

13.0 ROADWAYS

The design and construction of roadways for the Project shall be in accordance with the Contract Documents.

13.1 Administrative Requirements

13.1.1 Standards

The primary requirements for the design and construction of mainline roadways shall include, but are not limited to, the following documents:

Table 13-1 Standards for Roadway

Author or Agency	Title
Colorado Department of Transportation (CDOT)	<i>Roadway Design Guide</i>
American Association of State Highway and Transportation Officials (AASHTO)	<i>A Policy on Geometric Design of Highways and Streets</i>
AASHTO	<i>Roadside Design Guide</i>
CDOT	<i>Standard Plans, M&S Standards</i>
CDOT	<i>Standard Specifications for Road and Bridge Construction</i>
State of Colorado	<i>State Highway Access Code</i>
International Code Council (ICC)	<i>International Fire Code (IFC)</i>

13.1.2 Local Roadways

Local Roadways include county roads and local streets.

The requirements for the design and construction of local roadways shall include, but are not limited to those listed in Table 13-1 and other manuals and standards required to complete the work.

13.2 Design Requirements

13.2.1 Submittals

All submittals shall be prepared, reviewed and submitted in accordance with the requirements set forth in Book 2, Section 3.

13.2.2 General Design Requirements by Project Element

13.2.2.1 Basic Configuration Accommodation

The infrastructure constructed with the Project shall consider and accommodate the Basic Configuration, including but not limited to horizontal/vertical geometry and clearances to Structures.

The Contractor shall prepare and submit the preliminary design plan elements in consideration of the Basic Configuration for the Project for review prior to issuance of Released for Construction plans, according to procedures of its Approved Quality Management Plan.

13.2.3 Cross Slope and Superelevation

13.2.3.1 Normal Cross Section

All new and reconstructed pavement sections shall have a normal cross slope of 2%.

For pavement widening sections, the widened section shall have a normal cross slope of 2% or match existing cross slope.

For overlay sections where the existing cross slope is equal or greater than 2%, the Contractor shall maintain the existing pavement cross slope. For overlay sections where the existing cross slope is less than 2% the cross slope will be built up through the use of a variable thickness overlay to a minimum of 2%, unless otherwise Approved by CDOT in advance of construction activities.

13.2.3.2 Superelevation Rates

Superelevation design shall comply with the design criteria and methodology of AASHTO, A Policy on Geometric Design on Highways and Streets (PGDH), the CDOT Roadway Design Guide and CDOT Standard Plans List of M & S Standards. Maximum Superelevation rate (emax) is 8%.

Superelevation diagrams shall be provided in the Roadway plans to verify that edge profiles meet design criteria. Superelevation shall be modified if necessary to meet these criteria.

Superelevation transitions shall be designed to eliminate 0.0% cross slopes on Bridge Decks or on profile crest and sag curves where grades flatter than 0.5% occur.

13.2.4 Stopping Sight Distance, Decision Sight Distances, and Passing Sight Distances

Sight distances shall be determined in accordance with the AASHTO PGDH and the CDOT Roadway Design Guide.

13.2.5 Fill and Cut Slopes and Clear Zones

The Contractor shall design cut and fill slopes to obtain clear zones and avoid the need for guardrail wherever possible. Where clear zones cannot be obtained within CDOT ROW, guardrail shall be required.

Clear zones shall be designed in accordance with the recommendations of AASHTO Roadside Design Guide and shall use the horizontal curve adjustment factor where applicable. All other guidelines within the AASHTO Roadside Guide shall apply. Clear zones shall be measured from the outside edge of auxiliary lanes where they are present.

Note: All slopes stated herein are in terms of horizontal:vertical.

13.2.5.1 Roadside Slopes Adjacent to Pavement

Roadside slopes directly adjacent to the roadways shall be 6:1 except, at guardrail locations and where otherwise noted. The Point of Slope Selection (POSS) is defined as the location at which the roadside slope, also known as the Z-Slope, adjacent to the pavement ends and the cut or fill slope begins. Width and slope of the area between the Edge of Pavement (EOP) and the POSS shall be located a minimum of 8 feet beyond the edge of the pavement.

