by navigating to the [Jefferson County Citizen Portal](#), select “Advanced” and search by the Case Number (22-122945) and Permit Type (Regulation Amendment). From there, select “Detail” => “View Public Documents” and navigate to 3. Review Process Agency Comments, 2<sup>nd</sup> Referral, 1 Referral Documents.

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

Comments are due Friday, December 29, 2023.

Sincerely,

Planning and Zoning Staff

**Lindsey Wire, P.E.**

Planning & Zoning  
Engineering Supervisor  
303.271.8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

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County Plans and Regulations Update

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[\[togetherjeffco.com\]](https://togetherjeffco.com)



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1. Does newly added section 3.7.8.8. All rules and regulations of the applicable Fire Protection District shall govern, give the fire district, in this case South Metro Fire Rescue, the ability to enforce the adopted fire code within our jurisdiction, or are new developments required to follow the new transportation design guild?
2. If the fire code is enforceable within the fire protection district boundaries, as adopted by the Board of County Commissioners, then our only comment is item #3. If the transportation design guild is required to be used in leu of the adopted fire code, then we have major concerns with the new templates, specifically 18A-D, and will have several more comments to add.
3. We would like to add Emergency and Fire Apparatus Access to the signalized intersection list and the roundabout list.

## P&Z REFERRAL T&E RESPONSE

**To:** Lindsey Wire

**Case #:**22-122945 AM

**Case Name, Address, or PIN:**

**From:** Transportation & Engineering

**Due Date:**December 29, 2023

Transportation Design and  
Construction Manual

**Amanda Attempt Result & Attachments:**

☐ Comments Sent (no further review)

☐ Comments Sent (request re-review)

☒ No Comment (no further review)

### Drainage

☐ T&E is currently working on a project in the area. See attached information.

☐ No concerns.

☐ Other Notes:

### Right-of-Way / Roadway Corridor Expansion Projects

☒ **Corridor Projects / ROW**

☐ Land owner will need to refund the county \$ \_\_\_\_\_ for ROW purchased in \_\_\_\_\_ for  
This amount **must** be paid before plat is recorded and / or plans are approved and released for construction.

☐ Documentation attached in AMANDA. ☐ Documentation to follow.

☐ Additional ROW needed for upcoming T&E project. Plan sheet attached with required width / area.

☐ Fee-in-lieu of adjacent roadway construction preferred, due to planned construction by the county. Please have the applicant submit a cost estimate.

☒ No Concerns.

☐ Other Notes:

### Traffic Operations / Transportation Planning

	Included in referral	Reviewed		<input checked="" type="checkbox"/> Transportation Planning <input checked="" type="checkbox"/> Transportation Engineering
		No	Yes	
Traffic Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Signage & Striping Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic Signal Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Trails or Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Street / Road Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

☒ No Concerns.

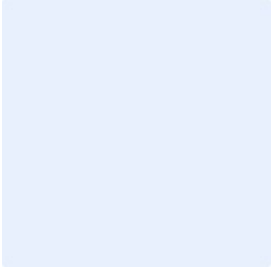
☐ Other Notes:



## Additional Comments

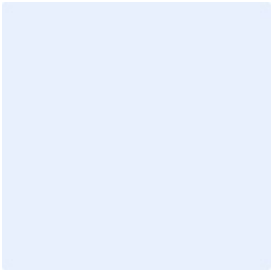
☐ Name:

Comments:



☐ Name:

Comments:





**Right of Way & Permits**

1123 West 3<sup>rd</sup> Avenue  
Denver, Colorado 80223  
Telephone: **303.571.3306**  
Facsimile: 303. 571. 3284  
[donna.l.george@xcelenergy.com](mailto:donna.l.george@xcelenergy.com)

December 19, 2023

Jefferson County Planning and Zoning  
100 Jefferson County Parkway, Suite 3550  
Golden, CO 80419

Attn: Lindsey Wire

**Re: Regulation Amendment - Transportation Design and Construction Manual – 2<sup>nd</sup> referral, Case # 22-122945AM**

Public Service Company of Colorado's (PSCo) Right of Way & Permits Referral Desk has reviewed the second referral documentation for **Transportation Design and Construction Manual**. Please be aware PSCo owns and operates existing natural gas and electric *distribution* and *transmission* facilities within and throughout Jefferson County and has no objection to these proposals, contingent upon the following:

1. PSCo's ability to maintain all existing rights and this amendment should not hinder our ability for future expansion, including all present and any future accommodations for natural gas transmission and electric transmission related facilities, and that our current use/enjoyment of the area would continue to be an accepted use on the property and that it be "grandfathered" into these changes.
2. Please note that no structures are allowed within utility easements, and the widening of roadways in no way changes the standard required width of utility easements on private property.
3. Bear in mind that per the National Electric Safety Code, a minimum 10-foot radial clearance must be maintained at all times from all overhead electric facilities including, but not limited to, construction activities and permanent structures.
4. Note that proper clearances must be maintained including ground cover that should not be modified from original depths. Contact Colorado 811 before excavating. Use caution and hand dig when excavating within 18-inches of each side of the marked facilities. Please be aware that all risk and responsibility for this request are unilaterally that of the Applicant/Requestor.

Donna George  
Right of Way and Permits  
Public Service Company of Colorado dba Xcel Energy  
Office: 303-571-3306 – Email: [donna.l.george@xcelenergy.com](mailto:donna.l.george@xcelenergy.com)

# **3<sup>RD</sup> REFERRAL COMMENTS**

Agency	3rd Referral Comments and Response Log	Response
CDOT	No Comments	Acknowledged
DWR	No Comments	Acknowledged
Ken Caryl Ranch	<p>Good morning. The new Library is located in Ken-Caryl Ranch (as you know) and so our Architectural Committee will be need to be involved in any exterior changes - which I know this is not so much that specifically.</p> <p>Ken-Caryl Ranch is working on new street signs for the entire business park and has an agreement with Jefferson County for them to be branded with the KC logo and be brown and white vs. standard green/white.</p> <p>Would love to work with you all during this project to incorporate the KC branded/colored signs.</p> <p>Please let me know how we can work together and what you need from me.</p>	<p>Thank you for your email. I reached out to our Transportation and Engineering Team regarding your comment and received the following response:</p> <p>“Thanks for sending this my way. No, this does not need to be incorporated as a regulation. We don't want every custom sign we approve for metro districts or HOAs to be inserted into the TDCM as a regulation. The metro district has their approved templates and they are the only ones using those and are allowed to use those; putting them in the TDCM would imply they could be broadly applied. We also don't want to encourage rogue installation of custom signs based on KCR logos being in our regs.</p> <p>Any metro district that presents custom neighborhood street signs to T&amp;E goes through a review process to ensure MUTCD compliance. Once they get our approval, we just enter a license agreement for them to maintain the signs.”</p> <p>Thank you and please let me know if you have any additional questions!</p>

<b>Tate</b>	While I have no comments on the proposed modifications, I did want to commend you for sending an informative email containing sufficient information. Most of the county emails I receive require multiple reloads to even find out what they are about. Your email was a welcome exception. THANK YOU!	Acknowledged
<b>County Geologist</b>	Text & detail for edge drains has been revised. No additional comments for this AM	Acknowledged
<b>Planning Engineering</b>	No comment.	Acknowledged
<b>Public Health</b>	Jefferson County Public Health has reviewed the changes submitted for the third referral of this case and has no comments or suggestions for these proposed changes.	Acknowledged
<b>Douglas County</b>	No comment	Acknowledged
<b>Jeffco Transportation and Engineering</b>	No comment	Acknowledged
<b>RTD</b>	No Exceptions	Acknowledged
<b>PSCO</b>	No objections	Acknowledged

