

Job No.: JSL0203  
Route: Various  
County: Various

JOB SPECIAL PROVISIONS TABLE OF CONTENTS (ROADWAY)


(Job Special Provisions shall prevail over General Special Provisions whenever in conflict therewith.)

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	<b>MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION</b> 105 W. CAPITOL AVE. JEFFERSON CITY, MO 65102 Phone 1-888-275-6636
	HNTB CORPORATION 715 Kirk Drive Kansas City, MO 64105  Certificate of Authority: 001270 Consultant Phone: 816-472-1201
	If a seal is present on this sheet, JSP's have been electronically sealed and dated.
	JOB NUMBER: JSL0203 VARIOUS COUNTIES, MO DATE PREPARED: 12/16/2025
	ADDENDUM DATE:

Only the following items of the Job Special Provisions (Roadway) are  
authenticated by this seal: All

JOB  
SPECIAL PROVISION

A. General - Federal JSP-09-02L

**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.org](http://www.modot.org) under "Doing Business with MoDOT", "Contractor Resources". 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.org](http://www.modot.org) under "Doing 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 July 2025 Missouri Standard Plans  
For Highway Construction

These supplemental bidding documents contain all current revisions to the published 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. Contract Liquidated Damages JSP-13-01D

**1.0 Description.** Liquidated Damages for failure or delay in completing the work on time for this contract shall be in accordance with Sec 108.8. The liquidated damages include separate amounts for road user costs and contract administrative costs incurred by the Commission.

**2.0 Period of Performance.** Prosecution of work is expected to begin on the date specified below in accordance with Sec 108.2. Regardless of when the work is begun on this contract, all work on all projects shall be completed on or before the date specified below. Completion by this date shall be in accordance with the requirements of Sec 108.7.1.

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Notice to Proceed: April 20, 2026

Contract Completion Date: April 15, 2027

**2.1 Calendar Days and Completion Dates.** Completion of the project is required as specified herein. The count of calendar days will begin on the date the contractor starts any construction operations on the project.

Job Number	Calendar Days	Daily Road User Cost
JSL0203	N/A	\$11,400

**3.0 Liquidated Damages for Contract Administrative Costs.** Should the contractor fail to complete the work on or before the contract completion date specified in Section 2.0, or within the number of calendar days specified in Section 2.1, whichever occurs first, the contractor will be charged contract administrative liquidated damages in accordance with Sec 108.8 in the amount of **\$750** per calendar day for each calendar day, or partial day thereof, that the work is not fully completed. For projects in combination, these damages will be charged in full for failure to complete one or more projects within the specified contract completion date or calendar days.

**4.0 Liquidated Damages for Road User Costs.** Should the contractor fail to complete the work on or before the contract completion date specified in Section 2.0, or within the number of calendar days specified in Section 2.1, whichever occurs first, the contractor will be charged road user costs in accordance with Sec 108.8 in the amount specified in Section 2.1 for each calendar day, or partial day thereof, that the work is not fully completed. These damages are in addition to the contract administrative damages and any other damages as specified elsewhere in this contract.

**5.0 Winter Period Exemption Eliminated.** The elimination of charges for liquidated damages from December 15 through March 15 in Sec. 108.8.1.3 (a) is deleted.

C. Scope of Work

**1.0 Description.** Replace 8 existing dynamic message signs (DMS) with contractor furnished full color matrix DMSs with a pixel pitch of 20 mm in St. Louis County and St. Louis City. Five of the DMSs are along freeways and have walk-in sign housings. The other three DMSs are along an arterial roadway and have front-access sign housings. Replace 117 Ethernet switches, expansion modules as noted and power supplies with Commission furnished equipment in existing roadside cabinets in Franklin County, Jefferson County, St. Charles County, St. Louis County and St. Louis City. New DMS controllers shall be installed at all of the DMS locations and provide new equipment cabinets, foundations and relocate equipment as noted in the plans. The work also includes modifying existing electrical conductors and fiber optic cabling to service the new equipment cabinets at the roadside locations. DMS control cable shall be a multimode fiber optic cable. At the DMS replacement locations and many of the cabinets getting replacement Ethernet switches, install Commission furnished Digital Logger IP addressable power strips.

**2.0 Coordination.** At the same time that this project is under construction, other related roadway and ITS 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 SL District ITS (Intelligent Transportation System) group known as the SLITS.** The contractor shall coordinate with the engineer and the other contractors, and endeavor to complete the fiber optic cable and ITS device installation

quickly so as not to delay other contractors. The contractor must coordinate with SLITS staff to make new and reconnected ITS devices operational.

