SIGNING, PAVEMENT MARKING, LIGHTING, AND INTELLIGENT TRANSPORTATION SYSTEMS

Design Requirements

The Contractor shall prepare signing, pavement marking and traffic signal designs and plans for all areas on the Project. These plans shall be a component of all Released for Construction Documents where any signing, pavement marking or traffic signal component is required for the Work.

The Contractor shall prepare lighting and electrical designs and plans for the~~all~~ areas ~~on the Project~~identified in Section 1 General. The Contractor shall coordinate with the electrical Utility Company to determine electric power requirements for the project and to develop the Project lighting design and construction requirements.

Permanent Signing

Signing Design

The Contractor shall prepare signing designs and plans for all areas on the Project. These plans shall include, but are not limited to, all necessary guide, warning, supplemental, and regulatory signs, and additions, removals or modifications to existing signs and appurtenances.

Signing design shall comply with the requirements of the MUTCD, Manual of Uniform Traffic Control Devices. ~~The requirements of the MUTCD shall include both the "standard:" requirements and the "guidance:" recommendations of the manual.~~

The design and plans shall address modifications to permanent signing outside the Project that are rendered inaccurate, ineffective, confusing or unnecessary by the Project, Signing plans shall provide layouts showing the locations of ground mounted and overhead signs, special sign details, and structural and foundation requirements.

The Contractor shall submit plans for all Class III and major overhead signs to CDOT for Approval. These plans shall identify the location and message content for each sign. Existing major overhead sign structures shall be relocated as necessary to comply with the geometric requirements of the Basic Configuration.

Major overhead sign structures shall comply with the I-25 Architectural Requirements.

Permanent signage on bridges shall not be allowed to hang or be attached to the face of bridge superstructures.

If applicable, illuminated street signs identifying local Streets shall be required for all permanent traffic signals, subject to the approval of the Local Agency.

Materials

The Contractor shall use tubular steel posts for all class I and class II ground signs. Wood posts for mounting ground signs shall not be used.

Retroreflective sheeting shall be provided for all sign panels as specified herein.

All ground signs shall include breakaway devices.

All delineators shall have metal posts.

The Contractor will be allowed to reuse any of the sign structures, ground signs and their components that comply with the requirements of this section.

Permanent Pavement Marking

Pavement Marking Design

The Contractor shall prepare pavement marking designs and plans for Roads on the Project. These plans shall include, but are not limited to, all striping required for center lines, edge lines, lane lines, gore areas, lane drops, merging lanes, transition lanes, arrows, legends, symbols, object markings, delineation, and other striping, as well as any modifications to permanent pavement markings required for transitions to existing pavement markings.

Pavement marking design shall comply with the requirements of the MUTCD, Manual of Uniform Traffic Control Devices. ~~The requirements of the MUTCD shall include both the "standard:" requirements and the "guidance:" recommendations of the manual.~~

Materials

Pavement markings shall conform to the requirements specified herein and the Standard Specifications, M&S Standards, MUTCD and the Local Agency Standard Specifications.

The Contractor shall use the following pavement marking materials at the specified locations:

Location	Pavement Marking Type
Edge lines and Channelization lines	Epoxy Pavement Marking
Skip lines on PCCP	Thermoplastic Pavement Marking (Type C)
Skip lines on HBP	Thermoplastic Pavement Marking (Type A)
Words/symbols/Cross Walks/Stop lines	Thermoplastic Pavement Marking (Type B)

Temporary and Permanent Traffic Signalization

~~Traffic signal improvements shall be required at the following locations:~~

~~I-25 & North Gate Ramps~~

~~The Contractor shall prepare traffic signal plans for each signalized intersection on the Project. These plans shall include, but are not limited to, existing and proposed intersection plan details, traffic signal pole locations, mast arm and signal head locations, descriptions and directions, pedestrian button and signal locations, descriptions and directions, approach striping and marking locations and types, cabinet and power source locations, conduit and pull boxes, detection systems and locations, and all other plan and component details for complete traffic signal installation.~~

~~All temporary and permanent traffic signals shall be designed and constructed in conformance to the Local Agency Standard Specifications and shall be subject to the review and approval of the Local Agency.~~

~~Video detection and illuminated street signs shall be required for all permanent traffic signals.~~

~~Permanent traffic signalization appurtenances will not be allowed to hang from, or be attached to the face of bridge superstructures.~~

Permanent Lighting

Lighting Design

The Contractor shall prepare lighting designs and plans for ~~all~~ the areas identified in Section 1 General~~on the Project~~. The plans shall address both temporary and permanent Work and shall include existing topography, right-of-way, utilities and drainage facilities, structures, and all other existing and proposed facilities. The plans shall include location and orientation of standards and fixtures, wiring, conduits, pedestals, power sources, and all other lighting components required to construct the lighting on the Project.