<b>Jeffco Planning</b>	LDR Section 15 Have we considered a lower number of residential units allowed for a cul de sac? At least in the high hazard areas of the County. Allowing 30 SF or 100 MF can be significant along narrow roads in the mountain communities. TDCM How will we enforce the certification requirements for Transportation Info and Trip Gen Memo? Is it at the discretion of T&E? I realize we are not requiring an engineer's stamp but the proposed language is a bit vague.	We have considered this however it is planned to be looked at with the ULUC process and not with the TDCM update. We are looking for input from the Regulation Update Team on what would make sense going forward. My understanding from T&E is that it will be at their discretion/review. The expectation is that they will use the ITE manual to prepare these documents, and T&E will know pretty quickly if it wasn't.
<b>Evergreen Fire</b>	1. Transportation Design and Construction Manual The fire district has no additional edits or additions to section 3.7.8 and supports the redlines for approval as written. 2. Land Development Regulation Section 15 The fire district has no comments for the updates to this document and supports the redlines for approval as written. 3. Zoning Resolution Sections 2 and 16 The fire district has no comments for the updates to this document and supports the redlines for approval as written. 4. Storm Drainage Design and Technical Criteria The fire district concurs with removal of fire district approval for alternate overtopping depth and supports the redlines for approval as written.	Acknowledged
<b>Bear Creek Water and Sanitation</b>	No comments	Acknowledged
<b>CORE</b>	No comments	Acknowledged
<b>Building Safety</b>	No comments	Acknowledged

<b>CoSECC (Olson)</b>	This section should contain a description of why these specifications are here and what the county hopes to achieve. Should also include statements of how any submittal will be judged by staff.	This is all within Section 1 (General Provisions)
	The word “should” is used throughout the document. This is not an appropriate word to use in a regulatory document, as it is legally unenforceable. The correct words to use are Shall or Must.	This is being addressed with these updates.
	The document should include discussion and presentation of the requirements for a “Clear Zone” where errant vehicles can safely recover without striking a hard impediment. <a href="https://highways.dot.gov/safety/rwd/provide-safe-recovery/clear-zones/clear-zones">https://highways.dot.gov/safety/rwd/provide-safe-recovery/clear-zones/clear-zones</a> This will impact design requirements for roadway construction and reconstruction. This is also included in the CDOT Roadway Design Guide, Chapter 7 section 7.1.1.1.2, 7.2.1.16 and Chapter 13, 13.5.5.1. It also has a significant presence in the AASHTO Roadside Design Guide and the FHWA/AASHTO Highway Safety Manual. This is particularly important for the safety of motorists traveling on Jefferson County rural roads.	For most roadways in the County, especially in rural areas, the FHWA - following the AASHTO Design Guide - recommends a clear zone of 7-10 feet. Jefferson County standards require a minimum of a 3-foot shoulder (4 ft on Collectors), plus an additional 4 feet in which the outside slope can not exceed 4:1, creating a clear zone of a minimum of 7 feet. In areas where this is not possible due to extreme geometric conditions, the County uses other strategies such as guardrail, rumble strips, and advanced warning signage
	In general, the Traffic Study portion of the document is greatly improved. It still needs work to clarify specific portions. My professional opinion is that it is headed in the right direction.	Acknowledged
	Traffic data volume collection shall always include weekday and weekend counts. The reports shall include an analysis of the impact at all these times.	Typically, the heaviest traffic generation is on weekdays. However, in unique circumstances where there is higher trip generation on a weekend or outside standard peak hours, County staff will request additional analysis be completed. Applying this as a requirement across all applicants is unnecessary.

<p>The study of future impacts shall take into account adjacent future developments and those proposed. Adjacent land shall be judged by allowable land use.</p>	<p>This is accounted for in the DRCOG growth model which uses agency comprehensive plan data (proposed zoning/land use), demographics, etc. to determine growth on a corridor. Staff is aware of specific areas where DRCOG data is inaccurate and, in those circumstances, staff requests additional traffic studies be incorporated. Outside these unique circumstances, adjacent proposed developments being included in addition to the growth model would be double counting other developments and deflate the potential impacts associated with the study being analyzed.</p>
<p>Section 6.2.1 Delete the last sentence. Any analysis using the HCM and/or Trip Generation Manual shall be done under the supervision of qualified and experienced transportation professional.</p>	<p>This section will be retained to ensure applicants are aware that they do not need to provide a PE stamp when providing Transportation Information, as is required with TIS.</p>



<p>There are number of things that should be included in all four levels of analysis,</p> <p>Limits of the area to be analyzed</p> <p>oIdentification of the main access routes to the site</p> <p>oI would only accept the “Letter of Conformance” if it covers all of the regulations currently in force. I have seen some really poor TIS documents submitted to the county and I would not accept them under this clause.</p> <p>oAdd a section to clearly state the requirements for data collection. This would include the following:</p> <p>oAreas covered (project limits)</p> <p>oTiming of the counts,</p> <p>oCount types,</p> <p>oOrigin and destination of potential development users,</p> <p>oCount durations,</p> <p>oDays when counts shall not be taken unless approved in writing by the County Traffic Engineer.</p> <p>oAcceptable counting technology and accuracy levels.</p> <p>oI should also include data (trip tables, O&amp;Ds, growth rates at a minimum) from the DRCOG traffic models.</p> <p>oCounts shall be continuous for the period specified, gaps in count data shall cause new counts to be taken.</p>	<p>The main access of a site is not determined at rezone and will not be required for all four levels of analysis. Site access analysis is always required for TIS (SDP and Plat). Staff supports only accepting a LOC if all current regulations are currently met. Traffic data collection requirements are outlined in 6.1 and address most of these requests, but certain requests for what is to be included is too contextual and is covered with applicants at the pre-application phase (project limits, count types, duration (weekends)). Additional data requests, while they may be within industry best practices, are unattainable for applicants and for formal staff review (O&amp;Ds, count technology, etc). Language exists allowing the County to request additional data under staff discretion. This circumstance is generally rare and in a variety of contexts would not change the outcome of a study.</p>
<p>A table summarizing the analysis for each level should also be considered.</p> <p>Traffic counts younger than 3 years may not be stale based upon the surrounding land use changes/developments.</p>	<p>A table was added in 6.1.1. Staff will not consider studies older than three years due to significant changes seen in the region and the infeasible request for staff to determine what land uses have changed in the area over the past three years.</p>

<p>2.The volume thresholds for both a “Transportation Analysis” and a “Traffic Impact Study” are 800 vpd. The “Transportation Analysis” should be eliminated and the TIS shall be completed as a part of the planning process not during the site development process. There isn’t enough rigor to the proposed analysis in the “Transportation Analysis” to identify the true impact and the infrastructure improvements needed to be included in the site development process. Waiting until the site development process weakens the county ability to control the project. Particularly since the volume threshold is the same for each.</p> <p>Traffic impact analysis shall be included at rezoning and updated at each step of the process. Particularly as the proposed development morphs at each stage.</p>	<p>The Transporation Analysis is for rezones only and the Traffic Impact Study is for site development. These studies are similar, but Transporation Analysis deliberately includes conceptual mitigation and less intense analysis, since much is unknown at rezone (site access(es), number of units proposed, size of commercial building, etc.). A site will first submit a TA when they rezone and then submit a more rigorous TIS when they go through site development, when proposed uses and intensities are solidified. For example, many mixed-use commercial PUDs have minimum square footages that increase between rezone and SDP.</p>
<p>The “Trip Generation Summary Tables” should be numbered. They should also include Saturday and Sunday as many land uses peak on the weekend.</p>	<p>Summary tables have already been revised to include numbering. Tables can be adjusted by applicant to include weekend if staff determines during pre-app that weekend counts must be collected.</p>

