



Ed Hassinger, District Engineer

**ADDENDUM 001
REQUEST FOR BID
SL13-066-RW ITS NETWORK RELOCATION**

Bidders shall acknowledge receipt of Addendum 001 (ONE) by signing and including it with original bid. The due date for receipt of this bid **does not change** by this Addendum. Accordingly, the following clarifications, additions/deletions, questions and answers are believed to be of general interest to all potential bidders. All other terms and conditions remain unchanged and in full force.

Name and Title of Signer (Print or type)	Name and Title of Department Authority Teresa (Terri) Mount Sr. Procurement Agent
Bidder Signature	Department of Transportation <i>Terri Mount (SAR)</i> Authorizing Signature
Signature of person authorized to sign	Authorizing Signature
Date Signed:	Date Signed: December 11, 2012

THIS PAGE MUST BE SIGNED AND RETURNED WITH ORIGINAL RFB.

REVISED JOB SPECIAL PROVISIONS WITH REVISED COMPLETION DATES

H. Order of Work has been revised from two (2) phases to three (3).

- Phase I- completion March 11, 2013**
- Phase II- completion May 10, 2013**
- Phase III- completion November 1, 2013**

Review revised JSP for details.

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ADDITIONAL INFORMATION

D-15 Equipment and Materials List

Job No. J6I2412
Route: I-70
County: St. Charles

 <p>THIS SHEET HAS BEEN SIGNED, SEALED, AND DATED ELECTRONICALLY.</p>	<p>MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION 105 W. CAPITOL AVE. JEFFERSON CITY, MO 65102 Phone 1-888-275-6636</p>
	<p>HNTB CORPORATION 715 Kirk Drive Kansas City, MO 64105 Certificate of Authority: 001270 Consultant Phone: 816-472-1201</p>
	<p>JOB NUMBER: J6I2412 ST. CHARLES COUNTY, MO DATE PREPARED: 11/28/2012</p>
	<p>ADDENDUM DATE: 12/07/2012</p>

JOB
SPECIAL PROVISIONS

A. GENERAL - FEDERAL JSP-09-02

1.0 Description. The Federal Government is participating in the cost of construction of this project. All applicable Federal laws, and the regulations made pursuant to such laws, shall be observed by the contractor, and the work will be subject to the inspection of the appropriate Federal Agency in the same manner as provided in Sec 105.10 of the Missouri Standard Specifications for Highway Construction with all revisions applicable to this bid and contract.

1.1 This contract requires payment of the prevailing hourly rate of wages for each craft or type of work required to execute the contract as determined by the Missouri Department of Labor and Industrial Relations, and requires adherence to a schedule of minimum wages as determined by the United States Department of Labor. For work performed anywhere on this project, the contractor and the contractor's subcontractors shall pay the higher of these two applicable wage rates. State Wage Rates, Information on the Required Federal Aid Provisions, and the current Federal Wage Rates are available on the Missouri Department of Transportation web page at www.modot.mo.gov under "Business With MoDOT". Effective Wage Rates will be posted 10 days prior to the applicable bid opening. These supplemental bidding documents have important legal consequences. It shall be conclusively presumed that they are in the bidder's possession, and they have been reviewed and used by the bidder in the preparation of any bid submitted on this project.

1.2 The following documents are available on the Missouri Department of Transportation web page at www.modot.mo.gov under "Business With MoDOT" "Standards and Specifications". The effective version shall be determined by the letting date of the project.

General Provisions & Supplemental Specifications

Supplemental Plans to October 2009 Missouri Std. Plans
For Highway Construction

These supplemental bidding documents contain all current revisions to the bound printed versions and have important legal consequences. It shall be conclusively presumed that they are in the bidder's possession, and they have been reviewed and used by the bidder in the preparation of any bid submitted on this project.

B. WORK ZONE TRAFFIC MANAGEMENT PLAN

1.0 Description. Work zone traffic management shall be in accordance with applicable portions of Division 100 and Division 600 of the Standard Specifications, and specifically as follows.

2.0 Traffic Management Schedule.

2.1 Traffic management schedules shall be submitted to the engineer for review prior to the start of work and prior to any revisions to the traffic management schedule. The traffic management schedule shall include the proposed traffic control measures, hours traffic control will be in place, and work hours.

2.2 Notify the engineer prior to lane closures or shifting traffic onto detours.

2.3 Notify the engineer as soon as practical of any postponement due to weather, material or other circumstances.

2.4 In order to ensure minimal traffic interference, the contractor shall schedule lane closures for the absolute minimum amount of time required to complete the work. Lanes shall not be closed until material is available for continuous construction and the contractor is prepared to diligently pursue the work until the closed lane is opened to traffic.

2.5 Traffic Congestion. The contractor shall, upon approval of the engineer, take proactive measures to reduce traffic congestion in the work zone.

2.5.1 Traffic Delay. The contractor shall be responsible for maintaining the existing traffic flow through the job site during construction. If disruption of the traffic flow occurs and traffic is backed up in queues of 15 minute delays or longer, then the contractor shall review the construction operations which contributed directly to disruption of the traffic flow and make adjustments to the operations to prevent the queues from occurring again.

2.5.2 Traffic Safety.

2.5.2.1 Where traffic queues routinely extend to within 1000 feet (300 m) of the ROAD WORK AHEAD, or similar, sign on a divided highway or to within 500 feet (150 m) of the ROAD WORK AHEAD, or similar, sign on an undivided highway, the contractor shall extend the advance warning area, as approved by the engineer.

2.5.2.2 When a traffic queue extends to within 1000 feet (300 m) of the ROAD WORK AHEAD, or similar, sign on a divided highway or to within 500 feet (150 m) of the ROAD WORK AHEAD, or similar, sign on an undivided highway due to non-recurring congestion, the contractor shall deploy a means of providing advance warning of the traffic congestion, as approved by the engineer. The warning location shall be no less than 1000 feet (300 m) and no more than 0.5 mile (0.8 km) in advance of the end of the traffic queue on divided highways and no less than 500 feet (150 m) and no more than 0.5 mile (0.8 km) in advance of the end of the traffic queue on undivided highways.

3.0 Work Hour Restrictions.

3.1 There are five holiday periods: Memorial Day, Independence Day, Thanksgiving, Labor Day, and Christmas. All lanes shall be scheduled to be open to traffic during these holiday periods, from 12:00 noon on the last working day proceeding the holiday until 9:00 a.m. on the first working day subsequent to the holiday.

3.2 The contractor shall not perform any construction operation on the roadway, including the hauling of material within the project limits, during restricted periods, holiday periods or other special events specified in the contract documents.

3.3 Any work requiring a temporary reduction in the number of I-70 WB through lanes of traffic shall be completed during nighttime hours. Nighttime hours shall be considered 9:00 p.m. to 10:00 a.m. for a single lane drop and 11:00 p.m. to 6:00 a.m. for a double lane drop. No daytime closures will be permitted.

3.4 Any work requiring a temporary reduction in the number of I-70 EB through lanes of traffic shall be completed during nighttime hours. Nighttime hours for I-70 EB shall be considered 7:00 p.m. to 5:00 a.m. for a single lane closure and 10:00 p.m. to 5:00 a.m. for a double lane closure. Impacts shall not be made to EB I-70 traffic after 5:00 a.m.

3.5 Any work requiring a temporary reduction in the number of lanes on Mid Rivers Mall Drive shall be performed Monday through Friday from 8:30 a.m. to 2:30 p.m. and from 8:00 p.m. to 6:00 a.m.

4.0 Detours and Lane Closures.

4.1 At least two lanes of traffic in each direction on I-70 shall be maintained at all times except for brief intervals of time required when the movement of the contractor's equipment will seriously hinder the safe movement of traffic. Periods during which the contractor will be allowed to halt traffic will be designated by the engineer.

5.0 Basis of Payment. No direct payment will be made to the contractor to recover the cost of equipment, labor, materials or time required to fulfill the above provisions, unless specified elsewhere in the contract document.

C. PROJECT CONTACT FOR CONTRACTOR/BIDDER QUESTIONS

1.0 All questions concerning this project during the bidding process shall be forwarded to the project contact listed below:

Mr. Tim Schroeder, P.E.
Transportation Project Manager
Missouri Department of Transportation
St. Louis District
1590 Woodlake Drive
Chesterfield, Missouri 63017

Phone: 314-453-5049
Fax: 314-340-4119
e-mail: Timothy.Schroeder@modot.mo.gov

2.0 Documentation of Bidder Questions. The contractor is encouraged to submit all questions in writing by email, fax, or letter. The contractor may call the project contact for general questions; however, the project contact may require any questions to be submitted and

answered by email, fax, or letter for clarity and documentation purposes. Contractors should refrain from contacting anyone other than the project contact for questions concerning this project.

3.0 All questions concerning the bid document preparation can be directed to the Central Office – Design at (573) 751-2876.

D. UTILITIES

1.0 For informational purposes only, the following is a list of names, addresses, and telephone numbers of the known utility companies in the area of the construction work for this improvement:

<u>Utility Name</u>	<u>Known Required Adjustment</u>	<u>Type</u>
Mr. Matt Greminger AmerenMissouri 200 N Callahan Rd Wentzville, MO 63385 Telephone: 636-639-8235 Email: mgreminger@ameren.com	None	Power
Mr. Kent Thaemert Laclede Gas Company 6400 Graham Road St. Louis, MO 63134 Telephone: 314-522-2297 Email: KThaement@lacledegas.com	None	Gas
Mr. John Danowski Charter Communication 815 Charter Commons Drive Town & Country, MO 63017 Telephone: 636-387-6667 Email: John.Danowski@chartercom.com	None	Cable
Mr. Wade Weakley AT&T Distribution 402 N. 3rd St. Charles, Missouri 63301 Telephone: 636-949-1320 Email: ww8571@att.com	None	Communications
Ms. Marcia Gay CenturyLink Telephone	None	Communications

1151 CenturyLink Drive Wentzville, MO 63385 Telephone: 636.332.7261 Email: marcia.gay@centurylink.com		
Mr. William Malach City of St. Peters City Hall One St. Peters Centre Blvd. Telephone: 636.477.6600 Ext. 1301 Email: bmalach@stpetersmo.net	None	Water and Sewer
Mr. Jason Johns LightCore, a CenturyLink Company 16141 Swingley Ridge Road, Suite 200 Chesterfield, MO 63017 Telephone: 916-296-8520 Email: Jason.Johns@CenturyLink.com	None	Communications

1.1 The existence and approximate location of utility facilities known to exist, as shown on the plans, are based upon the best information available to the Commission at this time. This information is provided by the Commission "as-is" and the Commission expressly disclaims any representation or warranty as to the completeness, accuracy, or suitability of the information for any use. Reliance upon this information is done at the risk and peril of the user, and the Commission shall not be liable for any damages that may arise from any error in the information. It is, therefore, the responsibility of the contractor to verify the above listing information indicating existence, location and status of any facility. Such verification includes direct contact with the listed utilities.

