

### **Administrative Requirements**

The design and construction of roadways for the Project shall be in accordance with all the relevant requirements of the following standards, in addition to the requirements of the Contract Documents.

### **Mainline and Ramps**

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

- CDOT Design Guide, 1995 (Revised November, 2011)
- AASHTO, A Policy on Geometric Design of Highways and Streets, 6<sup>th</sup> Edition 2011 (PGDH)
- AASHTO, Roadside Design Guide, 4<sup>th</sup> Edition 2011
- CDOT, Standard Plans, M & S Standards, July 2012
- CDOT, Standard Specifications for Road and Bridge Construction, 2011
- FHWA Interstate Access Report (IAR).

### **Local Roadways**

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

- Local Agency Design Standards.
- AASHTO, A Policy on Geometric Design on Highways and Streets, 6<sup>th</sup> Edition, 2011 (PGDH)
- AASHTO, Roadside Design Guide, 4<sup>th</sup> Edition 2011.
- State of Colorado, State Highway Access Code, Volume 2, Code of Colorado Regulations 601-1, March 2002.
- CDOT, Standard Specifications for Road and Bridge Construction, 2011
- Interstate Access Approval Report (IAR).

### **Design Requirements**

Design of the Project shall be in accordance with the Roadway Design Criteria Table as provided in Appendix A.

### **Design and Plan Submittals**

In addition to the submittal requirements specified in this section the Contractor shall submit design and plan documents for CDOT Approval and Acceptance as required in the Quality Section.

### **Split Profiles**

Split profiles shall be designed to the criteria detailed in Standard Plan No. M-606-13 Barrier Style CE. No other style of retaining walls will be allowed for split profile roadways.

### **Cross Slope**

All pavement totally reconstructed sections of mainline shall have a normal cross slope of 2% where superelevation is not required.

For pavement widening sections, the widened section will have a normal cross slope of 2%.

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%.

### **Superelevation**

Superelevation runoff and runoff lengths shall be designed based on the mainline configuration with additional auxiliary lanes, as required. Superelevation design shall comply with the design criteria and methodology of the PGDH. Runoff lengths ( $L_r$ ) shall be calculated based on a rotated pavement width, which is assumed to extend from an ultimate pivot point to the outside lane/shoulder line, including auxiliary lanes where present.

Superelevation transitions along mainline must be accomplished coincident with the use of spiral transitions for locations at which spiral curves are incorporated into the horizontal alignment. Spiral transition criteria within the PGDH recommend spiral lengths that are sometimes less than minimum runoff lengths calculated for wide pavements. The Engineer shall provide a consistent approach to spiral lengths and runoff lengths by applying superelevation transitions as follows:

1. Provide coincident runoff and transition spiral lengths equal to the minimum runoff length ( $L_r$ ) until  $L_r$  exceeds the maximum length of spiral ( $L_{smax}$ ).
2. Where  $L_r$  exceeds  $L_{smax}$ , provide coincident runoff and transition spiral lengths equal to  $L_{smax}$ , provided an analysis of edge profiles indicates the edges profiles will meet normal profile design criteria.
3. Where normal profile design criteria cannot be met at the edge profiles, increase the coincident spiral transition and runoff length until such normal profile design criteria can be met.
4. Superelevation transitions shall be designed to minimize the occurrence of 0% cross slopes on bridge decks or on profile grades flatter than 0.5%.

### **Stopping Sight Distance**

Stopping sight distance shall meet the requirements of Roadway Design Criteria Table, Appendix A. Stopping sight distances shall be determined in accordance with the PGDH.

### **Decision Site Distances**

Alignment design on the mainline shall provide for obtaining decision site distances on the mainline to all exit ramp gores, and at ramp approaches to ramp intersections. Decision site distances are provided in the Roadway Design Criteria Table, Appendix A.

### **Sight Distances Across Median Barriers**

Sight distance calculations for inside travel lanes on curves to the left may incorporate the use of lines of sight over the median guardrail, to avoid shoulder widening. Where such a design approach is used, the Project design shall include documentation of a graphical solution incorporating both profile grade and superelevation calculations in the development of ground lines and lines of sight.

**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 right-of-way guardrail shall be required.

Clear zones shall be designed in accordance with the recommendations of AASHTO, Roadside Design Guide. Clear zones shall be taken from the outside edge of auxiliary lanes where they are present.

*(Note: All slopes are stated herein are in terms of horizontal: vertical)*

**Roadside Slopes Adjacent to Pavement**

Roadside slopes directly adjacent to mainline and ramp pavements 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 adjacent to the pavement ends, and the cut, or fill slope begins. The POSS shall be located a minimum of 12 feet beyond the edge of the pavement on mainline, and a minimum of 8 feet beyond the edge of pavement for ramps.

**Fill Slopes**

Fill slopes shall be designed and constructed in accordance with the following priority.