All permanent lighting shall be designed and constructed in compliance with CDOT and the Local Agency Standard Specifications. Lighting designs and Plans shall be subject to the review and the approval of the CDOT and the Local Agency.

Highway lighting shall be provided from the outside edges of the roadways, unless otherwise Approved by CDOT.

The Contractor shall comply with the design criteria for average and minimum illuminance for the mainline, ramps and collector distributor roadway, as follows:

1. The average initial illumination of the traveled way will be at least 0.80 foot-candle.
2. The initial foot-candle value at the point of least illumination on the pavement area will be at least one fourth the average initial illumination.

The lighting design shall include iso-footcandle curve plots showing foot-candles levels at 1.0, 0.5, 0.2, and 0.1 foot-candles. The design and plans shall also include circuit layouts showing underground circuits alongside and under the roadway and through retaining wall and bridge structures.

The Contractor shall submit to CDOT for Acceptance lighting calculations showing the design meets the performance criteria for Roadway design to include average, maximum, minimum foot-candles, and average to minimum and maximum to minimum illuminance on the horizontal Roadway plane. In addition the Contractor shall submit voltage drop calculations for each circuit.

All permanent lighting at intersections and local streets shall be at locations and spacing as approved by the Local Agency.

Lighting Materials

Highway lights shall conform to the following:

Luminaires:	LED's
Davit poles:	35 foot vertical light standard, with breakaway base
Foundations:	Per the Standard Specifications

Photocell control of freeway lighting shall be provided to multiple fixtures through a common controller enclosure. Photocells shall be designed to fail to a "lights on" mode. Photocells shall be chemically or hermetically sealed. Photocell covers shall prevent the entry of dust or rain, shall be ultraviolet and hail resistant and shall be capable of withstanding an impact of up to 5 foot-pounds. Photocells shall have surge protection rated for 10,000 amps.

The Contractor shall provide a wiring design using a 240V system with a separate grounding conductor, using the neutral or phase conductor for grounding is not acceptable.

The Contractor shall provide all wiring in type DB conduit in all locations. All conduit to be jacked shall be rigid metallic conduit.

All hand holes shall be spaced no more than 500 feet apart. No runs over 500 feet will be permitted without the use of one or more hand holes.

A complete grounding system shall be provided for the entire lighting installation. Grounding shall consist of: ground cables, conduits, ground rods, wire or strap, and ground fittings by the National Electrical Code.

Highway lighting shall comply with the I-25 Architectural Requirements.

Lighting on and underneath all bridge structure shall comply with the design criteria for average and minimum illuminance for the Roadway as previously specified. Lighting underneath structures is only required if traffic runs below structure. Lighting on bridge structures shall comply with the I-25 Architectural Requirements ~~if applicable~~. The I-25 Architectural Requirements are available at the ~~CDOT office~~Project website.

Intelligent Transportation System

The Contractor shall relocate the VMS sign north of I-25 Briargate Interchange. The Contractor shall coordinate the relocation with the USAFA and CDOT.

Construction Requirements

Permanent Signing

The Contractor shall remove and dispose of the existing sign structures, ground mounted signs and delineators within the Project that do not meet the requirements of this section and shall become the property of the Contractor.

Permanent Pavement Marking

Existing PCCP shall be sandblasted prior to placement of any primer or pavement marking material.

Permanent Traffic Signalization

Contractor Requirements

The Contractor shall purchase and deliver controller cabinets to CDOT.

Local Agency Requirements

The Local Agency will equip the controller cabinets with all the necessary software to operate the permanent traffic signals.

The Local Agency will time the permanent traffic signals during the initial startup.