1.2 The contractor agrees that any effects of the presence of the utilities, their relocation, contractor's coordination of work with the utilities and any delay in utility relocation shall not be compensable as a suspension of work, extra work, a change in the work, as a differing site condition or otherwise including but, without limitation, delay, impact, incidental or consequential damages. The contractor's sole remedy for the effects of the presence of utilities, delay in their relocation or any other effects shall be an excusable delay as provided in Section 105.7.3. The contractor waives, for itself, its subcontractors and suppliers the compensability of the presence of utilities, delay in their relocation and any cost to the contractor, it's subcontractors and suppliers in any claim or action arising out of or in relation to the work under the contract.

1.3 The contractor shall be solely responsible and liable for incidental and consequential damage to any utility facilities or interruption of the service caused by it or its subcontractors operation. The contractor shall hold and save harmless the Commission from damages to any utility facilities interruption of service by it or it's subcontractor's operation.

2.0 Ameren has facilities along the north right way of I-70.

3.0 Laclede Gas has a gas main that crosses in the future commuter lot in the NE quadrant of the interchange of Mid Rivers Mall Drive and I-70. The contractor shall use care while working in the vicinity of this gas main.

4.0 City of St. Peters Water and Sewer plans to place a new water main crossing at approximate Station 951+90 consisting of a 12 inch water main in steel casing. The contractor shall contact the City of St. Peters to verify the completion of the work and the actual crossing location. The contractor shall be aware that there is an existing 8 inch water main crossing at Station 963+40. The contractor shall use care will excavating in the area of this watermain.

5.0 Lightcore, a Centurlink Company plans to relocate to the north right of way line from Route 370 to approximately 0.5 miles west of Route C. The relocation may occur during this project.

6.0 Centurylink has buried and aerial facilities along the north right of way line. In addition, they have existing crossing at approximate Station 972+10 consisting of copper and fiber in conduit. The contractor shall use care while excavating in close proximity to these facilities.

7.0 Charter Communications has a facility that crossing at Station 972+70 consisting of fiber in conduit.

8.0 AT&T Distribution has a facility along the north right of way as shown on the plans.

9.0 It shall be noted by the contractor that MoDOT is a member of Missouri One Call (800 Dig Rite). Some work on this project may be in the vicinity of MoDOT utility facilities, which includes but is not limited to traffic signal cables, highway lighting circuits, ITS cables, cathodic protection cables, etc. Prior to beginning work, the contractor shall request locates from Missouri One Call. The contractor shall also complete the Notice of Intent to Perform Work form located at the Missouri Department of Transportation website:

<http://www.modot.mo.gov/asp/intentToWork.shtml>

The contractor shall submit the form over the web (preferred method) or by fax to the numbers on the printed form. The notice must be submitted a minimum of 2 and a maximum of 10 working days prior to excavation just as Missouri One Call requires.

E. EMERGENCY PROVISIONS AND INCIDENT MANAGEMENT JSP-90-11

1.0 The contractor shall have communication equipment on the construction site or immediate access to other communication systems to request assistance from the police or other emergency agencies for incident management. In case of traffic accidents or the need for police to direct or restore traffic flow through the job site, the contractor shall notify police or other emergency agencies immediately as needed. The area engineer's office shall also be notified when the contractor requests emergency assistance.

2.0 In addition to the 911 emergency telephone number for ambulance, fire or police services, the following agencies may also be notified for accident or emergency situation within the project limits.

Missouri Highway Patrol (636)300-2800	
City of St. Peters (636)278-2222	Central County Fire & Rescue (636)970-9700
St. Charles County Ambulance District (636)344-7600	St. Charles County Sheriff (636)949-0809

2.1 This list is not all inclusive. Notification of the need for wrecker or tow truck services will remain the responsibility of the appropriate police agency.

2.2 The contractor shall notify enforcement and emergency agencies before the start of construction to request their cooperation and to provide coordination of services when emergencies arise during the construction at the project site. When the contractor completes this notification with enforcement and emergency agencies, a report shall be furnished to the engineer on the status of incident management.

3.0 No direct pay will be made to the contractor to recover the cost of the communication equipment, labor, materials or time required to fulfill the above provisions.

F. COORDINATION BETWEEN CONTRACTORS

1.0 This contract is one of several projects essential to the overall improvements along I-70. The I-70 and the Mid Rivers Mall Drive interchange improvements (J6I2412) and the I-70 westbound widening (J6I2412B) projects are anticipated to begin construction during this contract and some work must be completed concurrently with these projects.

2.0 Except as noted herein, all applicable provisions in Sec. 105 shall apply.

3.0 **Basis of Payment.** No direct payment will be made to the contractor to recover the cost of equipment, labor, materials, or time required to fulfill the above provisions.

G. SCOPE OF WORK

1.0 **Description.** The contractor shall provide communication infrastructure and traffic management equipment for the Commission. This work shall be performed at the following locations, as shown in the plans:

I-70 from just west of Rte. 79 to just east of Rte. C

In particular, perform the following work:

- Fiber Optic Communication Network. Furnish and install conduit, pull boxes, cable, enclosures and terminations. Install commission-furnished Ethernet switch and device servers.
- Relocated Dynamic Message Signs. Furnish and install foundations and electrical cables. Relocate support structures, dynamic message sign assemblies, cabinets and electrical service.

- Proposed Roadway Surveillance Camera. Furnish and install foundation, support structure, cabinet, electrical service, and cables. Install dome camera assemblies furnished by the Commission. Relocate City of St. Peters camera to the new pole.
- Relocated Roadway Surveillance Camera. Furnish and install foundation. Relocate support structure, dome camera assembly, cabinet, and cables.
- Relocated Radar Detectors. Furnish and install foundations and electrical cable where indicated on the plans. Relocate support structure, radar detector assemblies, cabinets, and cables. Salvage support structure where indicated in the plans.
- Traffic Signal Upgrades. Construct signal cabinet base wrap where indicated on plans. Relocate equipment and make network connections as indicated in the plans and job special provisions.

2.0 Coordination. At roughly the same time that this project is under construction, other related roadway projects will be underway. Any delays experienced by the contractor as a result of the other projects will not be considered as grounds for additional payment.

2.1 Coordination with the Commission and the Gateway Guide. The contractor shall coordinate with the engineer and the other contractors, and endeavor to complete the fiber optic cable installation and ITS device relocations quickly so as not to delay other contractors. The contractor must coordinate with Gateway Guide technical staff to make relocated and reconnected ITS devices operational.

3.0 Construction Requirements.

3.1 Dissimilar Metals. To prevent galvanic corrosion, all connections between dissimilar metals shall incorporate a means of keeping moisture out of the connection. Where the connection need not conduct electricity, interpose a non-absorbing, inert material or washer between the dissimilar metals. Use nonconductive liners and washers to insulate fasteners from dissimilar metals. Where the connection must conduct electricity, use a conductive sealant between the dissimilar metals. Alternatively, use an insulating gasket and a bond wire connecting the two metal parts.

3.2 Wiring. Every conductor, except a conductor contained entirely within a single piece of equipment, must terminate either in a connector or on a terminal block. Provide and install the connectors and terminal blocks where needed, without separate payment. Approved splice kits shall be used instead of connectors and terminal blocks for underground power cable splices.

3.2.1 All connectors must be permanently labeled and keyed to preclude improper connection. The labeling method(s) shall be approved by the engineer prior to use.

3.2.2 Terminal blocks shall be affixed to panels that permanently identify the block and which wire connects to each terminal. This may be accomplished by silk screening or by installing a laminated printed card under the terminal block, with the labels on portions of the card that extend beyond the block. Installation of terminal blocks by drilling holes in the exterior wall of the cabinet is not acceptable.

3.2.3 Do not install conductors carrying AC power in the same wiring harness as conductors carrying control or communication signals.

3.2.4 Arrange wiring, including jumpers, so that any removable assembly can be removed without disturbing wiring that is not associated with the assembly being removed.

3.2.5 Use wire saddles to guide and protect bundles of wires, jumpers, and cables. Affix the wire saddles to the wall of the cabinet or vertical member of the rack, and keep power and signal cables separated.

3.3 Labeling Cables. Label every cable immediately upon installation. Label the cables at every point of access, including pull boxes, and termination points. Use self-laminating vinyl labels at least 1.5" wide and long enough that the translucent portion of the label completely covers the white area bearing the legend. The vinyl shall have a layer of pressure sensitive acrylic adhesive. The labels shall resist oil, water, and solvents and shall be self-extinguishing. The legend shall be machine printed in letters at least 3/32" high. Consult with the engineer concerning the desired method of identifying each cable. Labeling cables is incidental to the installation of cable, and will not be paid separately.

4.0 Contractor Responsibilities. Contractor shall be responsible for any repair and/or replacement of any damaged contractor-furnished and installed devices (such as CCTV poles & cabinets, etc.) as well as existing or MoDOT furnished equipment (after the installation) until the project is accepted.

H. ORDER OF WORK (REVISED 12-07-2012)

1.0 Minimizing the downtime for all ITS devices to be relocated or reconnected to relocated fiber optic cabling is a critical aspect of this project. The ITS devices impacted by this project are critical to managing traffic operations given the Blanchette Bridge rehabilitation project. A construction schedule must be developed and approved by the engineer that sequences construction in a manner that minimizes the downtime of all the ITS devices. Only one ITS device can be down at any given time. As discussed in Section 5.0 the work must be completed in three phases with the second and third phases separated by a significant period with no work being completed. The Phase 2 and Phase 3 construction under this project must be coordinated and sequenced with construction work underway as part of the I-70/Route C (Mid Rivers Mall Drive) interchange improvement project J6I2412 and the westbound I-70 widening project J6I2412B, as noted in the plans and discussed below.

2.0 The project has been designed to allow for most of the new conduit and fiber optic cable to be installed without impacting the operation of the existing ITS devices. While the new conduit and fiber optic cable are being installed, the drilled shaft foundations for the relocated ITS devices and new CCTV camera (MR00CN000.1C) can also be constructed with the exception of relocated radar detector station MI070W222.2D. Construction of the drill shaft foundation for the eastbound DMS (MI070E222.5S) must be protected with temporary traffic barrier and crash attenuator, as shown in the plans.

3.0 During Phase 1 of the project, the existing 72F fiber optic cable shall remain in place and operational. The 72F fiber optic cable is allowed to be out of service for a period of time during

Phase 2 of the project if the roadway contractor on projects J6I2412 and J6I2412B must start work that will impact the existing 72F fiber optic cable. The relocated 72F fiber optic cable shall be in place, fully tested and operational by the end of Phase 2.

4.0 To limit the downtime for ITS devices being relocated or reconnected to the relocated fiber optic cable the device relocation and cutover process must be sequenced one device at a time working from the east to the west. As devices are disconnected from the existing 24F fiber optic distribution cable and reconnected to the new 24F fiber optic distribution cable the contractor must coordinate with Gateway Guide network administrators so the connected SONET node can be switched. Following this approach only one ITS device will be down at any given time. No device shall be down for longer than a 48-hour period with the exception of the DMSs as discussed in Section 4.1.

4.1 The process of moving along the corridor disconnecting and reconnecting devices in sequence must be scheduled so the cutover of the two DMSs occur during separate 58-hour periods over two weekends between 7:00 p.m. Friday night and 5:00 a.m. Monday morning. During this period the DMS must be disconnected, relocated, and reconnect to power and the network.

5.0 Completion Dates. ITS devices shall be relocated, reconnected, tested and operational on or before the completion dates provided below. The associated 24F fiber optic cable and fiber terminations connecting the devices to the east shall be in place.

