13.0 ROADWAYS

13.1 Administrative Requirements

The Contractor shall comply with the requirements of the following manuals and standards (latest versions at Proposal Due Date) for the design and construction of the Work for the Project.

13.1.1 I-25, US 24, and Ramps

1. CDOT Roadway Design Guide
2. AASHTO, A Policy on Geometric Design on Highways and Streets 2004
3. AASHTO, Roadside Design Guide
4. CDOT, Standard Plans List, M & S Standards, July 2012
5. CDOT, Standard Specifications for Road and Bridge Construction, 2011
6. FHWA Interstate Access Report (IAR)

13.1.2 Local Roadways

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

- City of Colorado Springs, Standard Specification Manual.
- AASHTO, A Policy on Geometric Design on Highways and Streets,
- AASHTO, Roadside Design Guide, 3rd Edition.
- State of Colorado, State Highway Access Code
- Colorado Springs Engineering Criteria Manual
- CDOT, Standard Specifications for Road and Bridge Construction.

Other requirements provided in Book 3 shall govern the design and construction as applicable.

13.2 Design Requirements

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 Book 2, Section 3 - Quality Management.

13.2.2 Traffic Analysis and Design

The IAR Re-Evaluation provides design year traffic volumes, ~~levels of service (LOS)~~Measures of Effectiveness (MOE's) and other operational parameters for the Project. The Project design shall meet or exceed the ~~LOS~~ MOE's and other operational parameters identified in the IAR Re-Evaluation.

The design of the Basic Configuration and Temporary Configuration shall provide ~~opening day Levels of Service of D or~~equivalent or better operations ~~better~~ for I-25 mainline, ramps, and ramp intersections for 2014 and 2035 as described in the IAR Re-Evaluation.

The Contractor shall perform a traffic study, to be submitted to CDOT for Approval concurrent with the Preliminary Design and Plans (refer to Section 3, Quality Management).

13.2.3 General Design Requirements by Project Element

13.2.3.1 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 and Plans prior to issuance of Released for Construction plans, according to procedures of its Approved Quality Management Plan.

13.2.4 Cross Slope and Superelevation

13.2.4.1 Normal Cross Slope

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

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

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

13.2.4.2 Superelevation Rates

Superelevation runout and runoff lengths for I-25, collector distributor roads, and interchange ramps shall be designed based on design criteria and methodology of AASHTO, A Policy on Geometric Design on Highways and Streets, the CDOT Roadway Design Guide, and CDOT Standard Plans List of M & S Standards.

An analysis of edge profiles (at the location of the shoulder/lane line) shall be peformed at location of superelevation transitions on the I-25 mainline to verify that edges profiles will meet normal profile design criteria. Superelevation transitions shall be modified if necessary to meet this criteria.

Superelevation transitions shall be designed to minimize the occurrence of 0% cross slopes on bridge decks or on profile grades flatter than 0.5%.

13.2.4.3 City Streets

City streets cross slopes shall be as shown in the Colorado Springs Engineering Criteria Manual.

Superelevation rates for city streets shall comply with the Colorado Springs Engineering Criteria Manual and the requirements for the design of Low-Speed Urban Streets, Table 3-13, Chapter 3, of PGDH. Existing superelevation in areas that are not totally reconstructed may be retained, provided sufficient drainage design criteria can be met.

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13.2.5 Stopping Sight Distance

Stopping sight distances and decision sight distances shall meet or exceed the requirements of Exhibit~~s 13-1 and 13-2~~A Roadway Design Criteria in this Section. Stopping sight distances shall be determined in accordance with the AASHTO, A Policy on Geometric Design on Highways and Streets 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 of I-25 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.

13.2.7 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 the AASHTO Roadside Design Guide.

13.2.7.1 Roadside Slopes Adjacent to Pavement

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

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. Width and slope of the area between the edge of pavement (or sidewalk) and the POSS shall be as follows:

1. Mainline I 25: 12 feet minimum at a 6:1 slope
2. Collector-distributor roads: 12 feet at a 6:1 slope
3. Ramps: 12 feet at a 6:1 slope
4. Curb and sidewalk areas: 2 feet at a 50:1 slope

13.2.7.2 Fill Slopes

Fill slopes beyond the POSS 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 cannot be obtained, the Contractor may use any of the following design approaches:

   A. Use 3:1 to 2:1 slopes with guardrail protection where not otherwise prohibited by the Aesthetic Plans and Details. Slopes of 2:1 to 3:1 shall incorporate the use of soil retention blankets in compliance with the requirements of Section 17, Landscaping. 2:1 Slopes will not be allowed north of Bear Creek and south of the existing Midland Trail.