Permanent Lighting

The Contractor shall remove and dispose of the existing lighting that does not meet the requirements of this section and shall become the property of the Contractor. The Contractor may reuse any of the existing light standards that meet the requirements set forth in this section. Permanent lighting within the limits of the Basic Configuration shall comply with the Architectural Requirements, if applicable.

Intelligent Transportation System

The Contractor shall relocate existing VMS signs and Cameras if applicable according to the current design standards and specifications. The VMS shall be relocated to the north, outside of the USAFA flight path boundary.

The Contractor shall maintain the ability to provide VMS messages to I-25 traffic during construction. The Contractor shall minimize the down time of traffic cameras and VMS signs.~~The Contractor shall keep all the existing VMS signs and the existing cameras operational at all times during the project~~.

The Contractor shall coordinate with CDOT and City of Colorado Springs Traffic Engineering to locate, and preserve the joint fiber optic backbone and branches that runs along the I-25 corridor. The Contractor shall be responsible for all costs associated with any impacts or relocation to the fiber optic lines caused by their design or construction

Project Special Provisions

The following specifications modify and take precedence over the Standard Specifications.

Lighting (Pull Boxes)

Section 613 of the Standard Specifications is hereby revised for this Project as follows:

Subsection 613.02 shall include the following:

Pull boxes for lighting installations shall be in accordance with the following specifications:

1. Description: Box Junction – Street light – 1 foot deep by 1 foot wide by 18 inches long.
2. Use: Junction in Street light feeds.
3. Codes/Standards: Shall meet all the requirements of AASHTO, ANSI, and the National Electrical Safety Code.
4. Identification: Standard Street Logo – Street Lighting.
5. Material: Open bottom gray material polymer concrete and reinforced by a heavy weave fiberglass.
6. Mechanical: Skid resistance cover shall have a minimum coefficient of friction of 0.50.
7. Security: Two recessed ½ inch – 13NC pentahead bolts with washers shall be

furnished. Bolts must be removed to remove covers.

Lighting

Requirement

This specification shall cover all single member aluminum poles with single and double davit type supports used for Street and Roadway lighting for the electrical provider.

General

Description:

Pole

Aluminum

Davit Type

Single and Twin Arms

35 Feet Mounting Height

Use:

For Street and Roadway Lighting

Standards

All poles covered by this specification shall be manufactured and tested in conformance with the following standards referenced herein. Latest published edition shall apply.

Where conflicts occur in the referenced standards, the more stringent at the Proposal Due Date shall apply unless modified by this specification.

Future references to standards in this specification will be made by their number when used.

At completion of the lighting construction, the Contractor shall notify the appropriate utility company to make the final connections at the power sources. The lighting installation shall operate for 30 consecutive Days before acceptance will be made. During the 30-Day burn in period the Contractor shall repair any faulty items. If the lighting installation is not operable for any period exceeding one Day, the time count for the burn in inspection will be suspended until the system is back in operation for one Day.

American Association of State Highway and Transportation Officials (AASHTO).

"Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" 1985. (All sections that apply to aluminum poles)

American Society for Testing Materials (ASTM)

A153 "Specification for zinc coating (hot-dip) on iron and steel hardware."

A576 "Specification for steel bars, carbon, hot-wrought, special quality.

A675, Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality Mechanical Properties.

A563, Specification for Carbon and Alloy Steel Nuts.

National Electrical Manufacturers Association (NEMA).

SH5, NEMA Standards for Tubular Steel, Aluminum and Prestressed Concrete Roadway Lighting Pole.

Construction

Anchor Bolts:

Four anchor bolts shall be 1-inch by 40-inches with minimum yield 55,000 psi, with top 12 inches galvanized, to include two 1-inch hex nuts on each bolt, one plat washer and one lock washer per bolt and two 16 GA galvanized shims. 1-inch hex nuts to be standard size. Heavy hex nuts are not acceptable

Poles:

Material: Aluminum Alloy 6063-T6

Poles shall be of the following sizes and possess the general characteristics shown:

TABLE I

Mtg. Ht.	Arm	Base Dia.	Top Dia.	Wall Thickness	Length	Bolt Circle
35 feet	6 foot Single	8 inch	4.33 inch	3/16 inch	As Req'd	11 – 11-13/16 inch
35 feet	10 foot Twin	8 inch	4.33 inch	3/16 inch	As Req'd	11 – 11-13/16 inch

Wind Loading:

Wind Zone: 90mph per AASHTO

Luminaire Weight: 55Lbs.