5.1 Phase 1. Work to be completed in Phase 1 of this project must be completed by March 11, 2013. The work to be completed in Phase 1 includes the following:

- Relocate MI070E222.6D detector station
- Install Ameren conduit and transformer pad
- Relocate MI070E222.5S DMS and associated power supply
- Relocate MI070W222.2C camera and MI070W222.3D detector
- Connect MI070E222.2D to network
- Install conduit, pull boxes and 24F fiber optic cable to provide the fiber optic connection to the east for the devices in this phase

5.2 Phase 2. Work to be completed in Phase 2 of this project must be completed by May 10, 2013. The Phase 2 work must be coordinated with the J6I2412 and J6I2412B roadway contractor who will receive notice to proceed on March 11, 2013. The work to be completed in Phase 2 includes the following:

- Complete installation of conduit and pull boxes to the west
- Install and connect 72F fiber optic cable backbone
- Relocate MI070W221.9S DMS and associated power supply
- Remove detector station MI070W222.3D pole, cabinet and foundation
- Relocate MI070E220.5D detector station
- Install new and relocated 24F fiber optic distribution cable

- Connect devices MI070W221.4D, MI070E220.7D, MI070W220.5C, MI070W220.4D, MI070W220.4Z and MOR70E000.6Z to the network using the new 24F fiber optic cable

5.3 Phase 3. Phase 3 of the project cannot be completed until much of the Route C (Mid Rivers Mall Drive) interchange is complete. The Phase 3 work must be coordinated with the interchange contractor to make sure conduit access is provided into the new interchange signal cabinet and conduit in the new bridge barrier rail can be used. The City of St. Peters camera and communications equipment must also be salvaged for relocation later in Phase 3. The Phase 3 work must be completed by November 1, 2013. Phase 3 work includes:

- Relocate MI070W222.2D detector station
- Install MR00CN000.1C camera
- Relocate City of St. Peters camera
- Base wrap MR00CN000.1Z
- Install fiber optic connection from MR00CN000.1C to signal cabinet at Mid Rivers Mall Dr. and Suemandy
- Install fiber optic connection from MI070W222.2C to MI070W222.1Z and MR00CN000.1Z

6.0 The contractor shall provide a construction schedule within 14 calendar days of notice to proceed outlining the proposed order of work which shows a timely progression of construction consistent with requirements provided above. Provide the plan to the engineer for review and approval.

7.0 No direct pay shall be allowed for following the above order of work or other requirements of this Special Provision except under items otherwise provided for in the contract.

I. CONDUIT

1.0 Description.

1.1 Furnish and install conduits as shown on the plans and as described within this section. The plans depict conduit routing in schematic form only. Determine final routing based on actual field conditions at each site, including utility locator service markings, to assure no conflicts with existing utilities.

1.2 Inspect the project area prior to submittal of bid to determine the types and extent of incidental removal, relocation and replacement items to include in the unit price of conduit and pull boxes.

2.0 Materials.

2.1 Conduits shall meet the requirements of Sec 1060.

2.2 Non-metallic flexible conduit shall be color coded orange for communication cable and black for power cable.

2.3 Pull ropes or tapes shall be polypropylene with a minimum tensile strength of 600 pounds.

2.4 Locator wire shall be solid copper wire, AWG 10, type THHN, with blue insulation.

3.0 Construction Requirements.

3.1 **General.** The contractor shall comply with Sec 902.16, except as noted in this special provision.

3.1.1 Warning tape shall be furnished and installed in all trenches containing conduit.

3.1.2 Pull ropes shall be furnished and installed in all empty conduit cells.

3.1.3 Install locator wire in all underground non-metallic conduits and into each pull box or base. Affix the wire to the sidewall of each pull box. Locator wire is incidental to the conduit and will not be paid for separately.

3.1.4 Flexible non-metallic duct shall not be spliced, unless noted on the plans. All runs shall be continuous.

3.1.5 When installing flexible duct in trench, keep the duct as straight as possible. Avoid undulations up and down and side to side.

3.2 Directional Drilling.

3.2.1 **Preliminary Site Work.** Determine all utility locations near the path of the proposed bore, including depth. Use this information to avoid damage to utilities and/or facilities within the work area. Provide this information, including the sources, to the engineer a minimum of five working days prior to boring. Do not bore until the engineer approves that submittal.

Prior to boring, expose all utilities for which it is customary and safe to do so.

3.2.2 **Boring.** The diameter of the drilled hole shall conform to the outside diameter of the conduit as closely as practical. Pressure grout as directed by the engineer, to fill any voids, which develop during the installation operation. Remove and replace any conduit damaged in directional drilling operations at no expense to the project.

3.2.3 **Drilling Fluids.** The use of water and other fluids in connection with the drilling operation will be permitted only to the extent necessary to lubricate cuttings. Jetting will not be permitted, and the use of water alone as a drilling fluid will not be permitted. Use a drilling fluid/slurry consisting of at least 10% high grade, processed Bentonite to consolidate excavated material, seal the walls of the hole, and furnish lubrication for subsequent removal of material and immediate installation of the pipe.

Provide a means of collecting and containing drilling fluid/slurry that returns to the surface, such as slurry pit, or a method approved by the engineer. Provide measures to prevent drilling fluids from entering storm sewer systems. Prevent drilling fluid/slurry from accumulating on or flowing onto sidewalks, other pedestrian walkways, driveways, or streets. Immediately remove any slurry that is inadvertently deposited on pedestrian walkways. Transport waste drilling slurry from the site and dispose of it. Do not allow slurry to enter wetlands. Protect wetlands using appropriate soil erosion control measures approved by the engineer.

3.2.4 Drilling Control. Use a digital walkover locating system to track the drill head during the bore. At minimum, the locating system shall be capable of determining the pitch, roll, heading, depth, and horizontal position of the drill head at any point along the bore. During each drilling operation, locate the drill head every 10 feet along the bore and prior to crossing any underground utility or structure. Upon completion of the drilling operation and conduit installation, furnish the engineer with an as-built profile drawing and plan drawing for the drilled conduit showing the horizontal and vertical locations of the installed conduit.

3.3 Wall Penetrations. Wall penetrations of existing concrete retaining walls shall be performed by the drilling, or other approved construction means, of an opening with a minimum diameter of 1 inch greater than the outside diameter of the conduit(s) to be inserted through the wall. Reinforcing bars shall be located on the fill face of the wall using non-destructive scanning techniques. Openings shall be located to avoid cutting or otherwise damaging reinforcing bars on the fill face side of the wall. Sufficiently remove any rough edges from the wall opening to prevent damage to the conduit(s). The wall penetrations shall be filled with a Type III epoxy grout conforming to Sec 1039. The cost of wall penetrations will be considered incidental to the unit price of conduit.

3.4 Intercept Existing Conduit With Proposed Pull Box. Where indicated on the plans, intercept an existing conduit with a proposed pull box. Excavate existing conduit, cut the existing conduit, and install a new pull box over the existing conduit.

3.4.1 Conduit With Backbone Fiber. If the conduit to be intercepted contains 72F fiber optic cable used as the Gateway Guide network backbone, then the pull box needs to be installed without cutting or damaging the cables. Excavate the earth at the conduit intercept location to allow placement of the new pull box. To determine the conduit location, use the existing locator wire in the conduit. Cut slots ("mouse hole") on the bottom of the pull box at locations where the existing conduits will be intersected to allow the pull box to slip over the conduits. Excavate along the existing conduits to lower them to within 4" of the bottom of the pull box to minimize the length of the slot. Carefully expose the cables by cutting the conduit perpendicularly in two places and then longitudinally between the perpendicular cuts. Do not damage the cables inside the conduit. New conduits entering the pull box must follow the standard entrance approach.

3.4.2 Conduit Without Backbone Fiber. Disconnect and pull back existing cables in the conduit to be intercepted. Mark the location of a 100 foot segment of the existing conduit, centered on the proposed pull box location. To determine the conduit location, use the existing locator wire in the conduit. Then excavate the earth above a 60 foot section of the conduit centered on the pull box. Take care not to damage the conduit. Saw cut the conduit at a point corresponding to the center of the new pull box. Lift the free ends of the conduit clear of the area where the pull box is to be installed, taking care not to violate the conduit's minimum bending radius. Install the pull box in the same manner as the other pull boxes in this project.

Ensure that the pull box's openings for conduit penetration align with the trench containing the existing conduit.

On each side of the pull box, lift the midpoint of the exposed conduit until the free end is drawn back far enough to be outside the pull box. At the lifting point, distribute the lifting force evenly over at least a 2 foot segment of the conduit. Then thread the free end of the conduit through the opening in the wall of the pull box and lower the midpoint of the conduit segment so that the conduit extends into the pull box. Cut off the excess conduit protruding into the pull box. Fill any void area between the drilled hole and the conduit with an engineer-approved filling material to protect against conduit movement and the entry of fill material.

3.4.3 Backfill. Backfill shall be carefully tamped in place. All disturbed areas shall be restored in accordance with the provisions of Section M.

3.5 Install Conduit into Existing Pull Box. Where indicated on the plans, install a proposed conduit into an existing pull box.

3.5.1 Carefully expose the outside of the existing pull box without disturbing any existing conduits or cabling.

3.5.2 Drill the appropriate sized hole for the entering conduit at a location within the pull box that will not disturb the existing cabling, and that will not hinder the installation of new cabling within the installed conduit.

3.5.3 Fill any void area between the drilled hole and the conduit with an engineer-approved filling material to protect against conduit movement and the entry of fill material.

3.5.4 Backfill shall be carefully tamped in place. All disturbed areas shall be restored in accordance with the provisions of Section M.

3.6 Conduit With Minimum Depth of 36". Where indicated on plans, conduit located south of the South Outer Road shall be installed at a minimum depth of 36". During installation, contractor shall coordinate with MoDOT representative to be present during installation and/or provide documentation to verify minimum required depth was achieved.

4.0 Shop Drawing Submittal Requirements.

4.1 A Professional Engineer registered in the State of Missouri shall design where conduit is supported on bridge structures, the support system, including fasteners and expansion anchors. Shop Drawings are required and shall show the layout of the conduit and details of the support system, including fasteners and hardware. Calculations showing support system design shall be submitted with the shop drawings, and calculations shall be signed and sealed by a Professional Engineer registered in the State of Missouri.

4.2 Catalog cuts shall be provided for all conduit types.

5.0 Basis of Payment.

5.1 All junction boxes, expansion fittings, liquid-tight flexible conduits, hangers, supports, resin anchor systems, and all hardware are incidental to the cost of conduit.

5.2 Conduit may be installed by directional boring at locations shown as trenched on the plans. Such conduit will be paid for as if it had been installed by trenching.