1. Use 6:1 slopes where fill heights are less than 4 feet, and matches with existing conditions that can be obtained within the Project limits.
2. Use 4:1 slopes where fill heights are greater than 4 feet but less than 10 feet, and matches with existing conditions that can be obtained within the Project limits.
3. Use 3:1 slopes where fill heights are less than 10 feet and slopes steeper than 4:1 are required to match existing conditions within the Project limits.
4. Use 3:1 slopes where fill heights exceed 10 feet, and matches with existing conditions can be obtained within the Project limits and clear zone can be obtained within the Project limits.
5. Where the above conditions can not be obtained the Contractor may use any of the following design approaches:
  - A. Use 3:1 to 2:1 slopes with guardrail protection. Slopes of 2:1 to 3:1 shall incorporate the use of soil retention blankets in compliance with the requirements of the Landscaping Section.
  - B. Use retaining walls as necessary, with guardrail protection, to obtain matches with existing conditions within the Project limits. Where retaining walls are used, they shall be located to avoid landscaping and maintenance areas of less than 10 feet in width.

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

**Cut Slopes**

Cut slopes 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 to 2:1 slopes with guardrail protection. Slopes of 2:1 to 3:1 shall incorporate the use of soil retention blankets in compliance with the requirements of the Landscaping Section 17.
  - B. Use slopes steeper than 2:1 where a slope stability analysis demonstrates the stability of the steeper slopes. The slope stability analysis shall be submitted to CDOT for Approval. Guardrail protection shall be required for this condition.
  - C. Use retaining walls as necessary, with guardrail protection to obtain matches with existing conditions within the Project limits. Where retaining walls are used, locate to avoid landscaping and maintenance areas of less than 10 feet in width.

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

#### **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.

#### **Interstate Access**

CDOT has obtained Interstate Access Approval from FHWA for the interchange configurations and locations as described in the Interchange Access Report (IAR). The Contractor shall be responsible for obtaining FHWA approval for any desired modifications to the IAR.

#### **Design Exception Process – Basic Configuration**

Design exceptions to the Basic Configuration of the Interstate facility shall be subject to the approval of the FHWA. The Contractor shall comply with the following requirements when requesting a design exception to the Basic Configuration:

1. The Contractor shall submit 5 copies of design exception requests in letter form, addressed to CDOT.
2. The design exception request submittals shall consist of the following items:
  - A. A letter identifying the exception(s) by number, Project number, location, and status (new submittal, re-submittal, etc.).
  - B. A completed design exception request form for each exception proposed. Exhibit A contains the Design Exception Request form.
  - C. Supporting documentation indicating the justification for the exception. The Contractor may use the form in Exhibit B as part of the documentation. Justification shall address the following items:
    - (1) Site conditions of the exception.

- (2) Compelling reason for the exception, including which standard is not being met, if the exception affects any other standards, and what will be done to mitigate the effects of the exception.
- (3) Effects of the exception on safety and operation of the facility.
- (4) Previous crash history near the location of the exception.
- (5) Calculations estimating the cost of attaining the design standard and costs of exception as proposed.
- (6) Effect on scenic, historical, or other environmental features.
- D. Plan and profile and other necessary drawings depicting the exception.
- 3. Upon Approval by CDOT, the exception request will be forwarded by CDOT to FHWA for approval.

**Construction Requirements**

Construction of roadways shall be in accordance with the requirements included in this Section.

**Guardrail**

Guardrail shall be required for the entire length of mainline to protect from opposing directions of traffic except between MP 154.0 and MP 157.0

Where cable guardrail is utilized, a 3' wide and 4" thick asphalt or concrete pad will be utilized to assist maintenance in weed and grass control.

The Contractor shall use galvanized (Standard Plan No. M606-1) steel posts with composite block for all guardrail installations unless otherwise Approved by CDOT. The Contractor shall pave asphalt a minimum of 1-foot behind the new guardrail.

**Fencing (IF APPLICABLE)**

Fencing shall be provided in accordance with the Architectural Requirements, which may be found on the project webpage, under Reference Documents.

**Deliverables**

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

Deliverable	Acceptance or Approval	Schedule
Slope stability analysis	Approval	Prior to issuance of applicable Released for Construction Documents
Access design modifications	Approval	Prior to issuance of applicable Released for Construction Documents
Design exceptions	Approval	Prior to issuance of applicable Released for Construction Documents

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

**Appendices**

Appendices are as follows:

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

<b>APPENDIX A</b>			
<b>ROADWAY DESIGN CRITERIA TABLE</b>			
<b>Design Criteria</b>	<b>I-25</b>	<b>Ramps</b>	<b>Remarks</b>
Design Speed (mph)	75		
Terrain	Rolling	Rolling	
<b><i>GEOMETRIC STANDARDS</i></b>	-	-	
<b><u>Horizontal Geometry</u></b>	-	-	
E <sub>max</sub> (%)	6	6	
Pivot Point	Center/Shoulder	Shoulder	
Minimum Horizontal Radius (ft)	2040	833	
Use of Spirals	Yes	No	Use spirals where identified as desirable in PGDH
<b><u>Vertical Geometry</u></b>	-	-	
Minimum Profile Grade (%)	0.5	0.5	
Maximum Profile Grade (%)	4	5	
Rate of Vertical Curve (K)	-	-	
Crest			Per Design Criteria
Sag			
<b><u>Sight Distance</u></b>	-	-	
Stopping Sight Distance (ft)			Per Design Criteria
Decision Site Distance (ft)			Per Design Criteria
<b><u>Vertical Clearance</u></b>	-	-	
Below Structure (ft)	16.5	16.5	
Sign Trussed and Ped. Overpasses (ft)	17.5	17.5	
<b><u>Horizontal Clearance</u></b>	-	-	

