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Intelligent Transportation Systems (ITS) Infrastructure

The ITS system in the project area currently includes a CDOT fiber optic trunk line along the north side of US 6. The project requirements include protection of this fiber optic trunk line, and/or relocating the trunk line to fit the new project design needs. In addition, a Closed Circuit Television (CCTV) is required to be added along US 6 near the bridge structure, with a tie-in to the fiber optic trunk line.

The Contractor shall design and construct ITS equipment in accordance with, but not limited to, the requirements of the standards of CDOT based on the project specifications in Section 20 and 21 as appropriate for CDOT ownership, oversight and approval of the Work. The contractor shall be responsible for all costs associated with impacts or relocation to the fiber optic lines cause by the contractor's final roadway, bridge, wall, or drainage design or construction. The existing splice points for the fiber optic trunk line are outside of the anticipated project limits CDOT ITS will direct where the fiber optic trunk line is allowed to be cut.

Design Requirements

The Contractor shall prepare ITS designs and plans for all areas on the Project in accordance with the requirements of the following sections. These plans shall be a component of all Released for Construction Documents where any new ITS elements or modifications are required for the Work. No material, part, or attachment of any equipment shall be substituted or applied contrary to the manufacturer's recommendations and standard practices. The contractor shall submit, for approval to CDOT, all ITS devices and materials prior to installation by submitting product sheets. ITS Infrastructure locations need to meet the requirements of CDOT.

Electrical Power

A new alternating current (AC) metered power source is required for the new camera that will be located on US 6 at Garrison St. The Contractor shall prepare electrical designs and shall include electrical and power requirements for the Intelligent Transportation Systems (ITS). The contractor shall coordinate with the electrical utility company to determine electric power requirements for the Project. The Contractor shall obtain approval of the power service design from the power service provider for the complete and operational power service to all required locations. All power connections to devices shall include a quick-disconnect.

The Contractor shall be responsible for the coordination of power source work to be performed by Xcel Energy. The Contractor shall contact Xcel Energy to request and process to completion the required coordination to establish the power sources for ITS equipment.

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All cost charges from the power service provider, and all necessary materials, including meter (if required), labor, and coordination required to maintain existing or establish new power sources shall be included in the Work.

Location and Protection of ITS Elements

The Contractor shall locate all ITS infrastructure elements within the public Right-of-Way (ROW) such that routine maintenance will not require a lane closure, affect mainline, ramp, or arterial roadway traffic operations, or require complex traffic control. ITS elements shall not be located in the highway median. All devices shall be placed outside of the clear zone, on approved breakaway devices, or placed behind guardrail for the protection of the travelling public and the infrastructure.

All existing underground utilities shall be identified, and all ITS infrastructure elements shall be designed to avoid outages. The Contractor shall be responsible for all repairs to facilities damaged during construction. The Contractor shall be responsible for maintaining and keeping operational all existing ITS devices during construction. All current live fibers shall be respliced in one work shift. Contractor shall notify CDOT ITS a minimum of two (2) weeks before any ITS device, fiber back-bone, or branch outages.

Pull Boxes and Manholes

The Contractor's design shall utilize fiberglass reinforced, polymer concrete pull boxes and pre-cast concrete manholes with a cast iron frame ring and cover. Pull boxes shall be 24 inches x 36 inches for intermediate locations and ITS Manholes shall be used for splice locations. 100 feet of fiber optic cable shall be coiled inside each manhole, and 50 feet of fiber optic cable shall be coiled inside each pull box. Pull box and manhole spacing shall not exceed 1,000 feet.

Material Requirements

If determined to be required, all CDOT pull boxes shall be constructed of fiberglass reinforced, polymer concrete and have a detachable cover with a skid-resistant surface and have the words "CDOT COMM", cast into the surface. Painting of words shall not be allowed. All pull boxes shall be verified by a third-party nationally recognized Independent Testing Laboratory as meeting all test provisions of

ANSI/SCTE 77 2007 Specification for Underground Enclosure Integrity, Tier 22 rating. Pull boxes shall be UL listed. Certification documents shall be submitted with material submittals.

Cabling and Conductors

The Contractor shall design conductors and cables utilizing a minimum of #12 AWG for all electrical conductors. All video-device control cables and connectors shall be designed in accordance with the manufacturer's recommendation and the CCTV manufacturer's signal attenuation requirements.

