13.0 Roadways

13.1 Administrative Requirements

The design and construction of roadways for the Project shall be in accordance with all the relevant requirements of the following standards (latest versions at Proposal Due Date), in addition to the requirements of the Contract Documents.

13.1.1 I-25 Mainline and Ramps and US50C (Santa Fe Avenue)

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 Roadway Design Guide
- AASHTO A Policy on Geometric Design of Highways and Streets
- AASHTO Roadside Design Guide
- AASHTO Guide for the Development of Bicycle Facilities
- CDOT Standard Plans, M & S Standards
- CDOT Standard Specifications for Road and Bridge Construction
- State of Colorado, State Highway Access Code
- United States Access Board, ADA Accessibility Guidelines for Buildings and Facilities
- United States Access Board, Revised Draft Guidelines for Accessible Public Rights-of-Way

Recovery Zones at all Ramp Gore Areas shall be designed per CDOT Design Guide.

13.1.2 Local Roadways

Local Roadways include Stanton Ave, D Street, Clark Street, Kelly Street, Gruma, 1st Street, Indiana, Mesa Ave, and Northern Ave.

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

- City of Pueblo Design Standards
- AASHTO A Policy on Geometric Design on Highways and Streets
- AASHTO Roadside Design Guide
- State of Colorado, State Highway Access Code
- United States Access Board, ADA Accessibility Guidelines for Buildings and Facilities
- United States Access Board, Revised Draft Guidelines for Accessible Public Rights- of-Way
- CDOT Standard Specifications for Road and Bridge Construction
- Other manuals and standards required to complete the work

13.2 Design Requirements

Design of the Project shall be in accordance with this Section 13 and the Roadway Design Criteria Table as provided in Exhibit A.

13.2.1 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 Section 3 – Quality Management.

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. Changes to the Basic Configuration may result in a Minor Interchange Modification Request (MIMR) or an Interstate Access Request (IAR).

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.

13.2.2 I-25 Mainline and Ramps Profiles

The Preferred Alternative profiles for I-25 Mainline and Ramps at 1st Street, as shown in Book 5 – Reference Documents, are a constant grade. The constant grade was selected to eliminate the "roller coaster effect" that currently exists on I-25 through Pueblo. Any change to this profile, including but not limited to adding vertical curves, shall meet the Roadway Design Criteria Table and AASHTO criteria and shall be Approved by CDOT. This Approval shall be part of the ACC process.

The As-Built profile of each lane line between the Arkansas River and the I-25 over 1st Street bridge shall not introduce a grade break greater than 0.10%. If any location in the final constructed roadway and structure profile exceeds the maximum grade break, the Contractor shall correct the deficiencies. The Contractor shall survey the roadway and structures no sooner than 60 days prior to Final Acceptance and shall submit for Approval the As-built profile of each lane line to CDOT prior to Final Acceptance.

13.2.3 Cross Slope

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

For pavement widening sections, the widened section shall 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%, unless otherwise Approved by CDOT in advance of construction activities.

13.2.4 Superelevation

Superelevation runout 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 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.

Runoff lengths (Lr) 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 (Lr) until Lr exceeds the maximum length of spiral (Lsmax).
2. Where Lr exceeds Lsmax, provide coincident runoff and transition spiral lengths equal to Lsmax, 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 so that cross slope is 0.5% to 2.0% on bridge decks or on profile grades flatter than 0.5%.

13.2.5 Stopping Sight Distance

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

13.2.6 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 per AASHTO standards.

13.2.7 Fill and Cut Slopes and Clear Zones

The Contractor shall design cut and fill slopes to obtain standard clear zones and avoid the need for guardrail wherever possible. Where standard 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. 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.

13.2.8 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 12 feet beyond the edge of pavement for ramps.

13.2.9 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 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.
4. Where the above conditions can not be obtained the Contractor may use any of the following design approaches:
    A. 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 12 feet width between face of wall and ROW or permanent line, fence line or other obstruction.