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

**4.0 Restrictions on Work.** The work entails connecting some existing traffic management equipment to the communication system extensions being built in conjunction with this project. It also entails working in some existing communication cabinets. These work activities may require shutting off power or disconnecting equipment from its communication links. Unless the engineer grants special approval, no existing traffic management device may be out of service for more than 48 hours in any 7-day period. Time out of service includes time that the device cannot communicate with its central computer.

D. Work Zone Traffic Management JSP-02-06N

**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.

**1.1 Maintaining Work Zones and Work Zone Reviews.** The Work Zone Specialist (WZS) shall maintain work zones in accordance with Sec 616.3.3 and as further stated herein. The WZS shall coordinate and implement any changes approved by the engineer. The WZS shall ensure all traffic control devices are maintained in accordance with Sec 616, the work zone is operated within the hours specified by the engineer, and will not deviate from the specified hours without prior approval of the engineer. The WZS is responsible to manage work zone delay in accordance with these project provisions. When requested by the engineer, the WZS shall submit a weekly report that includes a review of work zone operations for the week. The report shall identify any problems encountered and corrective actions taken. Work zones are subject to unannounced inspections by the engineer and other departmental staff to corroborate the validity of the WZS's review and may require immediate corrective measures and/or additional work zone monitoring.

**1.2 Work Zone Deficiencies.** Failure to make corrections on time may result in the engineer suspending work. The suspension will be non-excusable and non-compensable regardless if road user costs are being charged for closures.

**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, the hours traffic control will be in place and work hours.

**2.2** The traffic management schedule shall conform to the limitations specified in Sec 616 regarding lane closures, traffic shifts, road closures and other width, height and weight restrictions.

**2.3** The engineer shall be notified 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. The contractor shall immediately implement appropriate mitigation strategies whenever traffic congestion reaches an excess of **15 minutes** to prevent congestion from escalating beyond this delay threshold. If disruption of the traffic flow occurs and traffic is backed up in queues equal to or greater than the delay time threshold listed above, then the contractor shall immediately review the construction operations which contributed directly to disruption of the traffic flow and make adjustments to the operations to prevent the queues from reoccurring. Traffic delays may be monitored by physical presence on site or by utilizing real-time travel data through the work zone that generate text and/or email notifications where available. The engineer monitoring the work zone may also notify the contractor of delays that require prompt mitigation. The contractor may work with the engineer to determine what other alternative solutions or time periods would be acceptable. When a Work Zone Analysis Spreadsheet is provided, the contractor will find it in the electronic deliverables on MoDOT's Online Plans Room. The contractor may refer to the Work Zone Analysis Spreadsheet for detailed information on traffic delays.

#### **2.5.1 Traffic Safety.**

**2.5.1.1 Recurring Congestion.** Where traffic queues routinely extend to within 1000 feet of the ROAD WORK AHEAD, or similar, sign on a divided highway or to within 500 feet 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.

**2.5.1.2 Non-Recurring Congestion.** When traffic queues extend to within 1000 feet of the ROAD WORK AHEAD, or similar, sign on a divided highway or to within 500 feet of the ROAD WORK AHEAD, or similar, sign on an undivided highway infrequently, 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 and no more than 0.5 mile in advance of the end of the traffic queue on divided highways and no less than 500 feet and no more than 0.5 mile in advance of the end of the traffic queue on undivided highways.

**2.6 Traffic Management Center (TMC) Coordination.** The Work Zone Specialist (WZS) or their designee shall contact by phone the MoDOT Traffic Management Center (Gateway Guide TMC at #314-275-1513) within five minutes of a lane or ramp closure beginning and within five minutes of a lane or ramp closure being removed. The WZS shall make this phone call 24 hours a day, 365 days of the year since the MoDOT Traffic Management Centers are always staffed.

#### **3.0 Work Hour Restrictions.**

**3.1** Except for emergency work, as determined by the engineer, and long term lane closures required by project phasing, all lanes shall be scheduled to be open to traffic during the five major holiday periods shown below, from 12:00 noon on the last working day preceding the holiday until 6:00 a.m. on the first working day subsequent to the holiday unless otherwise approved by the engineer.