13.2.5.2 Fill Slopes

Fill slopes and heights beyond the POSS shall be designed and constructed in accordance with the following priority:

US 350/CO 239 (Plains)	CO 9 (Mountainous)	US 24 (Rolling)
H≤ 4', Z then 6:1	H≤ 4', Z then 4:1	H≤ 4', Z then 4:1
H>4'to10', Z then 4:1	H>4'to10', Z then 4:1	H>4'to10', Z then 4:1
H>10' to 15', Z then 4:1	H>10' to 15', Z then 3:1	H>10' to 15', Z then 3:1
H>15', Z, then 3:1	H>15', Z, then 3:1	H>15', Z, then 3:1

1. Where the above conditions cannot be obtained the Contractor may use any of the following design approaches:
 - A. Use 2:1 slopes with barrier protection, with CDOT Approval
 - B. Use retaining walls as necessary, with guardrail protection, to obtain matches with existing conditions within the Project limits. Where retaining walls are used, provide a traversable surface with a maximum 6:1 cross slope and a minimum 10 feet width between face of wall and ROW or permanent line, fence line or other obstruction.

~~Fill slope areas will be designed with ditch rip rap as necessary to prevent roadside and slope drainage from flowing onto adjacent properties.~~

All fill slopes shall be rounded at their matches to provide for a pleasing appearance.

13.2.5.3 Cut Slopes

Cut slopes beyond the POSS shall be designed and constructed in accordance with the following priorities:

1. Cut slopes must be transitioned at the match with the 6:1 slopes adjacent to roadway pavement in such a manner to comply with the recommendations of the AASHTO Roadside Design Guide.
2. Use 4:1 or flatter slopes for cut slopes where matches with existing conditions can be obtained within the Project limits.
3. Use 3:1 slopes for cut slopes where such slopes steeper than 4:1 are necessary to obtain matches with existing conditions within the Project limits.
4. Where the above conditions cannot be obtained, the Contractor may use any of the following design approaches:
 - A. Use 3:1 foreslopes with barrier protection.

- B. Use retaining walls as necessary, with guardrail protection to obtain matches with existing conditions within the Project limits. Where retaining walls are used, provide a traversable surface with a maximum 6:1 cross slope and a minimum 10 feet width between face of wall and ROW or permanent line, fence line or other obstruction.

All cut slopes shall be rounded at their matches to provide a pleasing appearance.

13.2.5.4 Guardrail

Guardrail shall be required wherever clear zone requirements cannot be achieved. All Guardrail Type 3 W Beam shall be Midwest Guardrail System (MGS) 31-inch with steel posts and synthetic blocks. Guardrail Type 3 W Beam shall include hot mix asphalt (HMA) as shown on M-606-1. Wooden curb and earthen shoulder is not allowed. Shoulder transitions shall occur after the length of need is met at a 50:25:1 taper length. Shoulder width shall be full width until length of need has been met.

13.2.5.5 Barrier

All concrete barriers shall be cast-in-place. Precast barriers are not allowed for permanent installations. All concrete barriers shall be Guardrail Type 9 Single Slope Barrier.

13.2.5.6 End Terminals

All end terminals shall be MASH compliant and included in CDOT's M&S.

13.2.6 Local Access

Modifications to currently proposed local access shall follow State of Colorado, State Highway Access Code, and shall be subject to CDOT Approval and the approval of the Local Agency prior to issuance of applicable Released for Construction Documents.

Connecting Approach (Access) roads shall be paved in accordance with CDOT M-Standard 203-1 using similar pavement as the adjacent roadway, and shall be replaced in conformance to the above requirements to the limits required to match existing grade.

13.2.7 Design Exceptions

13.2.7.1 Design Exception Process

Design exceptions shall be submitted to CDOT for Approval prior to the submittal of the Pre-RFC Documents. Design exceptions may be subject to the Approval of FHWA. Design exceptions that require Approvals beyond CDOT, may require additional time for Approval. Delays incurred from said Approvals are non-compensable and shall not justify any additional time to the schedule.