<p>If the Trip Generation Manual doesn't include the subject land use, there shall be at least 3 similar sites studied as required in the manual. The specific requirements for this in the Trip Generation Manual should be cited. You should specify the data to be collected. There shall also be a succinct description of each site as well as identification of who collected the data and when.</p> <p>It is currently suggested that the sites' capacity be used if no similar sites exist. Then who and how will the sites capacity be determined and documented? The number of parking spaces is not a good independent variable. I strongly suggest that this not be allowed. I see it as a loophole that will be abused.</p> <p>How will the county react if the trip generation is based upon the number of parking spaces and once the project is completed the traffic demand is significantly greater.</p>	<p>We must provide an avenue towards a solution when ITE does not provide an appropriate code for unique land use cases. Solutions are reasonable and align as closely with the ITE Trip Gen Manual as possible. It is unrealistic to anticipate a loophole when language is clear that the county will require similar site data collection and only state we "may" consider capacity in the rare circumstances this would apply.</p>
<p>The use of the Level of Service (LOS) is rather crude indicator of traffic operations.</p> <p>The origins of LOS was as a public relations tool not for quantitative analysis. The Volume Capacity Ratio (V/C) is more illustrative of the actual impacts.</p> <p>Consider a facility that operates at a V/C of 0.89 which would map to LOS D yet is just below LOS E. Would that be acceptable? How many hours during the day will the facility operate in the V/C regime? If it is 15 minutes it may be acceptable but 4 hours would clearly not be</p>	<p>LOS provides a great enough indication of traffic operations in Jefferson County. For unique circumstances, language has already been added stating staff reserves the right to request additional Measures of Effectiveness as identified in CDOT's Traffic Analysis and Forecasting Guidelines.</p> <p>The TMP highlights the County's project V/C ratio, not considering left turn lanes, and highlights the vast majority of roadways are well below capacity into the future. Pinch points are at intersections and why we generally feel comfortable with LOS with the right to reserve V/C or other analyses in specific circumstances.</p>

<p>A Traffic Impact Study shall include analysis using the DRCOG models. A simple HCM analysis won't tell the full regional impact of such a large development. For example, large developments with major traffic destinations in the Denver metro area have a significant impact on the overall transportation network.</p>	<p>"Background traffic growth estimates should be based on the most recent regional Travel Demand Model available" is currently stated in the Transportation Impact Studies portion of the Transportation Studies section. DRCOG is generally the most recent regional model available, but the current model misrepresents existing and projected growth on certain corridors and CDOT's OTIS projections are therefore accepted in some circumstances.</p>
<p>Evacuation Study. An Evacuation Study shall be included. The recent fires such as the Marshall and the Paradise Fires clearly indicate that evacuation is a major problem. It shall clearly delineate the tributary areas being evacuated and the capacity of each of the evacuation routes. In the mountains and rural areas of the county it should include large vehicles, vehicles evacuating livestock and other large animals as well as recreational vehicles.</p>	<p>Yes this will be a part of the Wildfire code updates that are ongoing and will be part of a separate regulation update.</p>
<p>Appendices. This is a good start. However making them a bit more detailed and prescriptive will make staff review more consistent and productive.</p>	<p>Staff will continue to review and update as necessary</p>
<p>Templates This is a good start. The tables could be expanded to include week days and weekends.</p>	<p>LOS tables require LOS for full intersection and each movement; it has not been seen that this language is resulting in challenging reviews. Synchro reports (or similar), as required, is acceptable for staff review.</p>

March 3, 2025  
Merrick Reference No: 118429.25

Lindsey Wire  
Jefferson County  
[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)

**RE: Jefferson County Referral – Regulation Amendment - Case #: 22-122945AM**

Dear Ms. Wire,

We appreciate the opportunity to review the above-mentioned document on behalf of the Bear Creek Water & Sanitation District (District) and have the following comment:

1. The District has no comments for the proposed regulation amendments and the proposed changes to the Transportation Design and Construction Manual.

Please call if you have any questions or need additional information.

Sincerely,  
MERRICK & COMPANY



Dillon C. Rodenbaugh, P.E.  
BCWSD Design Engineer

Reviewed & Approved,



Wade B. Wheatlake, P.E.  
BCWSD District Engineer

cc: Ms. Jan Walker, BCWSD District Manager  
Mr. Andy George, BCWSD Assistant Manager



## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Wednesday, March 5, 2025 4:20 PM  
**To:** Lindsey Wire  
**Cc:** Troy Jones  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

### **Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Building Division

**Results: No Comment (no further review)**

**Review Comments:**

**Scheduled End Date: 21-FEB-25**

**Reviewer: Troy Jones**

**Description: Regulations Amendment to the Transportation and Construction Manual**

## Lindsey Wire

---

**From:** bradley.sheehan@state.co.us  
**Sent:** Thursday, February 20, 2025 11:07 AM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- Re: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Completed

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Thank you, we have no comments or concerns.

On Fri, Feb 14, 2025 at 8:30 AM 'Lindsey Wire' via CDOT\_R1\_AccessPermitting\_GroupE <[cdot\\_r1access\\_groupe@state.co.us](mailto:cdot_r1access_groupe@state.co.us)> wrote:

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#).

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)

Engineering Supervisor

Planning & Zoning

o 303-271-8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



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--

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[www.codot.gov](http://www.codot.gov) [[codot.gov](http://codot.gov)]   [www.cotrip.org](http://www.cotrip.org) [[cotrip.org](http://cotrip.org)]

Please note that CDOT Region 1 Permits is now at 2829 W. Howard Pl., Denver, CO 80204, 2nd floor



Brad Sheehan P.E.  
Colorado Department of Transportation  
Access Engineer Region 1  
2829 W. Howard Pl.,  
Denver, CO 80204  
2nd floor  
720-284-8249

## Lindsey Wire

---

**From:** Brooks Kaufman <BKaufman@core.coop>  
**Sent:** Friday, March 7, 2025 7:57 AM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

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Good morning Lindsey

CORE Electric Cooperative has no comments.

Respectfully

#### Brooks Kaufman

Lands and Rights of Way Manager

800.332.9540 MAIN  
720.733.5493 DIRECT  
303.912.0765 MOBILE

[www. \[core.coop\]](http://www.core.coop)[core \[core.coop\]](http://core.coop)[.coop \[core.coop\]](http://core.coop)



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[\[outlook-sdf.office.com\]](mailto:outlook-sdf.office.com) [Book time to meet with me \[outlook-sdf.office.com\]](#)


---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Friday, February 14, 2025 8:40 AM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification

**[CAUTION:]** This email is from an external source. Avoid clicking links or opening attachments unless you trust the sender and verify the content's safety.

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM)  [here](#) [[jeffcogov.sharepoint.com](https://jeffcogov.sharepoint.com)].