<b>APPENDIX A</b>			
<b>ROADWAY DESIGN CRITERIA TABLE</b>			
<b>Design Criteria</b>	<b>I-25</b>	<b>Ramps</b>	<b>Remarks</b>
Clearance to Building (ft)	20	20	
Clearance to Retaining Wall/Piers (ft)	2	2	
<b>CROSS SECTION</b>	-	-	
<b><u>Lanes</u></b>	-	-	
Lane Widths (ft)	12	15 (Single) 12 (Multiple)	

APPENDIX A			
ROADWAY DESIGN CRITERIA TABLE			
Design Criteria	I-25	Ramps	Remarks
<b><u>Shoulders</u></b>	-	-	
Shoulder Widths – LT/Median (ft)	4-12	4	Mainline: 12' except where specifically noted otherwise in the Basic and Temporary Configuration
Shoulder Widths – RT/Outside (ft)	*8-12	8	* 8' Adjacent to Auxiliary lanes, 12' Adjacent to Through lanes
Shoulder Surface	Paved	Paved	
Shoulder Cross Slope (%)	Match	Match	
<b><u>CURB AND GUTTER</u></b>	-	-	Local Agency Standard
Curb Height – Outside (in)	-	8	
Gutter Width – Outside (in)	-	24	
Curb Height – Median (in)	-	6	
Gutter Width – Median (in)	-	12	
<b><u>Median</u></b>	-	-	
Median Width (ft)	Varies	-	
Treatment	-	-	
<b><u>Intersection At Grade</u></b>	-	-	
Minimum Curb Radius (ft)	-		
Design Vehicle	-	WB – 67	
<b><u>Ramp Terminals</u></b>	-	-	
Acceleration Length (ft)	-	Varies	
Deceleration Length (ft)	-	Varies	
<b><u>Terminals</u></b>	-	-	
Single Lane Entrance/Exit	-	Parallel	In accordance with Figures 10-14,15 of CDOT Design Guide
Two Lanes Entrance/Exit	-	Tapered	In accordance with Figure 10-19 of CDOT Design Guide

**Book 2 – Technical Requirements  
I-25 North Design Build  
PE: IM C040-029 (17354)  
Construction: I 025A-016 (18842)  
September 17, 2012**

**Section 13 - Roadway**

<b>COLORADO DEPARTMENT OF TRANSPORTATION DESIGN EXCEPTION VARIANCE REQUEST</b>		FHWA Oversight <input type="checkbox"/> Yes <input type="checkbox"/> No	Project Code
Project name		Date	Project Number
Type (check all that are applicable) <input type="checkbox"/> New construction <input type="checkbox"/> Restoration <input type="checkbox"/> Resurfacing <input type="checkbox"/> Rehabilitation <input type="checkbox"/> _____ <input type="checkbox"/> Reconstruction <input type="checkbox"/> Safety <input type="checkbox"/> Enhancement <input type="checkbox"/> _____		Revised	Region

**Part 1 – Complete A through H for all projects.**

A. Short project description ( <input type="checkbox"/> see CDOT Form 463 for more detailed description)		<input type="checkbox"/> AASHTO standards apply <input type="checkbox"/> 3R standards apply <input type="checkbox"/> Other: _____
B. Description of standard(s) reduced		
C. Rational need for exception(s)		
D. Mitigation measures proposed (include safety discussion)		
E. Description of adjoining sections: ( <input type="checkbox"/> see CDOT Form 463) Other:		<input type="checkbox"/> same as existing project <input type="checkbox"/> same as proposed project
F. Accident data Source:  Most recent statewide accident rate (calendar year) for this functional class / facility: (per million vehicle-miles of travel) a) _____ b) _____ Latest accident rate for this highway (usually 3 years): _____ a) _____ b) _____	G. Cost  Estimated item cost if built to full standard \$ _____ Estimated item cost with exception \$ _____ ± difference in cost: \$ _____	
H. Other (as needed)		

**Part 2 – Appropriate signatures required.**

A. Submitted by (Project Manager)	Date	Program Engineer Approval	Date
Resident Engineer Approval			Date
Required for Federal-oversight projects only Approved by (FHWA Division Administrator)			Date
B. <input type="checkbox"/> Not approved <input type="checkbox"/> Approved with conditions	Conditions/comments		

Distribution: Project Manager  
Program Engineer, FHWA, if applicable  
Resident Engineer, HQ Records Center

**Previous editions are obsolete and may not be used.**

**CDOT Form #0464 11/04**