The Contractor shall comply with the following requirements when requesting a design exception:

1. The Contractor shall submit design exception requests in the form of a letter addressed to the CDOT Project Director for Approval prior to the submittal of Pre-RFC Documents.

2. The design exception request shall consist of the following items:
 - A. A letter identifying the exception(s) by number, Project number, location, and status (new submittal, resubmittal, etc.).
 - B. A completed CDOT Form 464 – Design Exception Variance Request, Exhibit 13-B.
 - C. Supporting documentation indicating the justification for the design exception. Justification shall address the following items:
 - i. Site conditions of the exception.
 - ii. Compelling reason for the exception, including which standard is not being met. If the exception affects any other standards, state what will be done to mitigate the effects of the exception.
 - iii. Effects of the exception on safety and operation of the facility.
 - iv. Previous crash history near the location of the exception.
 - v. Calculations estimating the cost of attaining the design standard and costs of exception as proposed.
 - vi. Effect on scenic, historical, or other environmental features.
 - D. Plan and profile drawings depicting the exception.

13.3 Construction Requirements

13.3.1 Safety Edge

The Contractor's design shall include safety edges. Safety edge shall be constructed on all roadways except in front of guardrail.

13.3.2 Shouldering Material

Shouldering Material may be placed in lieu of topsoil along the pavement edge for 4' in width per the requirements of Book 2, Section 10.

13.3.3 Fencing

13.3.3.1 Temporary Fencing

Installation of temporary fencing shall be required where existing ROW fence needs to be removed to aid in construction in order to protect and control livestock and to protect adjacent private property. The Contractor shall maintain the temporary fence in such condition that it is capable of performing its intended function until such time the permanent fence is completed. The Contractor shall give the landowner 30 Days written notice before any existing fence or gates are removed unless otherwise noted in Book 2, Section 8.

In remaining areas, temporary fencing should be considered to control construction operations and avoid impacts beyond ROW limits. Temporary fence shall be placed as required as any other section of the Contract.

13.3.3.2 Permanent Fencing

The Contractor shall provide permanent fencing and gates in accordance with CDOT Standard M-607-1.

13.3.3.3 Mailboxes

Mailboxes shall be reset and replaced per CDOT Standard M-210-1.

13.4 Deliverables

At a minimum, the Contractor shall submit the following to CDOT for review, Approval and/or Acceptance:

Deliverable	Review, Acceptance or Approval	Schedule
Preliminary design plan elements in consideration of the Basic Configuration	Review	Prior to issuance of Released for Construction plans
Access design modifications	Approval	Prior to issuance of applicable Released for Construction Documents
Design exceptions(if applicable)	Approval	Prior to issuance of applicable Released for Construction Documents

All deliverables shall also conform to the requirements of Section 3 - Quality Management.

13.5 Exhibits

Exhibits are as follows:

- A. Roadway Design Criteria Table
- B. CDOT Design Exception Variance Request Form