Memorial Day  
 Labor Day  
 Thanksgiving  
 Christmas  
 New Year's Day

**3.1.1 Independence Day.** The lane restrictions specified in Section 3.1 shall also apply to Independence Day, except that the restricted periods shall be as follows:

When Independence Day falls on:	The Holiday is Observed on:	Halt Lane Closures beginning at:	Allow Lane Closures to resume at:
Sunday	Monday	Noon on Friday	6:00 a.m. on Tuesday
Monday	Monday	Noon on Friday	6:00 a.m. on Tuesday
Tuesday	Tuesday	Noon on Monday	6:00 a.m. on Wednesday
Wednesday	Wednesday	Noon on Tuesday	6:00 a.m. on Thursday
Thursday	Thursday	Noon on Wednesday	6:00 a.m. on Friday
Friday	Friday	Noon on Thursday	6:00 a.m. on Monday
Saturday	Friday	Noon on Thursday	6:00 a.m. on Monday

**3.1.2** Except for emergency work, as determined by the engineer, and long term lane closures required by project phasing, the contractor's working hours will be restricted for the Special Events as shown below. All lanes shall be scheduled to be open to traffic during these Special Events. There may be other events of regional significance, such as specific sporting events (i.e., St. Louis Cardinals and St. Louis Blues home games), events at Forest Park, Soulard, or parades, marathons, concerts, and other major St. Louis events. The engineer will advise the contractor of any such events and how they are to be handled. Restricted periods for special events shall be determined by the engineer.

**3.1.3 Cardinals and Blues Home Games.** Work requiring lane closures during any of the St. Louis Cardinals and Blues home games shall be stopped in accordance with the following schedule:

**I-170 in St. Louis County:**

Work shall stop two hours before the game begins. Work may resume one hour after the official end of the game.

**3.2** The contractor shall not perform any construction operation on the roadbed, 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** The contractor shall be aware that traffic volume data indicates construction operations on the roadbed between the following hours will likely result in traffic queues greater than 15 minutes. Based on this, the contractor's operations will be restricted accordingly unless it can be successfully demonstrated the operations can be performed without a 15 minute queue in traffic. It shall be the responsibility of the engineer to determine if the above work hours may be modified. Working hours for evenings, weekends and holidays will be determined by the engineer. The contractor may not work during the following listed hours:

**All Routes:**

6:00 a.m. – 9:00 a.m. Monday-Sunday

3:00 p.m. – 6:00 p.m. Monday-Sunday

**3.4** Any work requiring closure of two through lanes shall be completed during nighttime hours. Nighttime hours shall be considered to be 10:00 p.m. to 5:00 a.m. for this project.

**3.5** The contractor shall not alter the start time, ending time, or a reduction in the number of through lanes of traffic or ramp closures without advance notification and approval by the engineer. The only work zone operation approved to begin 30 minutes prior to a reduction in through traffic lanes or ramp closures is the installation of traffic control signs. Should lane closures be placed or remain in place, prior to the approved starting time or after the approved ending time, the Commission, the traveling public, and state and local police and governmental authorities will be damaged in various ways, including but not limited to, increased construction administration cost, potential liability, traffic and traffic flow regulation cost, traffic congestion and motorist delays, with a resulting cost to the traveling public. These damages are not easily computed or quantified. Therefore, the contractor will be charged with liquidated damages specified in the amount of **\$1,000 per 15-minute increment** for each 15 minutes that the temporary lane closures are in place and not open to traffic in excess of the limitation as specified elsewhere in this special provision. It shall be the responsibility of the engineer to determine the quantity of unapproved closure time.

**3.5.1** The said liquidated damages specified will be assessed regardless if it would otherwise be charged as liquidated damages under the Missouri Standard Specification for Highway Construction, as amended elsewhere in this contract.

**4.0 Detours and Lane Closures.**

**4.1** When a changeable message sign (CMS) is provided, the contractor shall use the CMS to notify motorists of future traffic disruption and possible traffic delays one week before traffic is shifted to a detour or prior to lane closures. The CMS shall be installed at a location as approved or directed by the engineer. If a CMS with Communication Interface is required, then the CMS shall be capable of communication prior to installation on right of way. All messages planned for use in the work zone shall be approved and authorized by the engineer or its designee prior to deployment. When permanent dynamic message signs (DMS) owned and operated by MoDOT are located near the project, they may also be used to provide warning and information for the work zone. Permanent DMS shall be operated by the TMC, and any messages planned for use on DMS shall be approved and authorized by the TMC at least 72 hours in advance of the work.

**4.2** At least one lane of traffic in each direction 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 interrupt 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. All authorized changes in the traffic control plan shall be provided for as specified in Sec 616.



**E. Emergency Provisions and Incident Management JSP-90-11A**

**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. Louis Police Department 314-231-1212
St. Louis County Police Department 314-615-5000

**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 law enforcement agency.

**2.2** The contractor shall notify law 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 law 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. Project Contact for Contractor/Bidder Questions JSP-96-05A**

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

Jamie Rana, P.E.  
Project Manager  
Missouri Department of Transportation - St. Louis District  
1590 Woodlake Drive  
Chesterfield, Missouri 63017

Telephone No.: 314-624-5035  
Email: jamie.rana@modot.mo.gov

**1.1** All questions concerning the bid document preparation can be directed to the Central Office – Design as listed below.