   B. Use retaining walls as necessary, with guardrail protection. Where retaining walls are used, they shall be located to avoid landscaping and maintenance areas of less than 10 feet in width.

Fill slope areas shall be designed to prevent Roadway and slope drainage from flowing onto adjacent properties.

13.2.7.3 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 to 2:1 slopes with guardrail protection where not otherwise prohibited by the Aesthetic Plans and Details.. Slopes of 2:1 to 3:1 shall incorporate the use of

soil retention blankets in compliance with the requirements of Section 17, Landscaping. 2:1 Slopes will not be allowed north of Bear Creek and south of the existing Midland Trail.

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.

13.2.7.4 Retaining Walls

The following retaining walls shall be included in the project in the horizontal plan location as shown in the reference documents to ensure compatibility with the ultimate interchange configuration.

- Wall E3-A
- Wall W4
- Wall W1-A
- Wall E1-A

Additional walls depicted in the Basic Configuration are for information only and may or may not be needed to meet the contract requirements.

13.2.8 Guardrail

Guardrail shall be required wherever clear zone requirements cannot be achieved.

Median barrier in the ultimate configuration shall be concrete barrier with a concrete glare screen in accordance with CDOT Standard M-606-13.

Guardrail on the I-25 Bridge over Cimarron shall be Concrete bridge rail following the requirements of the Aesthetic Plans and Details in Book 4.

Guardrail along outside edge of the NB lanes of I-25 from the I-25 Bridge to the Northbound on Ramp Gore shall be concrete barrier to comply with the agreement set forth with the City of Colorado Springs.

Guardrail along outside shoulders I-25, collector-distributor roads, and interchange ramps shall be concrete barrier where inlets are required for pavement drainage. All concrete barriers shall be cast-in-place. Precast barrier is not allowed for permanent installations.

13.2.9 Access Design

The Contractor shall construct connecting roads, driveways, or curb cuts to provide access to property parcels where existing accesses have been disturbed or modified. Access design and location shall conform to the following requirements, in the order of precedence listed:

1. Access locations and restrictions delineated on the ROW Plans (Book 4).

2. Access Location as defined in the Environmental Assessment.
3. Access locations as defined in the Basic Configuration and Temporary Configuration.
4. Access locations as defined in the Interchange Access Report (IAR).
5. Access locations as defined in the Reference Drawings.
6. Access locations as defined in the Reference Documents.
7. State of Colorado, State Highway Access Code.

Modifications to currently proposed local access shall be subject to CDOT Approval and the approval of the City of Colorado Springs.

Connecting roads and driveways shall be paved to the ROW limits using similar pavement as the adjacent roadway.

13.2.10 Interstate Access

CDOT is in the process of obtaining an Interstate Access Re-Evaluation Approval from FHWA for the Basic Configuration as described in the draft Interchange Access Re-Evaluation Report (IAR) to be provided with the Final Request for Proposal. The Contractor shall fully comply with the design ~~of the~~included in the IAR Re-Evaluation unless otherwise Approved by CDOT. The Contractor shall be responsible for obtaining FHWA approval for any modifications to the IAR Re-Evaluation. ~~A draft~~The final Methods and Assumptions Memorandum is included in Book 3 of the ~~with the~~ ~~Draft~~ Request for Proposal to outline the analysis approach approved by FHWA.

13.2.11 Trails

Final trail configuration shall be coordinated with and Approved by the City of Colorado Springs Parks and Recreation Department. Trail alignments provided in the Basic Configuration provide limits and locations of proposed trails.

Trail crossings of I-25, US 24 and the ramps shall be ~~made by means of pedestrian bridge~~grade separated bridge structures, crossings of Fountain Creek and Monument Creek shall be made by means of pedestrians bridges, with the exception of the extension of the culvert for the I-25 crossing of Bear Creek.