SECTION 13 - ROADWAY

Exhibit A: Roadway Design Criteria Table

<u>STRUCTURE LOCATIONS</u>			<u>ROADWAY CLASSIFICATIONS</u>			<u>CURRENT POSTED SPEEDS (MPH)</u>		<u>RFP MINIMUM ROADWAY DESIGN REQUIREMENTS SPECIFIC TO STRUCTURE REPLACEMENT LOCATIONS</u>			
<u>STR</u>	<u>HWY</u>	<u>MP</u>	<u>Functional Classification</u>	<u>Terrain</u>	<u>Access Control Classification</u>	<u>Regulatory Speed</u>	<u>Advisory Speed</u>	<u>DESIGN SPEED (MPH)</u>	<u>DESIGN VEHICLE</u>	<u>LANE WIDTH (FT)</u>	<u>SHOULDER WIDTH (FT) **</u>
J-15-G	CO 9	15.97	Minor Arterial	Mountainous	R-B Rural	45	35 (30)	30*	WB-67	12	8
J-14-C	CO 9	20.11	Minor Arterial	Rolling	R-B Rural	55	35	45*	WB-67	12	8
G-12-C	CO 9	71.44	Minor Arterial	Mountainous	R-A Regional	50	-	60	WB-67	12	8
I-13-G	US 24	227.1	Minor Arterial	Rolling	R-B Rural	65	-	50*	WB-67	12	8
I-13-H	US 24	229.47	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	8
H-13-N	US 24	240.69	Minor Arterial	Rolling	R-A Regional	65	-	75	WB-67	12	8
I-15-T	US 24	271.69	Minor Arterial	Mountainous	R-A Regional	50	45	50*	WB-67	12	8
I-15-AO	US 24	271.9	Minor Arterial	Mountainous	R-A Regional	50	45	45*	WB-67	12	8
I-17-X	US 24	295.45	Principal Arterial	Rolling	E-X Expressway	na	-	na	WB-67	12	8

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SECTION 13 - ROADWAY

<u>STRUCTURE LOCATIONS</u>			<u>ROADWAY CLASSIFICATIONS</u>			<u>CURRENT POSTED SPEEDS (MPH)</u>		<u>RFP MINIMUM ROADWAY DESIGN REQUIREMENTS SPECIFIC TO STRUCTURE REPLACEMENT LOCATIONS</u>			
<u>STR</u>	<u>HWY</u>	<u>MP</u>	<u>Functional Classification</u>	<u>Terrain</u>	<u>Access Control Classification</u>	<u>Regulatory Speed</u>	<u>Advisory Speed</u>	<u>DESIGN SPEED (MPH)</u>	<u>DESIGN VEHICLE</u>	<u>LANE WIDTH (FT)</u>	<u>SHOULDER WIDTH (FT) **</u>
O-19-D	US 350	10.29	Minor Arterial	Plains	R-B Rural	65	-	75	WB-67	12	6
N-21-C	US 350	47.13	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
N-21-F	US 350	48.74	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
M-21-C	US 350	50.58	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
M-21-B	US 350	51.68	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
M-21-J	US 350	57.07	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
M-22-Y	US 350	57.47	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
M-21-I	US 350	56.45	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
M-22-U	US 350	69.82	Minor Arterial	Rolling	R-B Rural	65	-	75	WB-67	12	6
P-19-G Minorg	CO 239	1.74	Minor Arterial	Plains	R-B Rural	45	-	55	WB-67	112	6

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* Based on the terrain and alignment of the existing facility - design alignments shall not be made worse than existing
** 6 foot shoulders require 2 foot paved guardrail offset ~~Exhibit A: Roadway Design Criteria Table~~

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SECTION 13 - ROADWAY

DESIGN ELEMENT	US-350-A	US-350-A	US-24-A	CO-9-A	CO-9-C	CO-239
<i>Roadway Classification</i> - -						
Roadway Classification	Minor Arterial					
Access Control Classification	R-B Rural	R-B Rural	R-B Rural	R-B Rural	R-A Regional	R-B Rural
Mile Marker to Mile Marker	0 to 45-149	49-149-72-718	226--376-59	8-626-21-246	71-153-76-454	0-97-3-345
Terrain	Plains	Rolling	Rolling	Mountainous	Mountainous	Plains
Design Speed (MPH)	75	75	75	65	60	55
Posted Speed Limit (MPH)	65	65	65	55	50	45
Design Vehicle	WB-67	WB-67	WB-67	WB-67	WB-67	WB-67
<i>Typical Section Criteria</i> - -						
Lane Width (Ft.)	12'	12'	12'	12'	12'	11'
Shoulder Widths	*6'	*6'	8'	8'	8'	*6'
*Six foot outside shoulders with a paved two foot guardrail offset.						

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Exhibit B: CDOT Design Exception Variance Request Form

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Field Code Changed