Job No.: JSL0203  
Route: Various  
County: Various

Telephone Number: (573) 751-2876  
Email: BCS@modot.mo.gov

G. Traffic Management Coordination

**1.0 Description.** The contractor shall coordinate traffic management between this project and any other projects on I-44 and Route 364, and projects which affect Route I-44 and Route 364, including all future projects.

**1.1** The contractor shall be aware that there may be other projects including, but not limited to, utility, St. Louis City, private, MoDOT maintenance, permit, or other projects that may impact project construction or traffic control in the vicinity of this project. It shall be the responsibility of the contractor to determine what, if any, projects other than the ones listed above may impact this project and work to coordinate construction and traffic management efforts between this project and any other project involved.

**1.2** Each Contractor shall conduct their work so as not to interfere with or hinder the progress or completion of the work being performed by other Contractors. In case of dispute, the Engineer shall be the referee and the Engineer's decision shall be final and binding on all.

**2.0 Site Construction.** The Contractor shall arrange the work and shall place and dispose of the materials being used so as not to interfere with the operations of the other contractors.

**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, unless specified elsewhere in the contract document.

H. Dynamic Message Sign Replacement

**1.0 Description of Work.** Replace existing dynamic message sign (DMS) with a Contractor furnished full color/full matrix display DMS. Install the new DMS on the existing sign structure. The DMS display shall have a pixel pitch of 20 mm. The sign controller shall be installed in a new or existing equipment cabinet. Provide a multimode fiber optic communications cable connecting the DMS to the sign controller in the equipment cabinet. Connect the sign and controller to power, communication, and ground. The contractor shall install, configure, and test the DMS for proper operation with assistance from the manufacturer's representative.

Five of the DMSs to be replaced are along freeways and have walk-in sign housings. The other three DMSs to be replaced are along an arterial roadway and have front-access sign housings. These existing signs to be replaced are all Ledstar full matrix DMS. They are full matrix signs with amber LEDs and 66 mm pixel pitch that allow for four lines of 18-inch text. The existing freeway signs to be replaced are all 4-line/15-character display with 18-inch characters and walk-in cabinet signs. The existing arterial signs to be replaced are three Ledstar signs have 27 x 110 66 mm pixel displays.

The contractor shall coordinate this work with MoDOT St. Louis District ITS group by emailing [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) and calling Leah White at 314-624-7448 to verify DMS can be operated by MoDOT ATMS (Advanced Traffic Management System). Construction related activities shall be coordinated with Nicholas Gibbons (314-453-1871 office, 314-239-5975 cell,

nicholas.gibbons@modot.mo.gov) and Nathan Norton (636-484-6018 cell, nathan.norton@modot.mo.gov).

## **2.0 Materials.**

**2.1 General.** All materials furnished, assembled, fabricated, or installed shall be new products and approved by the engineer. All internal and external components shall be manufactured from corrosion resistant material. Dissimilar metals shall be separated by an inert dielectric material. Sign components shall be capable of operating without any decrease in performance over a temperature range of -30°F to 165°F (-34°C to 74°C) with a relative humidity of up to 90 percent non-condensing.

**2.2 Display Size.** The freeway sign display shall provide a 120 rows x 336 columns pixel matrix of 20 mm pixels. The arterial sign display shall provide at a minimum an 80 rows x 288 columns pixel matrix of 20 mm pixels.

**2.3 Housing.** The freeway sign housing shall be a walk-in type. The arterial sign housing shall be front access. The sign housings shall meet the requirements of NEMA TS4 2016, Section 3.2.8.

**2.3.1 Dimensions and Weight.** The nominal exterior dimensions and weight of the DMS shall be as follows:

Freeway DMS: 9'-9" (H) x 24'-9" (W) x 4'-0" (D) and 4,200 lbs.

Arterial DMS: 6'-9" (H) x 19'-11" (W) and 2,000 lbs.

**2.3.2 Enclosure.** The sign housing external skin shall be constructed of aluminum alloy 5052 H32 that is a minimum of 0.125 inch thick. All exterior, excluding the sign face, and all interior housing surfaces shall be natural aluminum mill finish. The interior structure shall be constructed of aluminum. No internal frame connections or external skin attachments shall rely upon adhesive bonding or rivets. The sign enclosure shall meet the requirements of NEMA TS4 2016, Section 3.1.1. All drain holes and other openings in the sign housing shall be screened to prevent the entrance of insects and small animals.