5.3 The pay items for conduit are:

Item No.	Type	Description
910-99.03	Linear Foot	Conduit, 2 in., HDPE, Trench
910-99.03	Linear Foot	Conduit, 2 in., HDPE, Directional Drill
910-99.03	Linear Foot	2 Conduits, 2 in., HDPE, In Trench
910-99.03	Linear Foot	2 Conduits, 2 in., HDPE, Directional Drill
910-99.03	Linear Foot	Conduit, 2 in., PVC, Trench
910-99.03	Linear Foot	Conduit, 3 in., PVC, Trench
910-99.03	Linear Foot	Conduit, 3 in., PVC, Directional Drill
910-99.02	Each	Intercept Existing Conduit w/Proposed Pull Box
910-99.02	Each	Install Conduit into Existing Pull Box

J. ASPHALT AND CONCRETE REMOVAL AND REPLACEMENT FOR CONDUIT AND PULL BOX INSTALLATION

1.0 Description. If the contractor elects and receives approval from the engineer for alternate trench and/or pull box locations, any areas of concrete slope protection, sidewalk, pavement, shoulders, islands and medians – as well as any similar improvements consisting of asphaltic concrete materials – removed in conjunction with their construction shall be replaced with improvements of similar composition and thickness. Removals shall be achieved by means of full depth saw cuts, the resulting subgrade compacted to minimum density requirements and topped with 4 inches of compacted aggregate base course prior to replacement of surface materials. Concrete materials used in their replacement shall be approved by the engineer. A commercial asphalt mix may be used for replacement of asphaltic surfacing upon approval of the engineer.

2.0 Basis of Payment. Unless quantities and pay items for removal and subsequent replacement of improvements are contained in the plans for a specific location of removal work, no direct payment will be made for full depth saw cutting and the removal and subsequent replacement of asphalt or concrete slope protection, sidewalk, pavement, shoulders, islands, medians and the required dowel and tie bars removed and replaced by the contractor as a result of his election to vary the location of conduit runs and pull boxes. This work will be considered as included in the various unit bid prices for conduit and pull boxes established in the contract, and no additional payment will be made.

K. FIBER OPTIC CABLE

1.0 Description. This work shall consist of installing, splicing and terminating fiber optic cables.

2.0 Materials.

2.1 Cable. Fiber optic cable shall be loose tube, single mode dielectric cable. The cable shall be listed in the latest edition of the Rural Utilities Service (RUS) *List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers*, category oc-d-F, and shall have a short-term tensile rating of at least 600 lbs. The cable sheath shall have length markings in feet, and shall indicate that the unit of measure is feet. The cable shall have an operating temperature range of -40° C to 70° C.

2.1.1 All fibers shall be suitable for transmission using both 1310 nm and 1550 nm wavelengths. Attenuation shall not exceed 0.35 dB/km and 0.25 dB/km for 1310 nm and 1550 nm signals, respectively.

2.1.2 The cables shall be constructed with twelve fibers per tube.

2.2 Splice Tray. Splice trays shall be 11.7" long, 3.9" wide, and 0.2" tall. They shall be aluminum with clear plastic covers, designed for outdoor use. Each shall accommodate 24 fusion splices. The trays shall have a black powder coat finish. The trays shall have both perforations for cable ties and crimpable metal tabs for buffer tube strain relief.

2.3 Connector. Connectors shall be ST compatible, with ceramic ferrules. They shall be suitable for use in traffic cabinets and shall be designed for single mode fibers.

2.4 Pigtail. Pigtails shall be factory-made, buffered, and strengthened with aramid yarn to reduce the possibility that accidental mishandling will damage the fiber or connection. Pigtails shall be yellow. They must use the type of connector specified in Sec 2.3 of this provision. Each must contain one fiber. Length shall suffice to provide two feet of slack after installation.

2.5 Jumper. Jumpers shall meet the requirements for pigtails, but shall have a connector on each end. The second connector shall be as specified in Sec 2.3 of this provision except where a different connector is required for compatibility with the equipment to which the jumper connects. Length shall suffice to provide approximately five feet of slack after installation.

2.6 Rack-Mounted Splice Enclosure. The enclosure shall have brackets and all other hardware required for rack mounting in an EIA standard 19-in. equipment rack. However, alternate forms of mounting will be permitted if more practical at a particular location. The enclosure shall take up no more than five rack units (1¾ inch each) in the cabinet. It shall be made of powder-coated aluminum.

2.6.1 The enclosure shall have provisions for cable strain-relief. It shall have hinged front and rear doors.

2.6.2 The enclosure shall include splice trays as specified in Sec 2.2 of this provision. The contractor shall provide enough splice trays for all the splices made in the enclosure. The enclosure shall include a splice tray holder with capacity for 22 trays. It shall be mounted on a sliding shelf inside the enclosure so that individual trays can be removed from the enclosure without disturbing the other trays or removing the enclosure itself from the cabinet.

2.7 Rack-Mounted Interconnect Center. An interconnect center is a splice enclosure that has a patch panel built into one of its walls. Within the interconnect center, fibers in cables are spliced to pigtails and the pigtails are plugged into the patch panel from the inside. This allows jumper cables (not part of the interconnect center) to plug into the patch panel from the outside, connecting the fibers to equipment in the cabinet or to other fibers on the patch panel. Within an interconnect center, some fibers may be spliced to the corresponding fiber in a mating cable, rather than to a pigtail. Still other fibers may be coiled, unterminated.

The enclosure shall have brackets and all other hardware required for rack mounting in an EIA standard 19-in. equipment rack. It shall take up no more than three rack units (1¾ inch each) in the cabinet. It shall have front and rear doors. It shall be made of powder-coated aluminum.

The enclosure shall hold at least four splice trays meeting the requirements of Sec 2.2 of this provision. Provide enough trays for all splices made in the interconnect center. The enclosure's patch panel shall have at least 24 positions, compatible with the connectors specified in Sec 2.3 of this provision. It shall have provisions for cable strain relief and for connector labeling.

2.8 Wall-Mounted Interconnect Center. An interconnect center is a splice enclosure that has a patch panel built into one of its walls. Within the interconnect center, fibers in cables are spliced to pigtails and the pigtails are plugged into the patch panel from the inside. This allows jumper cables (not part of the interconnect center) to plug into the patch panel from the outside, connecting the fibers to equipment in the cabinet or to other fibers on the patch panel. Within an interconnect center, some fibers may be spliced to the corresponding fiber in a mating cable, rather than to a pigtail. Still other fibers may be coiled, unterminated.

The enclosure shall be designed for wall or panel mounting and occupy no more than 350 square inches of wall space. It shall be made of powder coated aluminum and have a gasketed, hinged door. It shall have provisions for cable strain relief and for connector labeling.

It shall have a patch panel with at least 24 positions compatible with the connectors specified in Section 2.3 of this provision. It shall accommodate at least six splice trays as specified in Section 2.2 of this provision and shall be equipped with enough trays for all the splices made in the interconnect center.

3.0 Construction Requirements.

3.1 Cable Installation. Prior to installation, perform such tests as indicated in Sec 4.0 of this provision to confirm that the cable is in good condition and complies with the specifications. Any defects found after installation will be deemed the fault of the contractor.

3.1.1 Install the cable such that the optical and mechanical characteristics of the fiber are not degraded. Do not violate the minimum bend radius or the maximum tension, both during and after installation.

3.1.2 Before any cable installation is performed, provide the engineer with four copies of the cable manufacturer's recommended maximum pulling tensions for each cable size. These pulling tensions shall be specified for pulling from the cable's outer jacket. Also, provide a list of the minimum allowable cable bending radius and the cable manufacturer's approved pulling lubricants. Only those lubricants approved by the cable manufacturer will be permitted.

3.1.3 If the cable is pulled by mechanical means, use a clutch device to ensure the allowable pulling tension is not exceeded. Also, attach a strain gauge to the pulling line at the cable exit location, and at a sufficient distance from the take-up device, such that the strain gauge can be read throughout the entire cable pulling operation.

3.1.4 Do not leave the let-off reel unattended during a pull, in order to minimize the chance of applying excess force, center pull, or back feeding.

3.1.5 Use an approved lubricant, in the amount recommended by the cable manufacturer, to facilitate pulling the cable. After the cable has been installed, wipe the exposed cable in a pull box, junction box, or cabinet clean of cable lubricant with a cloth before leaving the pull box, junction box, or cabinet.

3.1.6 In every intermediate pull box, store 30 feet of slack fiber optic cable for every cable that passes through the pull box. Additional slack storage, as indicated on the plans, is required in designated pull boxes. At cabinet locations, where cable runs from the pull box directly to an equipment cabinet, store 60 feet of slack fiber optic cable in the pull box. Additionally, treat the cable returning from the cabinet to the pull box as a separate cable, and store 60 feet of slack for these links. Store slack cable neatly on the walls of the pull box using racking hardware acceptable to the engineer.

3.1.7 Seal the fiber optic cable ends to prevent the escape of the filling compound and the entry of water.

3.2 Splicing. Splice all optical fibers, including spares, to provide continuous runs. Splices shall be allowed only in equipment cabinets except where shown on the plans.

3.2.1 Make all splices using a fusion splicer that automatically positions the fibers using either the Light Injection and Detection (LID) system or the High-resolution Direct Core Mounting (HDCM) system. Provide all equipment and consumable supplies.

3.2.2 Secure each spliced fiber in a protective groove. Completely re-coat bare fibers with a protective room temperature vulcanizing (RTV) coating, gel or similar substance, prior to insertion in the groove, so as to protect the fiber from scoring, dirt or microbending.

3.2.3 Prior to splicing to a fiber installed by others, measure and record the optical loss over that fiber. See Sec 4.0 of this provision.

3.2.4 Use a different splice tray for each buffer tube color. If an enclosure contains multiple buffer tubes of the same color, but none of the fibers in one of the tubes are spliced to fibers in other tubes of the same color, use a separate splice tray for that tube.

3.3 Termination. Terminate fibers by splicing them to factory-made pigtails. Cap all connectors that are not connected to a mating connector.

4.0 Acceptance Testing

4.1 General. Test the fiber after installation, including all splicing and termination, is complete. Note, however, that this test procedure involves measuring the loss of fiber installed by others before splicing to it. For each fiber optic link, including spare fibers, determine whether the optical loss is within the limits permitted by these specifications. A link is a continuous segment of fiber between one connector (or unterminated end) and another connector (or unterminated end). When testing links that do not have connectors on both ends, use a mechanical splice to attach a pigtail to the unterminated fiber for the duration of the test.

4.2 Test Procedure. For each fiber link, follow this procedure:

- (a) If the link includes fiber installed by others, use an optical loss test set to measure and record the optical loss over that portion of the link before it is spliced to new fiber.
- (b) Calculate the maximum allowable loss for the completed link, both at 1310 nm and at 1550 nm. Use the following formula:

$$\begin{aligned} \text{Maximum link loss} = & \text{Measured loss over portion installed by others} \\ & + (\text{Fiber length in km}) \times (0.35 \text{ for } 1310 \text{ nm and } 0.25 \text{ for } 1550 \text{ nm}) \\ & + (\text{Number of fusion splices}) \times (0.05) \\ & + (\text{Number of mechanical splices [for temp. connection]}) \times (0.3) \\ & + (\text{Number of connections}) \times (0.5) \end{aligned}$$

Provide this calculation to the engineer along with the test results.

- (c) Calibrate an optical loss test set and provide evidence satisfactory to the engineer that the set produces accurate results at both wavelengths. This can be a demonstration that the set correctly measures the loss of a test fiber whose loss is known.
- (d) Use the test set to measure the loss of the link under test. Record the result at both 1310 nm and 1550 nm. Arrange for the engineer or his representative to witness these tests.
- (e) If the measured loss exceeds the calculated maximum, use an optical time domain reflectometer and other test equipment to troubleshoot the link. Take whatever corrective action is required, including cable replacement, to achieve a loss less than the calculated maximum.