Fill slope areas will be designed with ditches and storm sewer 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.

13.2.10 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 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 12 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.

13.2.11 Guardrail

Guardrail shall be required wherever clear zone requirements cannot be achieved. Shoulder transitions shall occur after the length of need is met at a 50:1 taper length. Shoulder width shall be full width until length of need has been met.

Median barrier is required along the entire length of I-25. All Median barriers north of the Arkansas River shall be concrete barrier with a concrete glare screen in accordance with CDOT Standard M-606-13.

Guardrail along outside shoulders of I-25 and interchange ramps shall not be concrete barrier unless required for noise wall construction.
All concrete barriers shall be cast-in-place. Precast barrier is not allowed for permanent installations.

13.2.12 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 roads and driveways shall be paved to the ROW limits 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.

13.2.13 Bikeways/Multi-use Trails

The Bikeway/Multi-use trail design shall:

1. Provide horizontal and vertical separation from mainline I-25 that minimizes the need for barrier separation from the Roadway
2. Meet ADA requirements
3. Meet requirements of CDOT Roadway Design Guide – Chapter 14
4. Meet all other City of Pueblo requirements

13.3 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 for Approval prior to issuance of applicable Released for Construction Documents.
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 B contains the CDOT Design Exception Variance 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.
    B. 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.

13.4 Construction Requirements

Construction of roadways shall be in accordance with the requirements included in this Section 13.

13.4.1 Guardrail

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.

13.4.2 Bikeways/Multi-use Trails

The Bikeway/Multi-use trails may be temporarily realigned during construction. The realigned trail surface shall be asphalt or concrete. The Contractor shall submit to CDOT for Approval the temporary realignment plan prior to applicable Released for Construction Documents.

13.4.3 Fencing

Temporary Fencing

Installation of temporary fencing will be required according to ROW acquisition agreements to protect adjacent private property. In remaining areas, temporary fencing should be considered to control construction operations and avoid impacts beyond ROW limits. Temporary fence shall be placed as may be required in Section 5 - Environmental Requirements, Section 17 – Landscaping, and any other section of the Contract.

Permanent Fencing

Remove existing CDOT fencing and provide permanent fencing of types and at locations in Table 13.4-1. Fencing shall be provided in accordance with Book 4 – Contract Drawings.

Table 13.4-1
PERMANENT FENCING TYPES

Location	Type	Remarks
Right-of-Way line	Chain Link	Per CDOT Standard M-607-2
Retaining walls and bridges	-	Per Book 4 – Contract Drawings
Access control between bikeways/multi-use trails and railroads	Chain Link	Per CDOT Standard M-607-2
Water quality/detention ponds	Chain Link	Per CDOT Standard M-607-2

Gates

The Contractor shall provide gates in fences at locations, width and type as specified by requirements of the Contract or other maintaining entities for maintenance access, including CDOT. All gate locations and sizes shall be submitted to CDOT for Approval prior to issuance of applicable Released for Construction Documents.

13.5 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
As-Built profile of each lane line	Approval	Prior to Final Acceptance
Access design modifications	Approval	Prior to issuance of applicable Released for Construction Documents
Bikeway/Multi-use trail temporary realignment plan	Approval	Prior to issuance of applicable Released for Construction Documents
Design exceptions	Approval	Prior to issuance of applicable Released for Construction Documents
Gate locations and sizes	Approval	Prior to issuance of applicable Released for Construction Documents

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

13.6 Exhibits

Exhibits are as follows:

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

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Exhibit A: Roadway Design Criteria Table