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Conduit

Design Requirements

The Contractor shall design new and separate conduit systems (including all hardware, fasteners, and accessories) for communication and power control systems. Longitudinal conduits for the communications network shall be installed within the ROW and as close to the ROW line as practical. ITS conduit shall be a minimum of 4-foot deep. The mainline communications run shall contain:

1. One 2” conduit for the CDOT backbone

Material Requirements

All conduits shall meet CDOT specifications. The conduit shall be factory lubricated, low friction, high-density conduit constructed of virgin Schedule 80 high-density polyethylene resin. Conduit shall be capable of being coiled on reels in continuous lengths, transported, stored outdoors, and subsequently uncoiled for installation, without affecting its properties or performance.

Intelligent Transportation System (ITS) Construction Requirements

The Contractor is responsible for the design to maintain all ITS within the Project limits. Modification of ITS facilities shall be subject to the review and Approval of the CDOT ITS at 303-512-5805.

The ITS system is an existing 144-strand fiber optic cable (backbone) in a 2” conduit along the north side of US 6. If the project design requires relocation of the backbone, design details, splicing details and the schedule of downtime of camera and shall be subject to the Approval of CDOT ITS. The ITS design shall be submitted to CDOT at least 90 Days prior to Released for Construction Documents.

Final design shall include one new camera per the specifications in this Project that is on a 30’ pole (30’ above the US 6 roadway surface) near the east side of the new bridge structure on the north side. This position is flexible with pre-approval by Region 1 Traffic and CDOT ITS. This new camera will require a new power source and a 12-Strand Lateral in conduit to a new ITS manhole for splicing to the existing fiber line. The Contractor shall coordinate with CDOT ITS for fiber splicing diagram determination.

Outages

The Contractor shall maintain the operations of the US 6 fiber backbone at all times during the project. If the ITS line needs to be out of service for relocation purposes or splicing to the new ITS manhole, the line shall not be out of service for more than 48 hours.

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The allowed outage timeframe starts at 9pm Friday evening through Sunday evening. Notify 303-512-5805 for coordination of the fiber optic outage two weeks prior to the planned outage.

Pull Boxes and Manholes

The Contractor shall install all pull boxes and manholes based on the latest CDOT *Standard Specifications*. Each location shall be easily accessible for maintenance purposes. Pull boxes and manholes shall not be placed in a known flood-prone area or drainage ditch. A fiber optic cable label shall be attached to each fiber optic cable located within a pull box or manhole. All fiber optic cable splices inside manholes shall be housed in a separate splice closure.

Refer to the Modified Standard Specification for additional requirements.

Cabling and Conductors

All cables shall be installed per the manufacturer requirements for each device or the requirements found in the Modified Standard Specifications in Section 19.4, below. The maximum conduit fill ratio for both new and existing conduits shall be in accordance with the NEC, latest version.

Conduit

For bores that contain more than one conduit, the conduit shall be bundled together and contained in a single bore.

Refer to the Modified Standard Specifications for detailed construction requirements for all conduit installations.

Integration and Testing

Integration and testing shall be conducted for all components that meet any of the following criteria:

1. A device and/or cabinet supporting the device has been installed or relocated.
2. The communications path between the devices and the local cabinet has been disturbed and/or relocated.
3. A new communication path to a device has been established

The Contractor shall be responsible for the installation and integration of all ITS devices within the project limits. This includes all CCTVs and Fiber Optic Cable that currently exist within the project limits. All modifications to the CTMS or Camera software on the CDOT end will be performed by CDOT ITS.

For all devices connected to the fiber optic communication network, integration shall include field site integration and subsystem integration.

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Deliverables

The Contractor shall submit the following to the CDOT Project Engineer.

Deliverable	Review, Acceptance, or Approval	Schedule
ITS plan sheets and details	Acceptance	Prior to Released for Construction
Splicing details	Acceptance	4 weeks prior to splicing
Integration and testing plan	Approval	5 weeks prior to testing and integration
CDOT device data sheets	Acceptance	4 weeks prior to device integration

As-builts upon construction showing devices and fiber locations for integration into CDOT's fiber inventory system, for acceptance.