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)  
Engineering Supervisor  
Planning & Zoning  
o 303-271-8717  
[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](https://planning.jeffco.us)



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<https://togetherjeffco.com> [[togetherjeffco.com](https://togetherjeffco.com)]

**Project Name:** Jefferson County Regulation Amendments - Sections 2, 15, and 16

**Project Number:** RE2025-030

**Date Received:** 02/14/2025

**Jurisdiction:** Jefferson County

**Due Date:** 03/07/2025

**Addressing Comments:**

No Comments

**Engineering Comments:**

No Comments

**Planner Comments:**

No Comments

## Lindsey Wire

---

**From:** Wenli Dickinson <wenli.dickinson@state.co.us>  
**Sent:** Tuesday, February 18, 2025 7:45 PM  
**To:** PZ-Regulation-Revisions  
**Cc:** Ioana Comaniciu - DNR  
**Subject:** --{EXTERNAL}-- Re: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

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Good evening,

DWR has reviewed the Proposed Revisions to the Transportation Design and Construction Manual (3rd Referral), Case Number: 22-122945AM. Since there do not appear to be any water supply issues associated with the proposed revisions, DWR does not have any comments.

Regards,

Wenli Dickinson, P.E.  
Water Resource Engineer



[wenli.dickinson@state.co.us](mailto:wenli.dickinson@state.co.us) | (303) 866-3581 x8206  
[1313 Sherman St, Suite 821, Denver, CO 80203](https://www.dwr.colorado.gov) | [dwr.colorado.gov](https://www.dwr.colorado.gov)

----- Forwarded message -----

**From:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>  
**Date:** Fri, Feb 14, 2025 at 8:30 AM  
**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification  
**To:** PZ-Regulation-Revisions <[PZRegRev@co.jefferson.co.us](mailto:PZRegRev@co.jefferson.co.us)>

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#).

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)

Engineering Supervisor

Planning & Zoning

o 303-271-8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



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<https://togetherjeffco.com>



# Evergreen Fire/Rescue

1802 Bergen Parkway • Evergreen, Colorado 80439  
Phone: 303-674-3145 • Fax: 303-674-8701

February 28, 2025

Lindsey Wire, Engineering Supervisor  
Jefferson County Planning & Zoning  
100 Jefferson County Parkway  
Golden, CO 80401

Re: Case# 22-122945AM Regulation updates-3<sup>rd</sup> referral

Ms. Wire:

The fire district has reviewed the 3<sup>rd</sup> referral drafts of the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. The District has the following comments regarding the current drafts of these documents.

**1. Transportation Design and Construction Manual**

The fire district has no additional edits or additions to section 3.7.8 and supports the redlines for approval as written.

**2. Land Development Regulation Section 15**

The fire district has no comments for the updates to this document and supports the redlines for approval as written.

**3. Zoning Resolution Sections 2 and 16**

The fire district has no comments for the updates to this document and supports the redlines for approval as written.

**4. Storm Drainage Design and Technical Criteria**

The fire district concurs with removal of fire district approval for alternate overtopping depth and supports the redlines for approval as written.

Please contact me at (303) 679-4746 or via e-mail at [kferry@evergreenfirerescue.com](mailto:kferry@evergreenfirerescue.com) if you should have any questions or need further information.

Sincerely,

Kevin Ferry  
Fire Marshal

## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Monday, February 24, 2025 5:36 PM  
**To:** Lindsey Wire  
**Cc:** Pat OConnell  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

### **Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: County Geologist

**Results: Comments Sent (no further review)**

**Review Comments: Text & detail for edge drains has been revised. No additional comments for this AM**

**Scheduled End Date: 21-FEB-25**

**Reviewer: Pat O Connell**

**Description: Regulations Amendment to the Transportation and Construction Manual**



## Lindsey Wire

---

**From:** Brian Yowell <briany@kcranch.org>  
**Sent:** Friday, February 14, 2025 9:01 AM  
**To:** Lindsey Wire  
**Cc:** Brian Yowell  
**Subject:** --{EXTERNAL}-- Re: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

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Lindsey,

Good morning. The new Library is located in Ken-Caryl Ranch (as you know) and so our Architectural Committee will be need to be involved in any exterior changes - which I know this is not so much that specifically.

Ken-Caryl Ranch is working on new street signs for the entire business park and has an agreement with Jefferson County for them to be branded with the KC logo and be brown and white vs. standard green/white.

Would love to work with you all during this project to incorporate the KC branded/colored signs.

Please let me know how we can work together and what you need from me.

Thank you!  
Brian



Brian Yowell

**Executive Director**

Ken-Caryl Ranch Master Association  
7676 S. Continental Divide Road  
Littleton, CO 80127  
303-979-1876, ext. 113  
303-979-7524 Direct

[briany@kcranch.org](mailto:briany@kcranch.org)

[www.ken-carylranh.org](http://www.ken-carylranh.org) [[ken-carylranh.org](http://ken-carylranh.org)]

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---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Friday, February 14, 2025 8:30 AM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification

Some people who received this message don't often get email from lwire@co.jefferson.co.us. [Learn why this is important \[aka.ms\]](#)

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM)  [here \[jeffcogov.sharepoint.com\]](#).

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)  
Engineering Supervisor  
Planning & Zoning  
o 303-271-8717  
[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)

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COUNTY COLORADO  
Planning and Zoning

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## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Tuesday, February 25, 2025 12:48 PM  
**To:** Lindsey Wire  
**Cc:** Nathan Seymour  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

### **Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Engineer (Development Review)

**Results: Complete**

**Review Comments:**

**Scheduled End Date: 21-FEB-25**

**Reviewer: Nathan Seymour**

**Description: Regulations Amendment to the Transportation and Construction Manual**

## Lindsey Wire

---

**From:** Sara Kohles  
**Sent:** Thursday, March 6, 2025 6:18 PM  
**To:** Lindsey Wire; PZ-Regulation-Revisions  
**Subject:** Re: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Completed

Hey Lindsey, I have a couple of questions/comments.

### **LDR Section 15**

Have we considered a lower number of residential units allowed for a cul de sac? At least in the high hazard areas of the County. Allowing 30 SF or 100 MF can be significant along narrow roads in the mountain communities.

### **TDCM**

How will we enforce the certification requirements for Transportation Info and Trip Gen Memo? Is it at the discretion of T&E? I realize we are not requiring an engineer's stamp but the proposed language is a bit vague.

Best,

### **Sara Kohles, AICP**

Jefferson County Planning & Zoning  
Planner III  
P: 303-271-8734  
[skohles@jeffco.us](mailto:skohles@jeffco.us)

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---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Friday, February 14, 2025 8:39 AM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM)  [here](#).

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)  
Engineering Supervisor  
Planning & Zoning  
o 303-271-8717  
[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



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**MEMO**

**TO:** Lindsey Wire  
Jefferson County Planning and Zoning Division

**FROM:** Tracy Volkman  
Jefferson County Environmental Health Services Division

**DATE:** February 24, 2025

**SUBJECT:** Case #22-122945 AM  
Transportation And Construction Manual  
Jefferson County Planning & Zoning Division

Jefferson County Public Health has reviewed the changes submitted for the third referral of this case and has no comments or suggestions for these proposed changes.

**Lindsey Wire**

---

**From:** Clayton Woodruff <Clayton.Woodruff@RTD-Denver.com>  
**Sent:** Tuesday, March 4, 2025 10:52 AM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

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Lindsey,

The RTD Comments:

Department	Comments
Bus Operations	No exceptions
Bus Stop Program	No exceptions
Commuter Rail	No exceptions
Construction Management	No exceptions
Engineering	No exceptions
Light Rail	No exceptions
Real Property	No exceptions
Service Development	No exceptions
Transit Oriented Development	No exceptions
Utilities	No exceptions



This review is for Design concepts and to identify any necessary improvements to RTD stops and property affected by the design.