Proposed Tier 1 Trail Design Criteria	
Criteria Category	**Proposed Criteria (based on bicyclists)**
Design Speed	(12 MPH – 30 MPH) 20 MPH
Minimum Centerline Curve Radius	74’
Trail Width	16’ (12’ hard surface, 4’ soft surface)~~; Min 10’~~
Design Users	Pedestrians, Bicyclists, Equestrians, Maintenance Vehicles
Minimum Vertical Clearance	12’
Centerline Grade	0.5% min, 5% max

Centerline Grade (Ramps)	5% to 8.3%, rise 2.5' max, landing length 5' min
Stopping Sight Distance	137' (5% ascent), 195' (5% descent)
Length of Crest Vertical Curve	3' min; (SSD) 55' (A = 4%) to 1111' (A = 25%)
Horizontal Sight Distance (M)	30.4' to 57.4' min
Trail Cross Slope	1% (2% max)
Shoulders/Clear Zone	3' to 5' (1V:6H max cross-slope); 2' min to signs; 5' min w/out railing

Proposed Trail Design Exceptions			
Trail	**Tier**	**Design Exception**	**Notes**
Bear Creek Trail	1	Horizontal curve at Sta107+55 (I-25 HCL), R_{MIN}= 15'	-
Cimarron Trail Connection Westbound	N/A	N/A	Paved m~~M~~ulti-use trail , maximum slope = 5.0%, width = 10 ft
Cimarron Trail Connection Eastbound	N/A	N/A	Paved m~~M~~ulti-use trail, maximum slope = ~~8.5~~9.2%, width = 10 ft
Cucharras Spur Trail	1	N/A	-
Fountain Creek Trail	1	N/A	-
Midland Trail	1	N/A	-
Midland Trail Connection	1	12 ft paved and 2 ea-4 ft soft shoulders required	-
Pikes Peak Greenway Trail – Leg 1~~East~~	1	N/A	-
Pikes Peak Greenway Trail – Leg 2 ~~West~~	3	Width = 10 ft	~~-~~See City of Colorado Sprigs Trail Design Standards for Tier 3 requirements.

Contractor shall install one pedestrian bridge over Fountain Creek and one pedestrian bridge over Monument Creek. The pedestrian bridge over Monument Creek shall be no farther north than Sta 129+30 (I-25 HCL) and north of the confluence with Fountain Creek. The Pedestrian bridges shall be a single span bridge complying with the requirements of the flood plain development permit in Book 3, Section 12. New pedestrian bridges shall have a minimum width of 12' between the rails to meet the City of Colorado Springs Tier 1 Trail requirements.

All proposed pedestrian bridges associated with the project shall incorporate break-away anchorage and tethering systems.

13.2.12 Design Exceptions

13.2.12.1 Identified Design Exceptions

The following design exceptions are ~~Approved~~ anticipated for the Basic Configuration. The Contractor shall prepare the Design Exception request for approval by CDOT and FHWA:

Cimarron Street Interchange – Geometric Exceptions

No.	Item	Design Criteria	Concept Design	Comments
1	I-25 Horizontal Curve : Station 104+38.76	Design Speed 70 mph	Design Speed 65 mph	A design speed of 65 mph allows for a super-elevation of less than the maximum allowable of 6%.

13.2.12.2 Design Exception Process

Design Exceptions in addition to those identified herein shall be subject to the Approval of CDOT. If determined to be necessary by CDOT, Design Exceptions may be subject to the Approval of FHWA.

The Contractor shall comply with the following requirements when requesting a Design Exception to the requirements herein:

1. The Contractor shall submit Design Exception requests in the form of a letter addressed to the CDOT Project Director for Approval prior to issuance of applicable Released for Construction 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 464a

   C. Supporting documentation indicating the justification for the Design Exception. 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, state 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 drawings depicting the exception.

13.3 Construction Requirements

13.3.1 Guardrail

In areas that allow use of Type 3 guardrail, the Contractor shall use galvanized guardrail (Standard Plan No. M606-1) with steel posts. The Contractor shall pave asphalt a minimum of 1 foot behind the new guardrail posts.

13.3.2 Median Cover Material

Median cover material for raised medians constructed by the Project shall follow the requirements of the Aesthetic Plans and Details in Book 4.

13.3.3 Fencing

13.3.3.1 Temporary Fencing

Installation of temporary fencing will be required 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 any other section of the Contract.