Effective Projected Area: 1.5 Square Feet

All burrs shall be removed from all openings (holes) or drilling made to pole shaft.

Pole shaft shall be annular polished with not less than 80 grit.

Poles sizes shall be stamped in base with 1/4 inch die stamp as follows:

TABLE II

Pole	Marking
35 feet, 6 foot Single	35-S
35 feet, 10 foot Twin	35-T

All collars or loose pieces shall be permanently attached to pole shaft.

All poles for twin davit arms shall have internal dampers

Hand Hole:

Material: Aluminum Alloy 356-T6

Size: 4 inches by 8 inches reinforced that shall be 18 inches above the bottom of the anchor base.

Hardware: Covers shall be attached with 1/4 inch – 20 by 3/4 inch stainless hex head bolts.

Location: Reinforcement shall be welded to the pole shaft in the 90 degree location.

Grounding Point:

1/2 inch – 13NC tapped hole on frame of hand hole opening for ground lug attachment.

Davit Arms:

Material: Aluminum Alloy 6063-T6

Wall Thickness: 3/16 Inches

Radius: 5 feet to 5 feet-11inches, arms to accommodate a 2 inches slip-fitter luminaire.

Nominal Spreads: 6 inches for singles and 8 inches for doubles.

Hardware: Davit arm shall be attached by one 1/2 inch – 13NC stainless steel bolts, nuts and lock washers.

All burrs shall be removed from all openings (holes) or drillings made to davit arms.

Davit arms shall have final polish with not less than 80 grit.

Davit arms shall have cylindrical shape to permit arms to slide easily on the tenon of pole.

Bolt Covers:

Materials: Aluminum alloy 356.

Hardware: Covers to be attached with 1/4 inch – 20 stainless steel hex head bolts.

Tenon:

The tenon shall have a 5/8-inch by 1-1/2-inch slot 90 degree of hand hole.

Wire Hole:

Wire hole shall be full opening of the inside diameter as arms are welded together.

Packaging

Poles:

Shall be shipped unwrapped and with sufficient dunnage to prevent damage.

Dunnage shall consist of not less than 4 inches by 4 inches material placed on all four sides of bundle for stacking purposes.

Dunnage and banding shall be placed between 5 feet and 7 inches from each end and at the center of the poles.

Anchor Bolts:

Anchor bolts shall be stacked and layered, 20 anchor bolts to each layer, laid end-to-end and steel banded to two 4 inches by 6 inches pieces on the bottom of each stack. The bundle shall consist of not more than 200 anchor bolts.

Davit Arms:

Shall be shipped unwrapped and banded in bundles with 2 inch by 4 inch dunnage placed on both sides at TW locations on bundle. Twin arm bundle shall be placed on pallet.

Hardware:

For davit arm mounting, nut covers, washers, and two shims shall be bagged for each pole and boxed. (No 1-inch hex nuts in bags, both nuts shall be shipped on anchor bolts.)

Weights:

35 feet M.H., 6 foot single arm: Approximate 190Lbs.

35 feet M.H., 10 foot twin arm: Approximate 280Lbs.

Order Multiples:

35 feet, 6 foot single arm: 20 per bundle.

35 feet, 10 foot twin arm: 20 per bundle.

Shipping

Poles shall be shipped on a flatbed truck to permit off loading with a fork lift.

Shipments received in an enclosed truck shall not be accepted for delivery.

All davit arms, anchor bolts, and hardware shall be shipped with the poles.

Damage

Visual inspection shall be made and any damage noted on the freight bill prior to signing

Sign Painting

Sign Painting shall conform to the I-25 Architectural Requirements.

Paint Overhead Sign Structure

New overhead sign structures shall conform to the I-25 Architectural Requirements. Reset monotube sign structures will not need to be repainted.

Deliverables

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

Deliverable	Acceptance or Approval	Schedule
Class III and major overhead sign plans	Approval	Prior to issuance of Released for Construction Documents
Lighting design calculations	Acceptance	Prior to issuance of the Released for Construction Documents

All deliverables shall also comply with the requirements of the Quality Section.