Thank you,



**C. Scott Woodruff**

**Engineer III**

Regional Transportation District  
1560 Broadway, Suite 700, FAS-73 | Denver, CO 80202

o 303.299.2943 | m 303-720-2025

[clayton.woodruff@rtd-denver.com](mailto:clayton.woodruff@rtd-denver.com)

---

**From:** Lindsey Wire <[lwire@co.jefferson.co.us](mailto:lwire@co.jefferson.co.us)>

**Sent:** Friday, February 14, 2025 8:31 AM

**To:** PZ-Regulation-Revisions <[PZRegRev@co.jefferson.co.us](mailto:PZRegRev@co.jefferson.co.us)>

**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM) [here](#) [[jeffcogov.sharepoint.com](https://jeffcogov.sharepoint.com)].

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)

Engineering Supervisor

Planning & Zoning

o 303-271-8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



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## Lindsey Wire

---

**From:** AUTOMAILER@JEFFCO.US  
**Sent:** Friday, March 7, 2025 9:27 AM  
**To:** Lindsey Wire  
**Cc:** Lindsay Townsend  
**Subject:** 22 122945 AM - Agency Response

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

---

### **Case Number: 22 122945 AM**

Case Type: Regulation Amendment

Case Name: Transportation and Construction Manual

Review: Transportation and Engineering

**Results: No Comment (no further review)**

**Review Comments: No further revisions.**

**Scheduled End Date: 21-FEB-25**

**Reviewer: Lindsay Townsend**

**Description: Regulations Amendment to the Transportation and Construction Manual**

## Lindsey Wire

---

**From:** JeanTate <jeantate@enviro-support.com>  
**Sent:** Friday, February 14, 2025 9:09 AM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: 22-122945AM - Jefferson County Regulation Amendment Notification

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

This message came from outside your organization.

[Report Suspicious](#)

Lindsey,

While I have no comments on the proposed modifications, I did want to commend you for sending an informative email containing sufficient information. Most of the county emails I receive require multiple reloads to even find out what they are about. Your email was a welcome exception.

THANK YOU!

Jean Tate


Sent from my T-Mobile 5G Device

----- Original message -----

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Date:** 2/14/25 8:43 AM (GMT-07:00)  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

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**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)

Engineering Supervisor

Planning & Zoning

o 303-271-8717

[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](http://planning.jeffco.us)



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<https://togetherjeffco.com> [\[togetherjeffco.com\]](#)



**Right of Way & Permits**

1123 West 3<sup>rd</sup> Avenue  
Denver, Colorado 80223  
Telephone: 303.285.6612  
[violeta.ciocanu@xcelenergy.com](mailto:violeta.ciocanu@xcelenergy.com)

March 4, 2025

Jefferson County Planning and Zoning  
100 Jefferson County Parkway, Suite 3550  
Golden, CO 80419

Attn: Lindsey Wire

**Re: Jefferson County Regulation Amendment Notification, Case # 22-122945AM**

Public Service Company of Colorado's (PSCo) Right of Way & Permits Referral Desk has reviewed the plan for **Jefferson County Regulation Amendment Notification**. Please be aware PSCo owns and operates existing natural gas and electric *distribution* and *transmission* facilities within and throughout Jefferson County and has no objection to these proposals, contingent upon the following:

1. PSCo's ability to maintain all existing rights and this amendment should not hinder our ability for future expansion, including all present and any future accommodations for natural gas transmission and electric transmission related facilities, and that our current use/enjoyment of the area would continue to be an accepted use on the property and that it be "grandfathered" into these changes.
2. Please note that no structures are allowed within utility easements, and the widening of roadways in no way changes the standard required width of utility easements on private property.
3. Bear in mind that per the National Electric Safety Code, a minimum 10-foot radial clearance must be maintained at all times from all overhead electric facilities including, but not limited to, construction activities and permanent structures.
4. Note that proper clearances must be maintained including ground cover that should not be modified from original depths. Contact Colorado 811 before excavating. Use caution and hand dig when excavating within 18-inches of each side of the marked facilities. Please be aware that all risk and responsibility for this request are unilaterally that of the Applicant/Requestor.

Violeta Ciocanu (Chokanu)  
Right of Way and Permits  
Public Service Company of Colorado dba Xcel Energy  
Office: 303-285-6612 – Email: [violeta.ciocanu@xcelenergy.com](mailto:violeta.ciocanu@xcelenergy.com)

## Lindsey Wire

---

**From:** PRO <coug@2lazycats.com>  
**Sent:** Monday, May 5, 2025 6:30 PM  
**To:** Lindsey Wire  
**Subject:** --{EXTERNAL}-- RE: 22-122945AM - Jefferson County Regulation Amendment Notification  
**Attachments:** Redline\_TDCM\_DRAFT\_5-2-25-PRO.docx  
**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

### This Message Is From an External Sender

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Lindsey. Please accept my comments to this document. I am focusing only on the transportation portion of the document.

In General this is a considerable improvement from your beginning. However, many of my previous comments have not been addressed. Hopefully you will continue improving it. Given the speed at which transportation in particular is rapidly changing you should consider doing incremental in-house reviews how the regulations were applied and how well the documents submitted comport to the regulations.

My experience with traffic reports submitted to your group is that it was easy to subvert your and the public's intentions. If it isn't in writing no one will do it.

The development of these documents should be done by experienced traffic professionals even for small projects as these may be overlooked and misinterpreted. Particularly in the selection of an ITE land use code.

I think the outlines in the appendix are a very significant positive improvement. Looking from the Consultants' view it gives them guidance to scope the work and guide the client through the process!

Thanks for allowing me to review the document. I hope the whole process ends with a positive outlook for the future.


**\*\*PRO\*\***

---

**From:** Lindsey Wire <lwire@co.jefferson.co.us>  
**Sent:** Friday, February 14, 2025 8:39 AM  
**To:** PZ-Regulation-Revisions <PZRegRev@co.jefferson.co.us>  
**Subject:** 22-122945AM - Jefferson County Regulation Amendment Notification

Dear Agency/Interested Party,

Jefferson County Planning & Zoning is proposing a Regulation Amendment process pertaining to the Transportation Design and Construction Manual, Zoning Resolution Sections 2 and 16, Land Development Regulation Section 15 and the Storm Drainage Design and Technical Criteria. **A summary of changes can be found attached to this email.**

3<sup>rd</sup> Referral Red-marked drafts can be found in both Word and Adobe PDF formats on our Regulation Revision [website](#) and in the case folder (22-122945AM)  [here](#) [[jeffcogov.sharepoint.com](https://jeffcogov.sharepoint.com)].

We are very interested in any comments or concerns that you or your agency may have with these proposed changes. If you have any questions, please contact Planning and Zoning Regulation Revisions at [PZRegRev@jeffco.us](mailto:PZRegRev@jeffco.us).

**Comments are due Friday, March 7th, 2025.**

Thank you,

**Lindsey Wire** (she/her)  
Engineering Supervisor  
Planning & Zoning  
o 303-271-8717  
[lwire@jeffco.us](mailto:lwire@jeffco.us) | [planning.jeffco.us](https://planning.jeffco.us)



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<https://togetherjeffco.com> [[togetherjeffco.com](https://togetherjeffco.com)]



**Jefferson County Planning & Zoning**  
**100 Jefferson County Parkway**  
**Golden CO 80419**

VIA EMAIL

May 2, 2025

**To:** Lindsey Wire, P.E., Planning & Zoning Engineering Supervisor

**Cc:** Chris O'Keefe, Director of Planning & Zoning.

**From:** Paul R. Olson, P.E., T.E. for the *Conifer & South Evergreen Community Committee*.

**Subject:** Review comments regarding the proposed updates to the Transportation Design and Construction Manual "**Redline\_TDCM\_DRAFT\_12112023 distributed December 11, 2023**"

**GENERAL COMMENTS**

As I read this document several significant changes in response to our June 2023 comments have been made, yet many have not yet been addressed.