13.3.3.2 Permanent Fencing

Provide permanent right of way fencing of types and at locations in Table 13.3-1.

Table 13.3-1
RIGHT OF WAY FENCING LOCATIONS

Location	Type	Remarks
RW-7-Pikes Peak Broadcasting, LLC	Chain Link Per CDOT Standard M-607-2	1550' along the Northeast quadrant of the parcel.
RW-4 and RW-4A Humane Society of Pikes Peak	Chain Link Per CDOT Standard M-607-2	585' along the eastern parcel boundary.
Air Gas Property	Chain Link Per CDOT Standard M-607-2	900' along southern parcel boundary extending west along the City Parcel Boundary.
Along Eastside of I-25 South of Bear Creek.	Chain Link Per CDOT Standard M-607-2	940' South of Bear Creek to tie into existing fence on East Side of I-25
RW-5-City of Colorado Springs-Drake	Chain Link Per CDOT Standard M-607-2	215' along the NW quadrant of the Drake powerplant property.
Along Westside of I-25 South of Bear Creek	Chain Link Per CDOT Standard M-607-2	100' South of Bear Creek to tie into existing fence on Westside of I-25

13.3.3.3 Gates

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. Field locations of gates shall be approved by CDOT.

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
Traffic study	Approval	Concurrent with the submittal of the Preliminary Design and Plans.
Design Exceptions	Approval	Prior to issuance of applicable Released for Construction Documents

13.5 Exhibits

Exhibits are as follows:

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

Exhibit A – Roadway Design Criteria

Criteria	I-25/Cimarron Ramps			I-25 Mainline	US 24 (West)	Cimarron (East)	Remarks
	Cimarron Terminal	Ramp Proper	I-25 Terminal				
Design Criteria & Controls							
Design Speed (mph)	25	45	60	70	40	45	
Terrain	Rolling	Rolling	Rolling	Rolling	Rolling	Rolling	
Horizontal Alignment							
e_{MAX}	4%	6%	6%	6%	4%	2% (RC)	
Axis of Rotation	HCL	HCL	HCL	PGL	PGL	HCL	
Minimum Radius (ft)	154	643	1330	2040	533	1040	
Use of Spirals	N/A	N/A	N/A	Permitted	Permitted	N/A	Use spirals where identified as desirable in PGDH
Vertical Alignment							
Minimum Grade	0.5%	0.5%	0.5%	0.5%	0.5%	1.0%	
Maximum Grade	5.0%	5.0%	5.0%	4.0%	4.0%	4.0%	
Minimum K Value, Crest	12	61	151	247	44	61	
Minimum K Value, Sag	26	79	136	181	64	79	
Sight Distance (SD)							
Stopping SD (ft)	155	360	570	730	305	360	
Decision SD (ft)	520	930	1280	1445	825	930	
Vertical Clearance							
Underpass (ft)	16.5	16.5	16.5	16.5	16.5	16.5	
Overhead Sign Structures (ft)	17.5	17.5	17.5	17.5	17.5	17.5	
Cross Section							
Lane Width (ft)	15	15	15	12	12	11	
Inside Shoulder (ft)	4	4	4	12	0	0	
Outside Shoulder (ft)	8	8	8	12	6	6	
Normal Cross-Slope	2%	2%	2%	2%	2%	2%	
Design Vehicle	WB-67	WB-67	WB-67	WB-67	WB-67	WB-67	
Maximum Difference in Cross-Slope at Crossover Line	N/A	N/A	5%	N/A	N/A	4%	
Median Width (ft)	N/A	N/A	N/A	N/A	Varies (raised)	Varies (raised)	

Ramp Terminals							
Acceleration Length (ft)	1200			N/A	N/A	N/A	
Deceleration Length (ft)	530			N/A	N/A	N/A	
Entrance Ramp Type	Parallel (preferred) or Taper			N/A	N/A	N/A	Figure 10-13 of CDOT Roadway Design Guide 2005
Exit Ramp Type	Parallel (preferred) or Taper			N/A	N/A	N/A	Figure 10-18 of CDOT Roadway Design Guide 2005
Intersections							
Intersection Sight Distance (ft)	385	N/A	N/A	N/A	N/A	500	

Exhibit B – CDOT Design Exception Variance Request Form