**2.3.3 Design.** The sign housing shall comply with the fatigue resistance requirements of the sixth-edition American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals with current addendums. Design and construct the DMS unit for continuous usage of at least 20 years and the sign housing for a 50-year design life.

**2.3.4 Hoist Points.** The top of the housing shall include multiple galvanized or stainless steel lifting eyebolts or equivalent hoisting points. Hoist points shall be positioned such that the sign remains level when lifted. Ensure that the hoist points and sign frame allow the sign to be shipped, handled, and installed without damage. Hoist points shall be attached directly to structural frame members by the sign manufacturer.

**2.3.5 Fabrication.** The sign shall be fabricated, welded, and inspected in accordance with the requirements of the current American National Standard Institute/American Welding Society (ANSI/AWS) Structural Welding Code-Aluminum. Exterior seams and joints, except the finish coated face pieces, shall be continuously welded using an inert gas welding method. Limit the

number of seams on the top of the housing to a maximum of three. Stitch weld the exterior housing panel material to the internal structural members to form a unitized structure.

**2.3.6 Mounting Assembly.** Exterior mounting assemblies shall be fabricated from aluminum alloy 6061-T6 extrusions a minimum of 0.1875 inch thick. For the DMS, include a minimum of three 6061-T6 structural aluminum Z members on the rear of the sign housing. These structural members shall run parallel to the top and bottom of the sign housing and are each a single piece of material that spans the full length of the sign. These structural members shall be attached to the internal framework of the sign.

**2.3.7 U-Bolts.** Provide galvanized or stainless steel U-bolts of sufficient size to attach the Z member to the DMS structure posts.

**2.3.8 Access Door.** The freeway sign housing access shall be provided through an access door that meets the requirements of NEMA TS4 2016, Section 3.2.8.1 and is located on the left end of the enclosure. The access door shall include a door handle with a hasp for a padlock. The door shall include a closed-cell neoprene gasket and stainless steel hinges.

**2.3.9 Service Lighting.** The freeway sign housing shall meet the requirements of NEMA TS4 2016, Section 3.2.8.3 for service lighting. If incandescent lamps are provided, they shall be fully enclosed in heavy-duty shatterproof, protective fixtures. Incandescent fixtures shall include aluminum housing and base, a porcelain socket and clear glass inner cover. All removable components are secured with set screws. If fluorescent or LED lamps are provided, ensure they are fitted with protective guards.

**2.3.10 Work Area.** For the freeway signs, the work area within the sign shall meet the requirements of NEMA TS4 2016, Section 3.2.8.2. All edges of the walkway shall be finished to eliminate sharp edges or protrusions.

**2.4 Housing Face.** The sign face surfaces shall be finished with a matte black coating system that meets or exceeds American Architectural Manufacturers Association (AAMA) Specification No. 2605. Provide certification that the sign face parts are coated with the prescribed thickness. The sign face shall include a contrast border that meets the requirements of NEMA TS 4-2016, Section 3.1.6. No exposed fasteners shall be allowed on the housing face. Display modules shall be easily and rapidly removed from within the sign without disturbing adjacent display modules. If the sign includes external fascia panels, they shall be constructed using aluminum. Finish each fascia panel with a matte black coating system that meets or exceeds AAMA Specification No. 2605. The sign shall be resistant, either by active or passive subsystem, to fog and frost on the front face.

**2.5 Lens Panel Assembly.** If sign includes lens panel assemblies, they shall be modular in design, removable and interchangeable without misalignment of the lens panel and the light-emitting diode (LED) pixels. The lens panel assembly must consist of an environmental shielding layer coating to protect and seal the LEDs and internal electronics. The coating shall be a minimum 90 percent ultraviolet (UV) opaque. Lens panels must have a matte black coating that meets or exceeds AAMA Specification No. 2605. The mask shall be perforated to provide an aperture for each pixel on the display module. The apertures shall not block the LED output at the required viewing angle.

**2.6 Sign Housing Ventilation System.** The ventilation system must meet the requirements of NEMA TS 4-2016, Section 3.1.2. Air drawn into the sign shall be filtered upon entry. The

ventilation system shall be testable on command from remote and local control access locations. The sign shall include a sensor or a sensor assembly to monitor airflow volume to predict the need for a filter change. All ventilation system fans shall be new. The ventilation system fans shall have a 60,000-hour, L10-life rating. The sign controller shall continuously measure and monitor the temperature sensors. The sign shall blank when a critical temperature is exceeded and will report this event when polled. All temperature measurements from the sign controller shall be readable remotely. Humidity sensors shall detect from 0 to 100 percent relative humidity in 1 percent or smaller increments. Sensors shall operate and survive in 0 to 100 percent relative humidity, and have an accuracy that is better than plus or minus 5 percent relative humidity. A humidistat is not acceptable.