As matter of professional engineering protocol the document writer should reply to the commentor indicating the disposition of every comment. To date the county has failed to respond to my comments to the two previous versions of this document.

As a general matter, the Transportation Design and Construction Manual (TDCM) defines engineering standards; therefore, it is appropriate that the TDCM is under the strict authorship control of the Jefferson County Director of Traffic & Engineering engineer NOT the Director of Planning & Zoning. There is actually very little in the document that provides guidance with respect to planning and/or zoning. Similar documents authored by other cities, counties, and state departments of transportation are the domain of the engineering staff within the agency.

This section should contain a description of why these specifications are here and what the county hopes to achieve. Should also include statements of how any submittal will be judged by staff.

The word "should" is used throughout the document. This is not an appropriate word to use in a regulatory document, as it is legally unenforceable. The correct words to use are Shall or Must.

The document should include discussion and presentation of the requirements for a "Clear Zone" where errant vehicles can safely recover without striking a hard

impediment. <https://highways.dot.gov/safety/rwd/provide-safe-recovery/clear-zones/clear-zones> This will impact design requirements for roadway construction and reconstruction. This is also included in the CDOT Roadway Design Guide, Chapter 7 section 7.1.1.1.2, 7.2.1.16 and Chapter 13, 13.5.5.1. It also has a significant presence in the AASHTO Roadside Design Guide and the FHWA/AASHTO Highway Safety Manual. This is particularly important for the safety of motorists traveling on Jefferson County rural roads.

In general, the Traffic Study portion of the document is greatly improved. It still needs work to clarify specific portions. My professional opinion is that it is headed in the right direction.

### **SPECIFIC COMMENTS**

The following are our specific comments with respect to the **TDCM Design and Technical Criteria**:

- **Section 6.1.**
- *Traffic data volume collection shall always include weekday and weekend counts. The reports shall include an analysis of the impact at all these times.*
- *The study of future impacts shall take into account adjacent future developments and those proposed. Adjacent land shall be judged by allowable land use.*
- **Section 6.2.1** *Delete the last sentence. Any analysis using the HCM and/or Trip Generation Manual shall be done under the supervision of qualified and experienced transportation professional.*

*All of the following items shall covered in a written document. This help making sure that the initial discussions and agreements are clear to all parties.*

- *There are number of things that should be included in all four levels of analysis, Limits of the area to be analyzed*
  - *Identification of the main access routes to the site*
  - *I would only accept the "Letter of Conformance" if it covers all of the regulations currently in force. I have seen some really poor TIS documents submitted to the county and I would not accept them under this clause.*
  - *Add a section to clearly state the requirements for data collection. This would include the following:*
    - *Areas covered (project limits)*
    - *Timing of the counts,*

- Count types,
  - Origin and destination of potential development users,
  - Count durations,
  - Days when counts shall not be taken unless approved in writing by the County Traffic Engineer.
  - Acceptable counting technology and accuracy levels.
  - I should also include data (trip tables, O&Ds, growth rates at a minimum) from the DRCOG traffic models.
  - Counts shall be continuous for the period specified, gaps in count data shall cause new counts to be taken.
1. A table summarizing the analysis for each level should also be considered. Traffic counts younger than 3 years may not be stale based upon the surrounding land use changes/developments.
  2. The volume thresholds for both a “Transportation Analysis” and a “Traffic Impact Study” are 800 vpd. The “Transportation Analysis” should be eliminated and the TIS shall be completed as a part of the planning process not during the site development process. There isn’t enough rigor to the proposed analysis in the “Transportation Analysis” to identify the true impact and the infrastructure improvements needed to be included in the site development process. Waiting until the site development process weakens the county ability to control the project. Particularly since the volume threshold is the same for each.

*Traffic impact analysis shall be included at rezoning and updated at each step of the process. Particularly as the proposed development morphs at each stage.*

3. **The “Trip Generation Summary Tables”** should be numbered. They should also include Saturday and Sunday as many land uses peak on the weekend.
4. If the Trip Generation Manual doesn’t include the subject land use, there shall be at least 3 similar sites studied as required in the manual. The specific requirements for this in the Trip Generation Manual should be cited. You should specify the data to be collected. There shall also be a succinct description of each site as well as identification of who collected the data and when.

***It is currently suggested that the sites’ capacity be used if no similar sites exist. Then who and how will the sites capacity be determined and documented? The number of parking spaces is not a good independent variable. I strongly suggest that this not be allowed. I see it as a loophole that will be abused.***

***How will the county react if the trip generation is based upon the number of parking spaces and once the project is completed the traffic demand is***

***significantly greater.***

5. *The use of the Level of Service (LOS) is rather crude indicator of traffic operations.  
The origins of LOS was as a public relations tool not for quantitative analysis.  
The Volume Capacity Ratio (V/C) is more illustrative of the actual impacts.*

*Consider a facility that operates at a V/C of 0.89 which would map to LOS D yet is just below LOS E. Would that be acceptable? How many hours during the day will the facility operate in the V/C regime? If it is 15 minutes it may be acceptable but 4 hours would clearly not be.*

6. *A Traffic Impact Study shall include analysis using the DRCOG models. A simple HCM analysis won't tell the full regional impact of such a large development. For example, large developments with major traffic destinations in the Denver metro area have a significant impact on the overall transportation network.*
7. ***Evacuation Study.*** *An Evacuation Study shall be included. The recent fires such as the Marshall and the Paradise Fires clearly indicate that evacuation is a major problem. It shall clearly delineate the tributary areas being evacuated and the capacity of each of the evacuation routes. In the mountains and rural areas of the county it should include large vehicles, vehicles evacuating livestock and other large animals as well as recreational vehicles.*
8. ***Appendices.*** *This is a good start. However making them a bit more detailed and prescriptive will make staff review more consistent and productive.*

## ***9. Templates***

*This is a good start. The tables could be expanded to include week days and weekends.*

*There should be a standard set of standard tables for presentation of collected traffic data.*

## **CONCLUSION**

The Committee is hopeful that the above recommendations will help improve the future health, safety, and welfare of both residents, visitors, and travelers in the unincorporated areas of Jefferson County.

Respectfully submitted,

Paul R. Olson, P.E., T.E.  
25587 Conifer Road  
STE 105-611

Conifer & South Evergreen  
Community Committee  
[cosecc.co@gmail.com](mailto:cosecc.co@gmail.com)