4.3 Test Result Documentation. Prepare a diagram showing all of the links tested in this project. For the portions installed in this project, show the equipment cabinets, splices, and pigtails. On each line representing a link, show the maximum allowable loss and the actual loss. The actual loss shall be the one measured after all corrective actions have been taken. Submit 5 copies of this diagram to the engineer, along with the calculations for the maximum allowable loss. Submit the diagrams and calculations in an electronic format acceptable to the engineer.

5.0 Documentation. Provide the engineer mark-ups of the plans, neat and legible, illustrating as-built versions of the splice and connection diagrams that are contained in the plans.

6.0 Certifications. The fiber optic cable shall be factory certified to meet the requirements in this specification. In addition, the manufacturer shall certify that the fiber optic cable has a life expectancy of 20 years.

7.0 Guarantee. All items covered by this specification shall carry a two-year guarantee from the date of acceptance against any defects in workmanship or materials.

8.0 Basis of Payment. Measurement and payment for items covered by this specification include the documentation and acceptance testing, in addition to all materials and equipment necessary for a fully operational system. Payment will be made as follows:

Item No.	Type	Description
910-99.03	Linear Foot	Fiber Optic Cable, 72 Strand, Single Mode
910-99.03	Linear Foot	Fiber Optic Cable, 24 Strand, Single Mode
910-99.02	Each	Fiber Optic Pigtail, SM, Furnish and Install
910-99.02	Each	Fiber Optic Pigtail, MM, Furnish and Install
910-99.02	Each	Fiber Optic Jumper, SM, Furnish and Install
910-99.02	Each	Wall-Mounted Interconnect Center, Furnish and Install
910-99.02	Each	Rack-Mounted Interconnect Center, Furnish and Install
910-99.02	Each	Fiber Optic Splice

L. EROSION CONTROL

1.0 Description. The contractor shall follow the requirements set forth in MoDOT's Stormwater Pollution Prevention Plan (SWPPP). All areas disturbed by the contractor's operations shall be subject to erosion control measures. Erosion control measures shall follow the standard specifications and applications as set forth in the standard plans. The engineer will direct the contractor where erosion control measures will apply.

2.0 Basis of Payment. No direct payment will be made for erosion control measures.

M. SITE RESTORATION

1.0 Description. Restore to its original condition any disturbed areas at sites including, but not limited to, pull box, conduit and pole base installations. Restoration shall be accomplished by placing material equivalent to that of the adjacent undisturbed area. Disturbed unpaved areas shall be fertilized and either seeded and mulched or sodded as directed by the engineer. The engineer will have the final authority in determining the acceptability of the restoration work.

2.0 Basis of Payment. The cost of restoration of disturbed areas will be incidental to the unit price of pole base, conduit, and/or pull box. No direct payment will be made for any materials or labor, which is performed under this provision.

N. STRUCTURES

1.0 Drilled Shafts for CCTV Poles and DMS Structures.

1.1 Description. Follow the requirements of Sec 701 of the Standard Specifications except for the following:

- Delete Secs 701.4.10.3 through 701.4.11.4
- Delete Secs 701.6.4 and 701.6.5
- Replace Secs 701.7.1 and 701.7.8 with sections 1.2.1 and 1.2.2 respectively, below.
- Delete Secs 701.7.5 and 701.7.6

1.2 Basis of Payment. Follow the requirements of Sec 701.7 of the Standard Specifications except for the following.

1.2.1 Drilled Shaft. Replaces Sec 701.7.1 of the Standard Specifications. Payment will be considered full compensation for all reinforcing steel, anchor bolts and templates, washers, nuts, disposal of excavated soil, restoration of site around the drilled shaft, costs of drilling (including temporary casing), excavation, slurry, cleaning, an acceptable method of inspection as required, furnishing and placing concrete, grouting and incidental work and material required by the contract documents. Payment for any drilled shaft installed and accepted will be at the contract unit price per linear foot for the diameter of the drilled shafts specified, irrespective of the character of the material actually encountered during excavation. No additional compensation will be made for concrete required to fill an oversized casing or for oversized excavation. If the method of construction requires that drilled shaft casing be seated into the sound rock such that the bottom of the casing is below the determined top of sound rock elevation, payment for excavation below the top of the sound rock layer (top of the rock socket) will be included in the payment for the rock socket. If sound rock is encountered within the excavation at which point a rock auger, core barrel or other rock-removing specialty tool must be used by the contractor before the top of the sound rock elevation to be used as "top of the rock socket" is confirmed by the engineer, that work will be paid for as rock socket excavation.

Item No.	Type	Description
701-11.02	Linear Foot	Drilled Shaft (2 FT. 0 IN. Dia.)
701-11.03	Linear Foot	Drilled Shaft (2 FT. 6 IN. Dia.)
701-11.05	Linear Foot	Drilled Shaft (3 FT. 6 IN. Dia.)

1.2.2 Sonic Logging Testing. Replaces Sec 701.7.8 of the Standard Specifications. Payment for sonic logging testing of drilled shafts as required by the engineer will be made at the contract unit price per each for sonic logging testing. No payment will be made for supplementary sonic logging testing to evaluate defects. Payment for sonic logging testing will be considered full compensation for providing all equipment, access pipes, conducting the actual probing measurements as specified, furnishing reports, removing equipment, and all tools, labor and any incidentals necessary to complete the work. The number of sonic logging inspections may vary from the estimated quantities, but the contract unit price will prevail regardless of the variation.

Item No.	Type	Description
701-16.00	Each	Sonic Logging Testing

2.0 Resin Anchor Systems (Bridges).

The resin anchor epoxy shall be selected from the current MoDOT Pre-acceptance list (PAL), FS 1039 Table 5. The system used shall also meet any additional requirements as shown on the plans. The manufacturer shall certify the minimum ultimate pullout strengths. Reinforcing bars or threaded rods used with these systems shall be as specified on the plans.

3.0 Furnish and Install CCTV Pole.

3.1 Description. Furnish and install CCTV poles as shown on the plans by location and type.

3.2 Shop Drawings are required and shall include details of the hand holes, cable inlets, and pole cap, as well as fasteners and hardware. Calculations showing that the pole and foundation connection meet the requirements of the latest edition of AASHTO's *Specification for Structural supports for Highway Signs, Luminaires and Traffic Signals* shall be submitted with the shop drawings. Calculations shall be signed and sealed by a Professional Engineer registered in the State of Missouri.

3.3 Basis of Payment. Measurement and payment for CCTV pole includes the furnishing and the installation of the pole type, and all miscellaneous hardware required for a fully operational system as shown on the plans.

Item No.	Type	Description
910-99.02	Each	CCTV Pole, 30 FT, Furnish and Install

4.0 Conduit System on Structure

4.1 Description. Work shall be performed in accordance with Sec. 707, as modified herein.

4.2 Method of Measurement. The work provided herein will be measured for payment, as provided for in Section 4.3.

4.3 Basis of Payment. The accepted conduit system on structure will be paid for at the contract unit price, based on linear foot of structure in place.

Item No.	Type	Description
707-99.03	Linear Foot	Conduit System on Structure

O. EQUIPMENT CABINETS

1.0 Description. This work shall consist of furnishing and installing new cabinets.

2.0 Materials.

2.0.1 All cabinets shall include a grounding system. Connection to ground must be bare, solid AWG # 6 copper wire or equivalent bonding strap.

2.0.2 All powered cabinets shall be wired for three-wire 240/120 volt AC service. Provide a lightning arrestor designed to protect 120/240 VAC split phase breaker panels. The protector shall use metal oxide varistors as the protective elements. The response time shall be under five nanoseconds and the maximum surge current shall be at least 40,000 amps. The clamping voltage shall not exceed 400 volts. The device shall protect line-to-line and line-to-neutral.

2.0.3 Provide an additional surge protector just for the circuits powering the communication and traffic management equipment (excluding the dynamic message sign, which has its own surge protectors). This shall be a filtering, two-stage surge protector. Install it on the load side of the appropriate breaker. The protector shall provide radio frequency noise filtering and be capable of protecting equipment drawing a total of at least 10 amps. If the maximum load on the circuit exceeds 10 amps, the contractor shall split the load among multiple circuits, each with a surge protector. The protector shall clamp both the main line and the main neutral at 250 volts, both relative to each other and relative to the cabinet ground. The response time shall be such that the voltage never exceeds 250 volts. The surge protector shall suppress surges of up to 20,000 amps.

2.0.4 All circuit breakers shall be molded case units with quick-make, quick-break, trip-free mechanism, and with a minimum interrupting capacity of 10,000A (RMS Symmetrical). The circuit breakers shall be of fixed trip type and UL listed. Circuit breakers shall be listed on the latest Qualified Products List QPL-W-C-375 maintained by the Defense Supply Center.

2.0.5 All doors shall have cabinet identification labels displaying the cabinet identifier. The engineer will provide a list of the identifiers for each location, as well as the format for the labels.

2.0.6 All seams shall be continuously welded and ground smooth.

2.0.7 All fasteners must be stainless steel.

2.0.8 All cabinets shall have a natural aluminum finish, free from blemishes.

2.0.9 Provide terminal blocks for all conductors entering the cabinet. Except for blocks used for coaxial cable, the blocks shall be the barrier type with nickel-plated brass screw terminals and solid backs. Terminal blocks for conductors carrying more than 60 volts must be covered by a clear acrylic shield.

2.0.10 All cabinet doors shall have locks keyed to match MoDOT's other Gateway Guide cabinets.

2.1 Type 7 Cabinet.

2.1.1 Provide a single door, NEMA 3R, aluminum cabinet. The aluminum shall be at least 0.188 inches thick, except that the door and top need be only 0.125 inches thick. The cabinet shall be approximately 36 inches high, 20 inches wide, and 17 inches deep. The cabinets shall be

designed for pole mounting (with the back against the pole). The cabinet shall have a three-point door latch. It shall also have provision for padlocking. The door hinge shall be continuous and shall be affixed by nuts and bolts that are concealed when the door is closed

2.1.2 The cabinet shall be equipped with the following:

- **Rack:** For mounting 19-inch equipment. The mounting rails must have holes of the EIA standard size and spacing for the entire height of the cabinet.
- **Mounting panels:** For terminal blocks, breakers, surge protectors, and other small items on the back and side walls.
- **Fluorescent light:** Controlled by a door switch.
- **Duplex ground fault interrupt outlet:** For use by technicians.
- **Thermostatically controlled fan and heater:** The fan shall move 100 CFM through vents at the top of the cabinet. The air intake shall be through louvers in the door, and the air shall pass through a replaceable filter as it enters the cabinet. The heater shall use at least 250 watts and shall be designed to prevent accidental contact with dangerous heat or voltage.
- **Electrical distribution system:** Consisting of two 15 amp main circuit breakers, one for each side of the split phase service. One of the main breakers shall serve the communication and traffic management equipment in the cabinet. Provide at least four outlets on this circuit. The second main breaker shall power auxiliary devices in the cabinet, such as the fan, heater, light, and power strip.