**2.7 Photo Sensors.** The sign shall meet the requirements of NEMA TS 4-2016, Section 9.1.3.1. The photo sensors shall provide accurate ambient light condition information to the sign controller for automatic light intensity adjustment. The automatic adjustment of the LED driving waveform duty cycle shall occur in small enough increments that the sign's brightness changes smoothly, with no perceivable brightness change between adjacent levels. Stray headlights shining on the photoelectric sensor at night shall not cause LED brightness changes.

**2.8 Display Modules.** Provide display modules manufactured by one source and fully interchangeable throughout the manufacturer's sign systems. Removal or replacement of a complete display module or LED board can be accomplished without the use of special tools. Removal or failure of any display module shall not affect the operation of any other display module or sign component. Display modules shall contain solid-state electronics needed to control pixel data and read pixel status. The sign shall have a full matrix display area as defined in the glossary of NEMA TS 4-2016. The brightness and color of each pixel shall be uniform over the sign's entire face within a 30-degree viewing angle in all lighting conditions.

**2.9 LED and Pixel.** The LED lamps shall have a minimum viewing angle of 30 degrees. All pixels in all signs in a project shall have equal color and on-axis intensity. The sign display shall meet the luminance requirements of NEMA TS 4-2016, Section 5.4, for light emitting signs connected at full power. Provide LED brightness and color bins that are used in each pixel to the engineer for approval. The LED manufacturer shall demonstrate testing and binning according to the International Commission on Illumination (CIE) 127 (1997) standard. All LEDs shall operate within the LED manufacturer's recommendations for typical forward voltage, peak pulsed forward current and other ratings. Component ratings shall not be exceeded under any operating condition. Provide a pixel test as a form of status feedback to the traffic management center (TMC) from the local sign controller. The operational status of each pixel in the sign can be automatically tested once a day. The pixel status test shall determine the functional status of the pixel as defined by the pixel Failure Status object in National Transportation Communications for ITS Protocol (NTCIP) 1203v0239 and shall not affect the displayed message for more than half a second. The LEDs shall be individually mounted directly on a printed circuit board (PCB).

**2.10 Display Optical, Electrical and Mechanical.** The display modules shall be rectangular and have an identical vertical and horizontal pitch between adjacent pixels. The separation between the last column of one display module and the first column of the next module shall be equal to the horizontal distance between the columns of a single display module. The pitch shall be 20 mm. All components on the LED side of PCBs shall be black. There shall be a minimum of two power supplies that are wired in a parallel configuration for redundancy, so that if one or 25 percent of the supplies in a group, whichever is greater, completely fails, the sign shall still be supplied with enough power to run 40 percent of all pixels at a 100 percent duty cycle with an ambient operating temperature of 165°F. The sign controller shall continuously measure and

monitors all LED module power supply voltages and provides the voltage readings to the TMC central ATMS or a laptop computer on command. The LEDs shall be protected from external environmental conditions, including moisture, snow, ice, wind, dust, dirt, and UV rays. Do not use epoxy to encapsulate the LEDs. Removal of one or more display modules shall not affect the structural integrity of any part of the sign.

**2.11 Characters, Fonts, and Color.** The display area shall be capable of displaying four lines of 17 characters using an 18-inch font that meets the height-to-width ratio and character spacing in the Manual on Uniform Traffic Control Devices for Streets and Highways 2009 Edition (MUTCD), Section 2L.04, Paragraphs 05, 06, and 08. The signs shall be capable of displaying American Standard Code for Information Interchange (ASCII) characters 32 through 126, including all uppercase and lowercase letters and digits 0 through 9, at any location in the message line. The sign must be loaded (as a factory default) with a font in accordance with or that resembles the standard font set described in NEMA TS 4-2016, Section 5.6. The sign shall also be loaded (as a factory default) with a font set that resembles the Federal Highway Administration (FHWA) Series E Modified 2000 standard font. Signs shall display the colors prescribed in the MUTCD, Section 1A.12.