Conifer CO 80433

***Conifer and South Evergreen Community Committee***

# PREPARED PRESENTATION



# 22-122945AM Regulation Amendments



**Transportation and Access Standards**

June 10, 2025



**JEFFERSON**  
COUNTY COLORADO

# Regualation Amendment Team

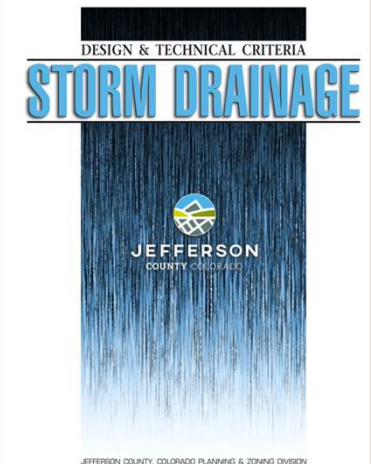
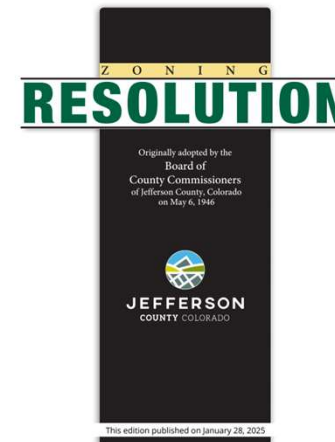
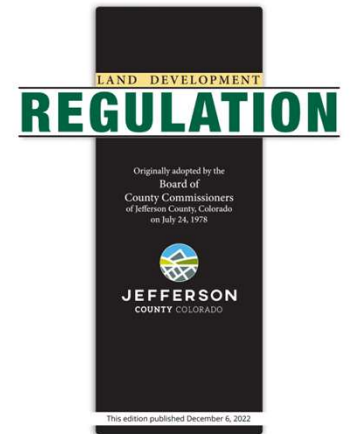
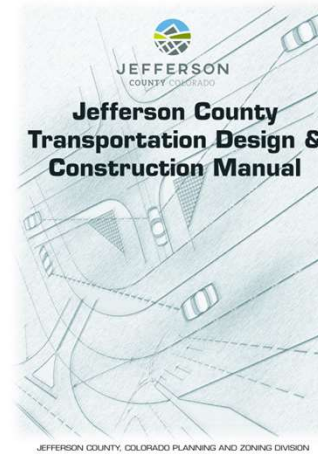
- Planning and Zoning
  - Lindsey Wire, Engineering Supervisor
  - Nathan Seymour, Civil Planning Engineer III
- Transportation and Engineering
  - Christina Lane, Transportation Operations & Planning Manager
- Fire Protection Districts
  - Rachel Rush, Elk Creek and Conifer Fire Protection Districts
  - John Sebastian, Evergreen Fire Rescue





# Purpose

- To amend the following County Regulations:
  - Transportation Design and Construction Manual (TDCM)
  - Zoning Resolution (ZR)
  - Land Development Regulation (LDR)
  - Storm Drainage Design and Technical Criteria (SDD&TC)



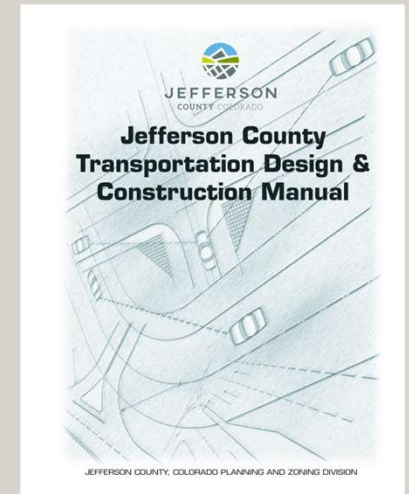
# Background

- The proposed revisions are necessary to provide clarity and align County requirements with industry standards.
- These proposed amendments are moving forward at this time as they have been in process for several years. If adopted, they will be carried forward and incorporated into the Unified Land Use Code, as appropriate.



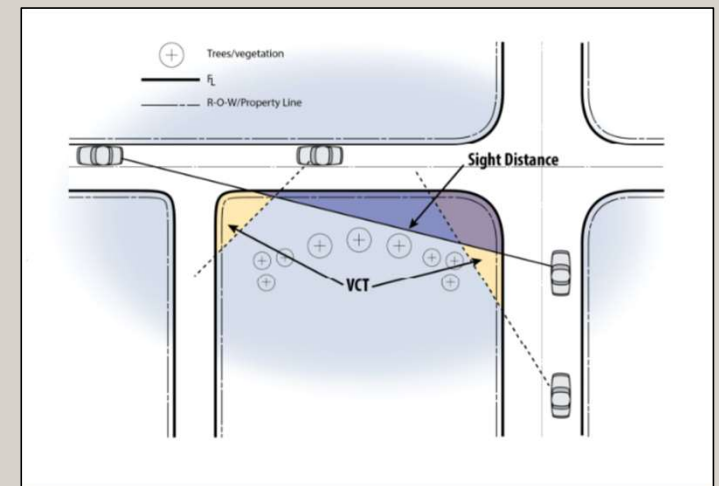
# Content

- TDCM Chapter 3: Design and Technical Criteria
  - Update Standard Templates for Streets/Roads
  - Align County requirements with the AASHTO Greenbook



# Content

- TDCM Chapter 3: Design and Technical Criteria
  - Update Section 3.7.1 to clarify intersection spacing requirements.
  - Update Section 3.7.2 to provide additional clarity on Vision Clearance Triangle and Site Distance requirements
  - Update Section 3.10 to add a reference to Colorado Department of Transportation criteria



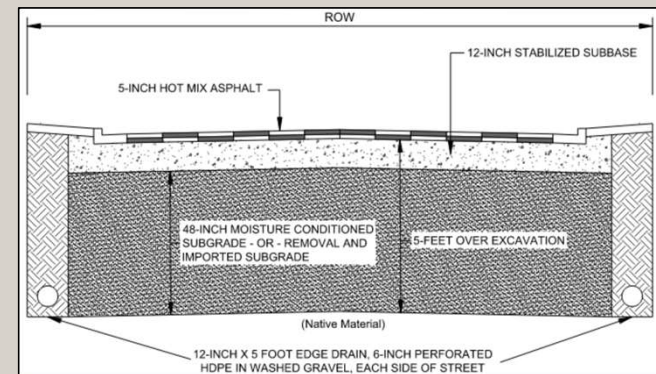
# Content

- Update Section 3.7.8 to:
  - Remove the statement that the appropriate Fire Protection District may approve alternate standards.
  - Define a new process for requesting relief of the requirements within this section, which must be approved by the County.
  - Allow up to 15% grade for driveways and private roads provided specific requirements are met.
  - Define minimum distance from a structure from a hammerhead turnaround.
  - Define loading requirements for bridges and other structures.
  - Clarify that the rules and regulations of the applicable Fire Protection District shall govern unless less restrictive than County requirements.



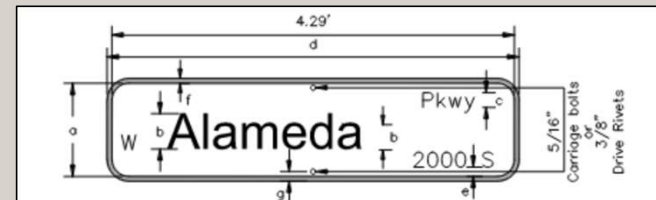
# Content

- TDCM Chapter 4: Pavement Design and Technical Criteria
  - Update Section 4.2 to clarify that edge drains are required with the Construction Plans for the Dipping Bedrock areas within the County, and may only be omitted if final pavement design shows they are not necessary.
  - Add Section 4.6.3.2 to specify when Stone Mastic Asphalt is required.



# Content

- TDCM Chapter 5: Construction Specifications and Standards
  - Update Construction Specifications and Standards to meet industry standards.
  - Updates to text for:
    - Medians
    - Waterproofing Membranes
    - Storm Sewer Pipe
    - Signs
    - Pavements Markings



# Content

- Transportation Studies Appendix
  - Relocate the text to Chapter 6 of the TDCM.
  - Create four types: Transportation Information, Trip Generation Memoranda, Transportation Analysis, Transportation Impact Study, and Letter of Conformance with an Approved TIS
  - For each type, provide an example template in the Appendix.