If the cabinet feeds power to other cabinets, the contractor shall provide two separate branch circuits for each of the other cabinets (one circuit for communication and traffic management equipment and the other circuit for the remaining devices). The contractor shall equip those branch circuits with 15 amp breakers.

- **Sunshield:** On the top.
- **Mounting brackets:** Stainless steel U-bolts and any other mounting hardware needed.

3.0 Construction Requirements.

3.1 Pole Mounted Cabinets. Securely fasten pole-mounted cabinets to their poles using mounting brackets as indicated in the plans.

3.2 Bonding and Grounding. Bond pole-mounted cabinets to the pole and ensure that the pole is connected to a ground rod.

4.0 Acceptance Testing.

4.1 Develop a proposed test procedure for the cabinets and submit it to the engineer for approval. It shall include visual inspection, testing of lights, fan, heater, power outlets and alarm sensors. It shall also include a test in which each branch circuit is shorted to the cabinet wall to confirm that the breaker trips. Revise the proposed test procedure until it is acceptable to the engineer.

4.2 Provide all equipment and personnel needed to safely conduct the tests, arrange for the engineer's representative to witness the tests, and give the engineer a report documenting the result of every visual inspection and test. Include a summary indicating whether the cabinet passed every test. The cabinet must pass every test to be accepted.

4.3 If the cabinet fails, correct the problems and arrange for a new test. If the test of the breakers reveals breakers that do not trip, the resistance to ground is too high; lower the resistance by adding more ground rods and improving the connections in the ground system.

5.0 Documentation.

5.1 Prior to purchasing the cabinets, provide five sets of complete shop drawings, layout drawings, catalog cuts, and schematics. The layout drawings shall be dimensioned drawings showing the proposed location of all equipment for each cabinet. The drawings shall demonstrate that all the equipment will fit, and that all controls, connections, and other service points are readily accessible. It should also demonstrate that incoming conductors reach surge suppressors as soon as they enter the cabinet. Lay out all cabinets that have the same equipment in the same way and submit a single drawing for all like cabinets. Revise the layout as instructed by the engineer and resubmit the drawings until they are accepted.

5.2 After installation, provide one reproducible 24 inch X 36 inch and two prints of the cabinet wiring diagram for each cabinet. The diagrams shall be nonproprietary. They shall reflect as-built conditions and shall identify all circuits in such a manner as to be readily interpreted. The diagrams shall be placed in a heavy duty, clear plastic pouch and attached to the front cabinet door. The pouch shall be of such design and material that it provides adequate storage and access to the wiring diagram.

6.0 Guarantee. All items covered by this specification shall carry a two-year guarantee from the date of acceptance against any imperfections in workmanship or materials.

7.0 Basis of Payment. Measurement and payment for items covered by this specification include the documentation and acceptance testing, in addition to all materials, including base adapters and equipment. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Field Terminal Cabinet, Type 7, Furnish and Install

P. INSTALL COMMUNICATION EQUIPMENT

1.0 Description. Install Commission-furnished communication equipment in new and existing roadside cabinets, including existing traffic signal cabinets. Connect it to power, communication, and ground. Test the completed installation and report any problems to the engineer. Trouble shoot to the point of identifying the particular device that is causing the communication problem.

2.0 Materials.

2.1 Ethernet switches, SFP transceivers and device servers will be provided by the Commission. These will include power cables.

2.2 Provide communication cables (Category 5E patch cords, coax patch cords, and short serial cables) as required.

3.0 Construction Requirements.

3.1 Provide to the engineer a detailed schedule of installation of Commission-furnished communications equipment, at least thirty (30) days before commencing this type of work. Additionally, coordinate such work with the engineer.

3.2 For equipment installed in cabinets, mount the equipment in the rack as shown in the approved cabinet layout diagram or, for existing cabinets, as directed by the engineer, and connect the power cables and ground wires. If there are insufficient outlets in existing cabinets, provide power strips as required. Connect the communication cables as shown on the connection diagrams in the plans. The equipment will be configured by the Commission, and therefore do not change any configuration settings. Jumpers shall not be plugged into any Ethernet switches located inside node cabinets unless directed to do so by the Commission.

3.3 Assist Commission staff in making the installed equipment operational. This may entail having a person with a cellular telephone at the cabinet reporting on results and making changes as directed by Commission staff. It may also entail installing replacement equipment when a unit cannot be made to work properly.

4.0 Basis of Payment. Measurement and payment for communication equipment installation will be on a per cabinet basis. The unit price shall include patch cords, cabling, assistance to Commission staff in getting the equipment operational, and all miscellaneous hardware required for a safe, fully operational system. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Install Communication Equipment

Q. INSTALL CCTV CAMERA ASSEMBLY

1.0 General.

1.1 Description. Install a Commission-furnished closed circuit television (CCTV) assembly on a metal pole, and install a Commission-furnished power supply and surge protection in a nearby cabinet. The pole and cabinet will be paid for separately. Provide cables connecting the camera to the equipment in the cabinet and to ground, provide an air terminal, set up the camera assembly, and test for proper operation.

1.2 Qualified Personnel. The Commission's agreement with the camera assembly manufacturer obligates the manufacturer to train the Commission's installation contractors in the unpacking, assembling, mounting, positioning, connecting to the communication network, set up, and testing of the camera assemblies. The training is free to the contractor, and is conducted at the jobsite. Do not perform any work until the manufacturer has certified the contractor as qualified. Only personnel who have been trained by the manufacturer shall

participate in the camera assembly installation, setup, and testing. A Commission representative will be present to observe the training.

1.2.1 Contractors certified under a previous Commission contract need not be trained a second time, but only personnel who received the training shall participate in the camera assembly installation and testing.

1.3 Support During Installation. The Commission's agreement with the camera assembly manufacturer obligates the manufacturer to provide both on-site and remote factory support.

2.0 Materials.

2.1 Camera assembly, mounting bracket, power supply, and surge suppressors will be provided by the Commission.

2.2 Provide cables for power, video, and camera control in accordance with the camera manufacturer's recommendations

2.3 Provide stainless steel bands to affix the mounting bracket to the pole. The banding shall be 1-inch wide, 0.044-inch thick, stainless steel.

2.4 The air terminal shall be solid copper at least 5/8 inch in diameter. The top of the rod shall be tapered to a point. The bottom of the rod shall be flattened and bolted to the pole using at least three stainless steel bolts as indicated on the plans.

3.0 Construction Requirements.

3.1 Install the dome so that the pole does not block the camera's view of traffic.

3.2 Install the air terminal on the opposite side of the pole from the dome. Position the rod to project a minimum of five feet above the highest point of the pole, and attach it to the pole with bolts passing through the wall of the pole and bond the air terminal to the top of the pole. Apply a copper-based conductive sealant between the rod and the pole before tightening the bolts. The pole itself shall be the ground conductor.

3.3 Connect the bottom of the pole to one or more ground rods using a bare, solid AWG # 6 copper wire. Use exothermic welding for all ground wire connections, except the connection to the pole, which shall use the pole's grounding lug. Use a device that measures resistance to ground using the three-point fall-of-potential method to ensure that the resistance from the air terminal to ground does not exceed 8 ohms. Add more ground rods if necessary to achieve this requirement. The contractor shall perform all work related to the installation of the air terminal in accordance with NFPA 780.

3.4 Terminate all the cables on surge protectors, install the Commission-furnished power supply in the cabinet, and connect the camera power circuit to the power supply.

3.5 Restrict the camera's field of view, if necessary, so that a user cannot use the cameras to look in the windows of dwellings. To the extent that it does not interfere with the use of the camera for traffic management purposes, ensure that a camera cannot be used to view

residential property. Prior to creating these restrictions, submit to the engineer a written description of the proposed restrictions to be installed at each camera, and the proposed method of achieving them. It shall not be possible for an operator to override these restrictions without intervention by his or her supervisor. Affixing a mask to the inside of the clear dome shall be an acceptable method to achieve this. Highlight situations in which there is a conflict between the need to protect privacy and the need to know about traffic situations. Revise the field of view restrictions as directed by the engineer.

3.6 Apply a rain repellent coating to the outside of the lower dome, following the coating manufacturer's instructions. The coating must be recommended by its manufacturer for clear acrylic.

4.0 Acceptance Testing.

4.1 Upon delivery of a shipment of camera assemblies, the manufacturer's representative shall conduct a visual inspection and test of the camera assemblies to check for manufacturing defects and shipping damage. The camera assembly shall be powered during this testing, and tests shall follow procedures developed by the manufacturer and approved by the engineer. The engineer will witness this testing and the contractor may witness this testing if he or she chooses. The manufacturer shall be responsible for replacing all defective units uncovered by this testing.

4.2 After installing the camera assembly, test it using the same procedures as the manufacturer's representative used when the camera assemblies were delivered. In addition, demonstrate that the agreed upon viewing restrictions have been implemented. Also, use a device that measures resistance to ground using the three-point fall-of-potential method to demonstrate that the resistance from the air terminal to ground does not exceed 8 ohms. If the installed camera assembly fails to operate properly, and the problem cannot be fixed by changing the wiring or setup parameters, the camera assembly will be deemed defective and the contractor shall return it to the manufacturer for replacement. Except for costs borne by the manufacturer under his warranty agreement, the cost of replacement shall be borne entirely by the contractor.

5.0 Basis of Payment. Measurement and payment for camera assembly installation includes cables, testing, grounding, and all miscellaneous hardware required for a safe, fully operational camera assembly. Payment will be made as follows:

Item No.	Type	Description
910-37.00	Each	Install CCTV Camera Assembly

R. REMOVE RADAR DETECTOR STATION

1.0 Description. Remove and salvage a radar detector, pole-mounted cabinet and pole. Obliterate the foundation and restore the area. Relocate the radar detector.

2.0 Materials. Topsoil, seed, and fertilizer shall meet the requirements of Secs 804, 805, and 801, respectively, of the Standard Specifications.

3.0 Construction Requirements.

3.1 Prior to beginning work, inspect the pole and cabinet. Have the engineer's representative observe any damage, so that the contractor is not charged for it.

3.2 Remove the radar detector unit, power supply, termination blocks and cable running between the cabinet and detector unit. These materials are relocated as shown in the plans.

3.3 Disconnect the power wires and communication cables at both ends and remove the cables. Disconnect the ground wires in the detector cabinets and pull them out.

3.4 After the work of disconnecting the cables connecting the cabinet to power, communication and ground is complete, carefully remove the cabinet and its mounting hardware from the pole. Then remove the pole from its foundation.

3.5 Tag the cabinet, cabinet contents, and pole with the date of removal and location. Deliver them to the Missouri Department of Transportation's maintenance lot located at 2309a Barrett Station Road, Ballwin, Missouri 63021. Notify the shop 24 hours prior to each delivery by calling Mr. Roy Bochenholt at 314-340-1467 or Mr. Norman Falls at 314-340-1466. Repair or replace any cabinets and contents damaged by the contractor's negligence.

3.6 Demolish the foundation to a point two feet below grade. Remove and dispose of the debris.

3.7 Backfill the foundation pit. Deposit backfill material in layers not exceeding 6 inches deep. Each layer shall be compacted to the approximate density of the adjacent material before the next layer is placed. Backfill shall be carefully tamped in place. All disturbed areas shall be restored in accordance with the provisions of Section M.