DESIGN ELEMENT		I-25	INTERCHANGE RAMPS	D STREET
Roadway Classification				
Roadway Classification		Interstate - Urban	Interchange Ramps	Local Road
Access Control Classification		Interstate (Full)	-	-
Design Speed				
	Minimum (MPH)	70	50	25
	Desirable (MPH)	80	60	30
Posted Speed Limit Minimum (MPH)		65	45	25
Design Vehicle		WB-67	WB-67	WB-50
Horizontal Alignment Criteria				
Curve Radius For Design Speed Minimum (Ft.)		2040'	833'	200'
Curve Radius For Design Speed Desirable (Ft.)		3050'	1330'	250'
Superelevation (e_{max})		6%	6%	4%
Max. Degree of Curve - Design Speed Minimum (Calculated)		2.81	6.88	
Max. Degree of Curve - Design Speed Desirable (Calculated)		1.87	4.31	
Cross Slope - Normal		2%	2%	2%
Maximum Algebraic Difference at Crossover Line		4 to 5%	4 to 5%	4 to 5%
Clear Zone (On Tangent)				
	Minimum	22'	22'	10'
	Desirable	30'	30'	10'
Clear Zone (On Curve)				
	Minimum	29	33'	10'
	Desirable	36	45	10’
Lane Width (Ft.)		12'	12'(Two Lane) 15’(Single)	Varies 10-12'
Shoulder Widths				
	Left Inside (Ft.)	12'	4’	N/A
	Right Outside (Ft.)	12'	8'(Two Lane) 6’(Single)	N/A
Curb and Gutter Type		N/A	N/A	Type II
Sidewalk Widths		N/A	N/A	12’
Median Widths		N/A	N/A	17’
Buffer to Sidewalk				10’-20’
	Z slope (6:1)	12'	12'	12'
	Fill Slope	3:1 to 6:1	3:1 to 6:1	3:1 to 6:1

DESIGN ELEMENT		I-25	INTERCHANGE RAMPS	D STREET
	Cut Slope	3:1	3:1	3:1
Redirect Taper (Ft.)		65:1 min.	65:1 min.	65:1 min.
Transition Taper for Accel/Decel Lanes		25:1 min.	25:1 min.	25:1 min.
Taper Length for Roadway Lane Drop and Shoulder Width Transition		70:1 Desirable 50:1 min.	70:1 Desirable 50:1 min.	70:1 Desirable 50:1 min.
Vertical Alignment Criteria				
Maximum Grade		4%	5%	5%
Minimum Grade		0.30%	0.30%	0.3%
Min. Vertical Grade Break without a Curve		0.20%	0.20%	0.20%
Min. Vertical Curve Length (Ft.)		390	150	80'
K-Value Ranges				
	Crest VC (Minimum)	247	84	12
	Crest VC (Desirable)	384	151	19
	Sag VC (Minimum)	181	96	26
	Sag VC (Desirable)	231	136	37
Sight Distances				
Min. Stopping Sight Distance (Ft.) Minimum				
	Level (Minimum)	730’	425’	155’
	3% Downgrade (Minimum)	771’	446’	158’
	3% Upgrade (Minimum)	690’	405’	147’
	Level (Desirable)	910’	570’	200’
	3% Downgrade (Desirable)	965’	598’	205’
	3% Upgrade (Desirable)	859’	538'	200'
Interchanges Parallel/Taper Type Ent./Ex. Terminals				
Taper Length Taper Entrance Terminal (L>1300 Ft.)		between 50:1 & 70:1	between 50:1 & 70:1	between 50:1 & 70:1
Taper Length Parallel Entrance Terminal (L<1300 Ft.)		300' Minimum	300' Minimum	300' Minimum
Taper Length Parallel Exit Terminal		between 15:1 & 25:1	between 15:1 & 25:1	between 15:1 & 25:1
Structure Clearance Criteria				
Highway Underpass Vertical (Ft.)		16.5'	16.5'	16.5'
Local Road Underpass Vertical (Ft.)		16.5'	16.5'	16.5'
Rail Road Structure (Ft.)		23.5'	23.5'	23.5'
Sign Structures and Pedestrian Overpass (Ft.)		17.5'	17.5'	17.5'
Overhead Power Lines Vertical (Ft.)		20.5' to 21.5'	20.5' to 21.5'	20.5' to 21.5'