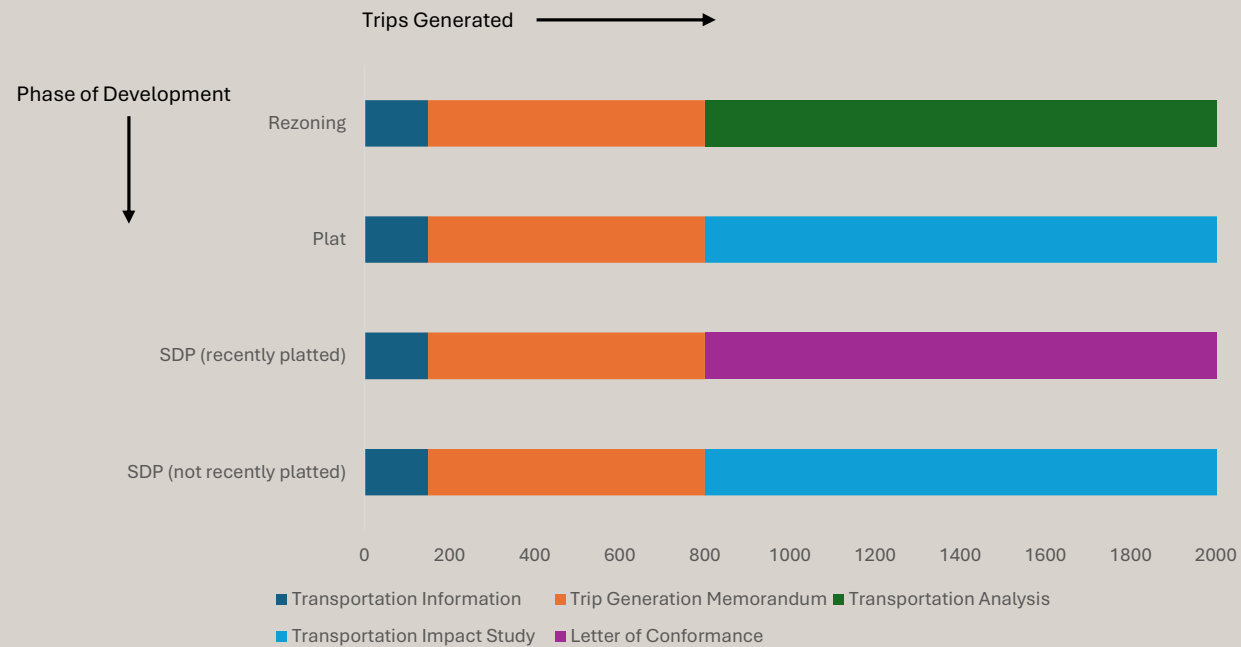
# Content

- Transportation Studies

1. Transportation Information: Any development less than 150 trips
2. Trip Generation Memoranda (TGM): Any development between 150 and 800 trips
3. Transportation Analysis (TA): Rezoning with greater than 800 trips
4. Transportation Impact Study (TIS): Site Development Plan or Plat with greater than 800 trips
5. Letter of Conformance with an Approved TIS: Site Development Plan within 3 years of regional development



# Content



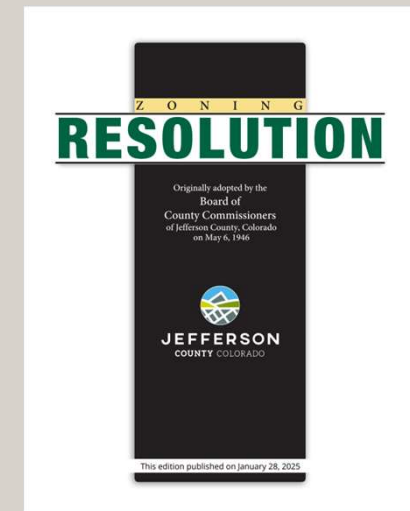
# Content

- Definitions
  - Add a definition for All Weather Travel Surface
  - Add definition for Dip of Natural Terrain
  - Add definition for Sidewalk
  - Add definition for Vulnerable Roadway User



# Content

- ZR Section 2: General Provisions and Regulations
  - Update Section 2.D.1.j.(4), to clarify how the physical standard of access will be evaluated for different Building Permit types (ie habitable vs non-habitable structures and additions)
  - Clarify that the Fire Protection District may still provide a letter for offsite streets/roads associated with an addition.



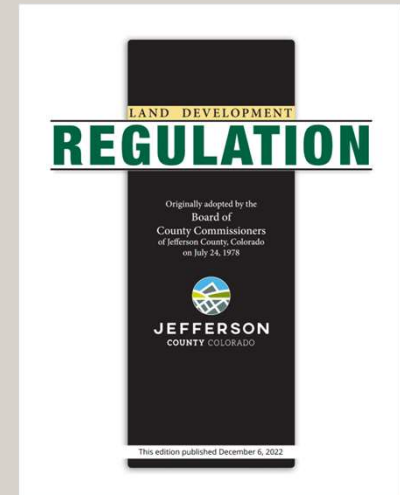
# Content

- ZR Section 16: Land Disturbance
  - Clarify that land disturbance activities with or in advance of a building permit with less than 0.5 acres of land disturbance where the applicant is requesting relief of a regulatory requirement requires a Grading Permit.
  - Add the requirement that land disturbance associated with access to detached living space where either the access does not exist or has not previously been approved as access to living space requires a Notice of Intent Permit.
  - Update the Notice of Intent process to allow modifications to previously accepted plans when construction does not occur per the plans through an Administrative Review rather than a Grading Permit.



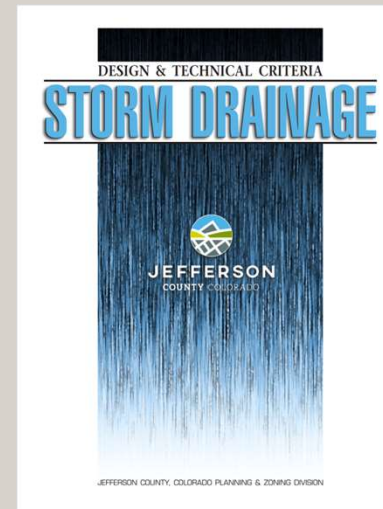
# Content

- Land Development Regulation Section 15: Circulation
  - Clarify that adjoining street improvements are required for all Arterial Streets/Roads.
  - Remove the statement that the appropriate Fire Protection District may approve alternate standards for cul-de-sacs and clarify that any relief would be processed by Planning and Zoning.



# Content

- Storm Drainage Design and Technical Criteria (Chapter 10 Streets/Roads)
  - Remove the statement that the appropriate Fire Protection District may approve alternate standards for overtopping depth for the 100-year storm event that exceeds 12" and clarify that any relief would be processed by Planning and Zoning.



# Recommendation

- Staff and the Planning Commission recommend approval of these amendments to provide clarity and align County requirements with industry standards.







**JEFFERSON**  
COUNTY COLORADO

Thank you for  
your time!



# Definitions

- **All Weather Travel Surface:** An all weather travel surface is defined as an improved surface that is designed to withstand all weather conditions for typical road use and able to support emergency vehicles. The surface is required to be constructed of concrete, asphalt, recycled asphalt or a minimum of 6-inches of class 6 road base.
- **Dip of Natural Terrain:** The dip of the natural terrain refers to the direction at which the existing ground surface slopes downward. The direction of the dip should be drawn perpendicular to the existing contour lines.
- **Sidewalk:** A portion of a street designated for pedestrians and other vulnerable roadway users, in accordance with state law.
- **Vulnerable Roadway User:** Roadway users that are not protected by a vehicle or other shield while on a roadway and is at a greater risk for involvement in a serious injury or fatal crash. Vulnerable roadway users include, but are not limited to, bicyclists, pedestrian, and equestrians; those using mobility devices such as wheelchairs; those using micromobility devices such as electric scooters; and other forms of rolling such as roller blades and skateboards.