4.0 **Acceptance Testing.** Testing will consist of visual inspection of the salvaged equipment and restored area. If electronic equipment appears to have been damaged by the contractor, the Commission may test its performance to assess the extent of the damage.

5.0 **Basis of Payment.** Measurement and payment for removing a detector station includes salvage, demolition, restoration of site, and delivery to the MoDOT shop. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Remove Radar Detector Station

S. REMOVE EXISTING CABLES

1.0 **Description.** Remove and dispose of the fiber optic, instrument, and power cables in the conduits indicated on the plans.

2.0 Construction Requirements.

2.1 Shut off power at the meter and disconnect the power wires at the meter (load side of breaker or disconnect switch) and at the cabinet. If the meter serves other cabinets, then disconnect the power wires at the point where they are spliced to the wires serving other cabinets, not at the meter. Disconnect the ground wires and communication cables at both ends.

2.2 Pull out and dispose of the cables that the plans say should be removed.

3.0 Basis of Payment. Measurement and payment for removing and disposing of cables includes shutting off power and disconnecting the wires or cables. Payment is covered by the lump sum Removal of Improvements pay item.

T. SIGNAL CABINET BASE WRAP AND CABINET SHIFT

1.0 Description. Where required, an existing concrete signal cabinet base shall be widened on all sides in order to provide additional conduits into an existing cabinet as detailed in the plans.

2.0 Existing Cabinet Assembly. The existing cabinet assembly shall be kept in operation at all times during the base widening procedure, except for a brief amount of time needed to shift the cabinet on the widened base.

3.0 Construction Requirements. Construction requirements shall conform to Sec 902.

4.0 Method of Measurement. Method of measurement shall conform to Sec 902.

5.0 Basis of Payment. Payment for signal cabinet base wrap and cabinet shift shall be considered full compensation for all contractor-provided equipment, labor and material to complete the described work. Payment will be made as follows:

Item No.	Type	Description
902-99.02	Each	Signal Cabinet Base Wrap and Cabinet Shift

U. CONDUIT SPLICING

1.0 Description. At locations noted on the plans, trenched conduit shall be spliced to existing conduit.

2.0 Requirements. At locations where connection of the new trenched conduit to existing conduit is shown, a watertight connection shall be made using a mechanical coupler. The coupler shall be designed by the manufacturer to join conduits of the type and size to be joined. The splicing device shall be approved by the engineer.

3.0. Construction Requirements. Construction requirements shall conform to Sec 902.16.

4.0 Basis of Payment. No direct payment will be made to provide conformance to this section. Payment is to be included as part of Conduit, 2" Trenched.

V. PRIMARY POWER

1.0 Description. Construct a conduit bank and transformer pad to Ameren specifications for Ameren's exclusive use. Arrange for Ameren to provide primary electrical service to the location shown on the plans. Coordinate with Ameren throughout the project to ensure that the work is satisfactory to Ameren.

1.1 The plans depict the trench routing in schematic form only. Determine final routing based on actual field conditions at each site, including utility locator service markings, to assure no conflicts with existing utilities. The routing must remain on Commission right of way or easement.

1.2 Inspect the project area prior to submittal of bid to determine the types and extent of incidental removal, relocation and replacement items to include in the unit price of trenching, transformer pad construction, and pull box installation.

2.0 Materials. Unless otherwise specified here, materials shall be as specified in Ameren's *Specifications for Customer-Installed Underground Distribution Facilities (Non-Residential)*.

2.1 Conduit shall be 3" PVC Schedule 80. Note the trench depth for the primary power conduit system shall conform to Ameren's *Specifications for Customer-Installed Underground Distribution Facilities (Non-Residential)*. Contractor shall install a 2500# pull tape in the primary power conduit. All costs associated with the pull tape installation shall be included under the item "Conduit, 3 in., PVC, In Trench."

2.2 Transformer Pad shall be constructed at the location shown on the plans. Prefabricated pads may be used.

3.0 Construction Requirements. Unless otherwise specified here, construction shall be as specified in Ameren's *Specifications for Customer-Installed Underground Distribution Facilities (Non-Residential)*. Obtain the required standard drawings from Ameren. All disturbed areas shall be restored in accordance with the provisions of Section M.

4.0 Basis of Payment. Measurement and payment for transformer pad, installed includes grading, other incidental materials, installation, disposal of excess material, and restoration.

Measurement and payment for conduit is as described in Section I.

Payment for the transformer pad will be made as follows:

Item No.	Type	Description
910-99.02	Each	Utility Transformer Pad

W. ITS PULL BOX

1.0 Description. Furnish and install ITS Pull Boxes as shown on the plans.

2.0 Construction Requirements. Construction requirements shall conform to Sec 902.

3.0 Basis of Payment. Measurement and payment for ITS Pull Boxes includes excavation, materials, construction, backfill and all miscellaneous hardware required for a fully operational system.

Item No.	Type	Description
910-99.02	Each	ITS Pull Box

X. RADAR DETECTOR POLE FOUNDATION

1.0 Description. Construct detector pole foundation in accordance with Standard Plan 901.01 of the Missouri Standard Plans for Highway Construction.

2.2 Basis of Payment. Measurement and payment for detector pole foundation includes the excavation, materials, construction, backfill, and all miscellaneous hardware required for a fully operational system. Payment will be made as follows:

Item No.	Type	Description
910-38.01	Each	Detector Pole Foundation, 30 FT. Mounting Height

Y. MODIFY EXISTING POWER SUPPLY ASSEMBLY

1.0 Description. Provide and install one 60 amp double pole circuit breaker in existing power supply in order to provide 120 volt circuits to proposed camera site.

2.0 Materials. Provide circuit breakers, splices, cabinet wiring, and any incidental materials necessary to provide a source of power for the camera cabinet.

3.0 Construction Requirements. Mount new circuit breaker(s) at the existing power supply in the enclosed power supply cabinet. No conduit may be installed external to the power supply footing. The contractor shall clearly label all breakers and cables as to cabinet serviced.

4.0 Acceptance Testing. Provide all equipment and personnel needed to safely test the circuit. Arrange for the engineer to witness the tests.

5.0 Documentation. Provide testing results for all modified service disconnects.

6.0 Basis of Payment. Measurement and payment for modify existing power supply assembly includes the circuit breaker, splicing, incidental wiring, testing, and all miscellaneous hardware required for a fully operational power source. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Modify Existing Power Supply Assembly

Z. INSTALL RELOCATED CABLES

1.0 Description. Relocate existing communications or power cables as described in the plans.

2.0 Construction Requirements. The removal and installation of fiber optic cables shall meet all requirements specified in Section K including testing. The removal and installation of copper cables shall meet all requirements specified in Sec. 902.

3.0 Basis of Payment. Measurement and payment for install relocated cables shall be considered full compensation for all contractor-provided equipment, terminations, labor and material to complete the described work. Payment will be made as follows:

Item No.	Type	Description
910-99.03	Linear Foot	Install Relocated Cable
910-99.03	Linear Foot	Install Relocated Power Cable

AA. CATEGORY 5E CABLE

1.0 Description. This work shall consist of installing and terminating Category 5E copper cable.

2.0 Materials. Cable shall be Cat-5E STP cable suitable for outdoor use. Category 6 cable may be substituted with the approval of the engineer.

3.0 Construction Requirements.

3.1 Cable Installation. Install the cable such that the electrical and mechanical characteristics of the cable are not degraded. Do not violate the minimum bend radius or the maximum tension, both during and after installation.

3.1.1 Before any cable installation is performed, provide the engineer with four copies of the cable manufacturer's recommended maximum pulling tensions for the cable. These pulling tensions shall be specified for pulling from the cable's outer jacket. Also, provide a list of the minimum allowable cable bending radius and the cable manufacturer's approved pulling lubricants. Only those lubricants approved by the cable manufacturer will be permitted.

3.1.2 If the cable is pulled by mechanical means, use a clutch device to ensure the allowable pulling tension is not exceeded. Also, attach a strain gauge to the pulling line at the cable exit location, and at a sufficient distance from the take-up device, such that the strain gauge can be read throughout the entire cable pulling operation.

3.1.3 Do not leave the let-off reel unattended during a pull, in order to minimize the chance of applying excess force, center pull, or back feeding.

3.1.4 Use an approved lubricant, in the amount recommended by the cable manufacturer, to facilitate pulling the cable. After the cable has been installed, wipe the exposed cable in a pull box or cabinet clean of cable lubricant with a cloth before leaving the pull box or cabinet.

3.1.5 At cabinet locations, where cable runs from the pull box directly to an equipment cabinet, store 30 feet of slack cable in the pull box. Store slack cable neatly on the walls of the pull box using racking hardware acceptable to the engineer.

3.1.6 Seal the cable ends to prevent the escape of the filling compound and the entry of water.

3.1.7 Label every cable immediately upon installation. Label the cables at every point of access, including pull boxes, and termination points. Use self-laminating vinyl labels at least 1.5" wide and long enough that the translucent portion of the label completely covers the white area bearing the legend. The vinyl shall have a layer of pressure sensitive acrylic adhesive. The labels shall resist oil, water, and solvents and shall be self-extinguishing. The legend shall be machine printed in letters at least 3/32" high. Consult with the engineer concerning the desired method of identifying each cable. Labeling cables is incidental to the installing the cable, and will not be paid separately.

4.0 Documentation. Prior to purchasing the cable, submit five copies of catalog cut sheets to the engineer for approval.

5.0 Basis for Payment. Measurement and payment for items covered by this specification include the documentation, in addition to all materials and equipment necessary for a fully operational system. Payment will be made as follows:

Item No.	Type	Description
910-99.03	Linear Foot	CAT-5E Cable

BB. RELOCATE DMS

1.0 Description. Relocate DMS assembly, structure and cabinet as shown in the plans.

2.0 Bonding and Grounding. Use an AWG # 6 wire or equivalent bonding straps to bond the sign to the structure. Use an AWG # 6 solid, bare copper wire to bond the sign structure to the ground rod(s). Bond the bottom of the sign structure to one or more ground rods, using exothermic welding at each end of the ground wire (unless the steel structure has a suitable grounding lug). Use a device that measures resistance to ground using the three-point fall-of-potential method to ensure that the resistance from the sign's ground bar to ground does not exceed 8 ohms. Add more ground rods if necessary to achieve this requirement.

2.1 Foundation. Demolish the original foundation to a point two feet below grade. Remove and dispose of the debris.

2.2 Backfill the foundation pit. Deposit backfill material in layers not exceeding 6 inches deep. Each layer shall be compacted to the approximate density of the adjacent material before the next layer is placed. Backfill shall be carefully tamped in place. All disturbed areas shall be restored in accordance with the provisions of Section M.

3.0 Acceptance Testing.

3.1 Before removing the sign conduct a visual inspection with the engineer to document any existing damage to the sign, structure or cabinet. Obtain sign testing procedures from the sign manufacturer. Once the sign is relocated, test the relocated signs following the procedures developed by the manufacturer and approved by the engineer to demonstrate that the sign is still in satisfactory condition. The test will be witnessed by the engineer. The contractor shall be responsible for fixing any new problems uncovered by these tests.