**2.12 Power Supply.** The sign shall meet the requirements of NEMA TS 4-2016, Section 10.2 and shall operate from a 120/240 VAC, 60Hz, single-phase power source. Locate all 120 VAC wiring in conduit, pull boxes, raceways or control cabinets as required by the National Electrical Code (NEC). No 120 VAC wiring shall be exposed inside or outside of the sign housing. Do not use the sign housing as a wiring raceway or control cabinet. Provide Type THHN/THWN-2 or XHHW-2 power cables sized as required by the NEC for acceptable voltage drops while supplying alternating current from the existing cabinet to the sign. Provide surge protective devices (SPD) installed or incorporated in the sign system by the manufacturer to guard against lightning, transient voltage surges, and induced current. The SPDs shall protect all electric power and data communication connections.

**2.13 Sign Controller.** The sign controller shall monitor the sign in accordance with NEMA TS 4-2016, Section 9. The sign shall monitor the status of any photocells, LED power supplies, humidity, and airflow sensors. The sign controllers shall use fiber optic cables for data connections between the sign housing and ground-level cabinet. The sign controller within ground cabinets shall be rack-mountable, designed for a standard EIA-310 19-inch rack and include a keypad and display.

**2.14 Sign Controller Communications Interface.** The sign controller shall have communication interfaces in accordance with NEMA TS 4-2016, Section 8.3.2. The sign controller shall have a 10/100 Base TX 8P8C port and EIA-232 serial interface. The EIA-232 serial interface shall support the following:

- Data Bits - 7 or 8 bits
- Parity - Even, Odd, or None
- Number Stop Bits or 2 bit

Switching between Ethernet and serial operation shall not require sign controller software or hardware modifications. The TMC central ATMS or a laptop computer shall be able to remotely reset the sign controller.

**2.15 Message and Status Monitoring.** The DMS shall provide two modes of operation: (1) remote operation, where the TMC central ATMS commands and controls the sign and determines the appropriate message or test pattern; and (2) local operation, where the sign controller or a

laptop computer commands and controls the sign and determines the appropriate message or test pattern. The sign shall provide for local or remote sign control to be selected. There shall be a visual indicator on the controller that identifies whether the sign is under local or remote control. The sign controller shall be able to select a blank message or any one of the messages stored in the sign controller's nonvolatile memory when the control mode is set to local. The sign controller shall activate the selected message. The sign shall be programable to display a user-defined message, including a blank page, in the event of power loss. Remotely from the TMC central ATMS or from a local laptop computer message additions, deletions and sign controller changes can be made. Each font shall be customizable, and modifications to a font may be downloaded to the sign controller from the TMC central ATMS or a local laptop computer at any time without any software or hardware modifications. No perceivable flicker or ghosting of the pixels during sign erasure and writing periods shall be visible.

**2.16 TMC Communications.** The sign controller shall be addressable by the TMC central ATMS through the Ethernet communications network using software that complies with the NTCIP 1101 base standard (formerly the NEMA TS 3.2 -1996 standard), including all amendments as published at the time of contract letting, the NTCIP Simple Transportation Management Framework, and conforms to Compliance Level 1. The sign shall comply with the NTCIP 1102v01.15, 2101 v01.19, 2103v02.07, 2201v01.15, 2202 v01.05 and 2301v02.19 standards. The sign shall also comply with NTCIP 1103v02.17, Section 3. The controller's internal time clock shall be configurable to synchronize to a time server using the network time protocol (NTP). NTP synchronization frequency must be user-configurable and permit polling intervals from once per minute to once per week in one-minute increments. The controller shall allow the user to define the NTP server by internet protocol (IP) address.

**2.17 Central Software Compatibility.** The sign controller shall be compatible with the central ATMS software protocol for sign functionality, which is compliant with NTCIP 1203 version 3.

**2.18 Sign Control Software.** Computer software from the manufacturer shall be provided that allows an operator to program, operate, exercise, diagnose and read current status of all sign features and functions using a laptop computer. The sign control software shall provide a graphical representation that visibly depicts the sign face and the current ON/OFF state of all pixels, as well as allows messages to be created and displayed on the sign. The laptop computer and sign shall be able to communicate when connected directly by an EIA-232 cable and via Ethernet. The software shall allow communication between multiple users and multiple signs across the same communication network.

**2.19 DMS Auxiliary Controller.** The freeway sign shall include an auxiliary controller that will provide a secondary user interface panel for control, configuration, and maintenance from within the sign housing. The auxiliary controller shall be located inside the sign cabinet to facilitate operation by maintenance workers while working in the sign. The auxiliary controller shall meet the same electrical, mechanical, and environmental specifications as the primary controller, except that it shall communicate with the primary sign controller. The auxiliary controller shall have an LCD panel and keypad identical to those found on the primary controller. It shall also contain a local/remote switch, a reset switch, status LEDs and one NTCIP compatible EIA-232 communication port that meets the same specifications as the primary controller. The auxiliary controller shall include an identical menu system to the primary controller with all its features and functionality.