3.2 Use a device that measures resistance to ground using the three-point fall-of-potential method to demonstrate that the resistance from the sign's ground bar to ground does not exceed 8 ohms. The acceptance test shall also include a demonstration that each branch circuit breaker in the sign's breaker box trips when the hot side of the circuit is shorted to ground. If the sign fails this test, reduce the resistance to ground by adding ground rods and improving electrical connections.

4.0 Basis of Payment. Measurement and payment for relocation of a DMS structure includes the removal, transportation and the installation of the DMS structure, DMS assembly, cabinet and catwalk, and all miscellaneous hardware required for a fully operational system as shown on the plans. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Relocate DMS

CC. RADAR DETECTOR RELOCATION

1.0 General. This work shall consist of removing an existing radar vehicle detection unit from an existing radar detection station and installing it on a camera poles as shown in the plans.

2.0 Materials. The radar detector unit, mounting bracket, power supply, terminal block and cabling between the cabinet and radar unit are salvaged from an existing detector station shown in the plans.

3.0 Construction Requirements. The existing radar detector unit, mounting bracket, power supply and terminal blocks are to be removed from the existing pole and cabinet and installed at the new location. The existing cables between the unit and cabinet shall be removed from inside the existing pole and installed inside the pole it is being relocated on.

3.1 The set up shall include speed calibration using measured (not estimated) reference speeds. When the set-up is complete and the detector is ready for operation, the values of all parameters that were set during the process shall be delivered to the engineer in printed or computer-readable form. All equipment, such as a radar gun, software, laptop computer, tools and cables, needed for the set-up work shall be provided.

4.0 Measurement and Basis of Payment. Measurement and payment for radar detector relocation includes the removal, transportation and the installation of the radar unit, mounting bracket, power supply, terminal block, cables, and all miscellaneous hardware required for a

fully operational system as shown on the plans. Set up and calibration is also included. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Relocate Radar Detector

DD. RELOCATE TYPE 2 POWER SUPPLY ASSEMBLY

1.0 Description. Remove and relocate power supply assembly to new base as shown in the plans.

2.0 Materials. The principal materials to be used in this work shall be those salvaged with the exception of cables extending from the assemblies and the base. Items shall be modified with the same type of material as used in the original construction. The suitability of existing material for salvage, modification, or reuse will be determined by the engineer. New, salvaged, or refurbished materials necessary for relocating the item specified shall conform to the requirements of the applicable specifications for items of the same character and type.

3.0 Construction Requirements

3.1 Prior to beginning work, inspect the assembly. Have the engineer's representative observe any damage, so that the contractor is not charged for it.

3.2 Contact the appropriate utility to shut off power to the power supply assembly. Disconnect the power and ground wires. Existing electrical conductors which are no longer used shall be removed from the conduit and the conduit may be abandoned in place. Dispose the cables that are removed.

3.3 After the work of disconnecting the cables connecting the assembly to power and ground is complete, carefully remove the assembly and transport it to the new location. If not immediately installed at the new locations, stockpiled in areas where they will not be damaged. Items designated for relocation shall be installed in accordance with the applicable specifications in Sec. 901 or as directed by the engineer. The contractor is responsible for any damage to stored equipment.

3.4 The existing foundation shall be removed and the site restored as required in Section M.

3.5 Construct a new foundation consistent with original foundation that is compatible with the power supply assembly being relocated.

3.6 Grounding and other requirements specified in Sec. 901 apply to relocated power supply assemblies.

4.0 Acceptance Testing. Testing will consist of visual inspection of the relocated equipment. If the assembly appears to have been damaged by the contractor, the engineer may request tests to assess the extent of the damage.

5.0 Basis of Payment. Measurement and payment for relocate power supply assembly includes removal, transportation, installation on new foundation and all miscellaneous hardware required for a fully operational assembly as shown on the plans. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Relocate Power Supply Assembly

EE. RELOCATE CITY CAMERA AND COMMUNICATIONS EQUIPMENT

1.0 General. This work shall consist of removing an existing camera from a pole and installing it on a new pole as shown in the plans. Associated communications equipment must also be removed from an existing cabinet and installed in the new cabinet.

2.0 Materials. The camera, mounting bracket, power supply and communications equipment will be reused. A new composite communications and power cable that matches the existing cable connecting the camera to the cabinet shall be provided.

3.0 Construction Requirements. The existing camera, mounting bracket, power supply and communications equipment are to be removed from the existing pole and cabinet. The camera will be mounted 5' below the Commission camera located at the top of the pole. The new composite communications and power cable between the camera and cabinet shall be installed inside the pole it is being relocated on.

4.0 Acceptance Testing. Before removing the camera conduct a visual inspection with the engineer to document any existing damage to the camera assembly. Once the camera is relocated, use camera testing procedures as specified in Section Q to demonstrate that the camera is still in satisfactory condition and functioning. The test must be coordinated with and witnessed by a representative from the City of St. Peters. The contractor shall be responsible for fixing any new problems uncovered by these tests.

5.0 Measurement and Basis of Payment. Measurement and payment for relocate city camera and communications equipment includes the removal, transportation and the installation of the camera, mounting bracket, power supply, communications equipment, terminal block, cables, and all miscellaneous hardware required for a fully operational system as shown on the plans. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Relocate Radar Detector

FF. RELOCATE CCTV CAMERA

1.0 Description. Relocate the CCTV camera pole, cabinet, and camera assembly as shown in the plans.

2.0 Bonding and Grounding. Use an AWG # 6 solid, bare copper wire to bond the camera pole to the ground rod(s). Bond the bottom of the pole to one or more ground rods, using

exothermic welding at each end of the ground wire (unless the steel structure has a suitable grounding lug). Use a device that measures resistance to ground using the three-point fall-of-potential method to ensure that the resistance from the air terminal to ground does not exceed 8 ohms. Add more ground rods if necessary to achieve this requirement.

3.0 Acceptance Testing.

3.1 Before removing the camera pole conduct a visual inspection with the engineer to document any existing damage to the camera assembly, pole, or cabinet. Once the camera is relocated, use camera testing procedures as specified in Section Q to demonstrate that the camera is still in satisfactory condition and functioning. The test will be witnessed by the engineer. The contractor shall be responsible for fixing any new problems uncovered by these tests.

3.2 Use a device that measures resistance to ground using the three-point fall-of-potential method to demonstrate that the resistance from the air terminal to ground does not exceed 8 ohms. The acceptance test shall also include a demonstration that each branch circuit breaker in the sign's breaker box trips when the hot side of the circuit is shorted to ground. If the sign fails this test, reduce the resistance to ground by adding ground rods and improving electrical connections.

4.0 Basis of Payment. Measurement and payment for relocation of a CCTV Camera includes the removal, transportation and the installation of the camera assembly, pole, cabinet, and all miscellaneous hardware required for a fully operational system as shown on the plans. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Relocate 50' CCTV Camera

GG. VIDEO SWITCHER

1.0 Description. A video switcher allows the video from any detection camera to be displayed on the in-cabinet monitor without impacting the video transmission to the video encoder from any of the detection cameras.

2.0 Material. The switcher shall make all camera video available to the monitor and network without requiring the disconnection and reconnection of cables. The video being transmitted to the monitor in the cabinet shall be selectable by pressing a manual switch. The video switcher shall have at least four ports for video input and at least four ports for video output to the network and one port for video output to the in-cabinet monitor. Coax patch cables must be provided to make connections from the switcher to the existing video detection system, the video encoder and the monitor. Terminate the cables with connectors that are compatible with the equipment.

3.0 Construction. Connect the video switcher to the video detection system, the Commission furnished video encoder and monitor. Demonstrate to the engineer that video from each detection camera can be displayed on the monitor while not impacting the video from all cameras to the video encoder.

4.0 Basis of Payment. Measurement and payment for video switcher includes the furnishing the switcher, installation of the switcher, patch cables, and all miscellaneous hardware required for a fully operational system as shown on the plans. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Video Switcher

HH. IP VIDEO ENCODER

1.0 Description. The contractor shall furnish and install a video encoder in signal cabinets as specified in the plans. The video encoder will be utilized to bring back streaming video from intersection video detection systems.

2.0 Technical Specifications.

2.1 The video encoder must meet the following minimum requirements:

- Utilize a 120 Volts Alternating Current (VAC) power supply. If the power supply is separate from the unit, then the power supply must be provided at no additional cost.
- The video encoder must be field harden and suitable for operating in outdoor, non-cooled, ventilated controller assemblies or in cooled controller assemblies or buildings.
- Support four (4) video inputs and have the flexibility to transport all four video signals simultaneously for remote monitoring.
- Support Quad image views at full resolution with no additional bandwidth requirements.
- The video encoder must have the ability to multicast several video streams with different compression rates (MPEG-2 and MPEG-4).
- The video encoder must be IP addressable with a 10/100 Base-T Ethernet interface via RJ-45 connectors.
- A minimum of one serial data port that supports RS232/RS422/RS485 serial data connections.
- Accept one or more NTSC (60Hz) color video format signals via a coaxial cable, 75 ohm BMC-style connector.
- The video encoder must be software and firmware upgradable remotely and have remote user interface capabilities.
- The video encoders must be compatible with Commission's intersection video detection interface software.

3.0 Construction Requirements.

3.1 Requirements. The contractor shall be responsible for ensuring that the appropriate connections are made with the existing and/or newly installed intersection video detection system. The contractor is responsible for verification that the video detection system is fully

operational in the field and that all cameras and the video detection processor are remotely viewable and accessible from the St. Louis District TMC per manufacture's recommendation.

3.2 Support. The equipment provided must include a manufacturer's warranty.

3.3 Training. If needed, training shall be provided in the operation, setup, and user interface of the video encoders.

4.0 Basis of Payment. Payment for furnishing and installing the video encoder shall include all materials, labor and work incidental thereto, and shall be considered to be completely covered by the contract unit price agreed upon by the contractor and the Commission. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	IP Video Encoder

II. COMMUNICATIONS PLANS

1.0 As-Built Plans. Contractor is responsible for providing both Visio and PDF files of as-built communication plans for the project. If there are any field connections or terminations completed that are different from the provided communication plans, contractor must submit revised drawings in the requested formats to the Commission.

2.0 Basis of Payment. No direct payment will be made to the contractor to recover the cost of equipment, labor, materials or time required to fulfill the above provisions, unless specified elsewhere in the contract document.

JJ. PARTIAL ACCEPTANCE

1.0 ITS devices along I-70 within the project limits, with the exception of ITS devices along Route C (Mid Rivers Mall Drive), will be accepted by the Commission prior to final project completion based on the following conditions:

- Once all ITS devices and fiber have been relocated along the specified section of I-70 and are successfully communicating with the TMC, the contractor can request a partial punch list for these items. All required acceptance testing and documentation for each device and the fiber optic cabling must be completed as specified in the contract documents.
- These relocated devices shall undergo a 30 day operational test period. Any communication failures and/or device malfunctions during this test period will be the responsibility of the contractor to troubleshoot and correct at the contractor's expense. This test period will be repeated until the ITS equipment has operated to the engineer's satisfaction for 30 consecutive days.

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2.0 Basis of Payment. No direct payment will be made to the contractor to recover the cost of equipment, labor, materials or time required to fulfill the above provisions, unless specified elsewhere in the contract document.

KK. SUPPLEMENTAL REVISIONS

No supplemental revisions at this time.