**2.20** Use an AWG # 6 wire or equivalent bonding straps to bond the sign to the structure.

**2.21** The Contractor shall furnish any other miscellaneous hardware required to complete this task per manufacturer and MoDOT specifications.

### **3.0 Construction Requirements.**

**3.1** Examine DMS carefully to verify that the materials, design, construction, markings, and workmanship comply with all applicable standards, specifications, and requirements.

**3.2** Remove the existing DMS from the structure and install the new DMS on the same day. The DMS shall not be removed until the contractor has the new DMS delivered and ready for installation. Transport the existing DMS to an off-site indoor facility for the salvaging of components. The contractor is responsible for any damage occurring during existing DMS removal and new DMS installation.

**3.3** The contractor shall mount the DMS to the sign structure in accordance with the manufacturer's recommendations. The manufacturer shall have an on-site representative for sign commissioning. Do not provide initial power to the sign without the permission of the manufacturer's representative. The contractor shall have full responsibility of working with the manufacturer's representative to ensure sign commissioning is completed fully and to the approval of engineer.

**3.4** 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 10 ohms. If resistance exceeds 10 ohms check and repair grounding system to meet the requirement.

**3.5** Install new sign controller in existing or new cabinet. Make needed power and network connections within the cabinet.

**3.6** Install the new power conductors, ground wire and fiber optic communications cable between the new roadside cabinet and the sign housing.

**3.7** The contractor shall be responsible for disposal of all removed sign components not salvaged and all associated costs.

### **4.0 Testing.**

**4.1 Site Testing.** Conduct stand-alone equipment installation tests at the field site following an engineer approved test plan. Test all stand-alone (i.e., non-network) functions of the DMS equipment using equipment installed as detailed in the plans and as approved by the engineer. Complete approved testing documentation forms and turn them over to the engineer for review and as a basis for rejection or acceptance. Provide a minimum notice of 15 calendar days prior to all tests to permit the engineer or his representative to observe each test.

**4.2 System Testing.** Conduct DMS system tests on the field equipment with the master equipment including, at a minimum, all remote-control functions. Testing shall follow an engineer approved test plan. Display the return status codes from the sign controller for a minimum of 72 hours. Demonstrate the sign's ability to display the proper predefined message or remain blank when power is restored following an AC power interruption. Complete approved testing documentation forms and turn them over to the engineer for review, and as a basis for rejection or acceptance.



**4.3 Testing Failure.** If any component fails during either site or system testing, the component shall be corrected or another component substituted in its place and the test repeated. If a component has been modified as a result of a failure, a report shall be prepared and delivered to the engineer. The report shall describe the nature of the failure and the corrective action taken. If a failure pattern develops, the engineer may direct that design and construction modifications be made to all signs without additional cost to the Department or an extension of the contract period.

**4.4 Acceptance Testing.** Conduct a 60-day acceptance test after the successful completion of the system test. During the 60-day test period, limit downtime due to mechanical, electrical, or other malfunctions to a maximum total of five calendar days. If the equipment fails to operate for a total of five or more calendar days, testing will be restarted. The engineer may select to pause and extend the 60-day test period by the number of days lost by failure and repair time in lieu of restarting the full 60-day test. The engineer will furnish the contractor with a letter of approval and completion stating the first and last day of the 60-day test period.

## **5.0 Warranty.**

**5.1** Provide a one year manufacture warranty for parts and material that begins when the project is accepted.

## **6.0 Documentation.**

**6.1 Electronic Equipment.** Provide documentation for electronic equipment. Provide operational manuals, troubleshooting and service manuals, assembly and installation instructions and warranty information. The manufacturer shall grant MoDOT a license that allows for use and internal distribution of any and all sign communications protocols, operating systems, drivers, and documentation.

**6.2 As-Built Drawings.** Provide drawings illustrating the equipment locations, conduit routing and display module attachment. A wiring diagram shall also be provided for the new electrical and communications wiring.

**7.0 Basis of Payment.** Measurement and payment for replacing existing DMSs with new color DMS includes all miscellaneous hardware required for a safe, fully operational color DMS along with removal, transport, testing and documentation. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Freeway Dynamic Message Sign Replacement
910-99.02	Each	Arterial Dynamic Message Sign Replacement

## **I. Sign Structure Base Mesh**

**1.0 Description.** Existing grout between the sign structure base plate and the drilled shaft foundation shall be removed and steel mesh shall be installed to prevent access by rodents.

**2.0 Materials.** Screens shall be press-formed of 3 or 4 mesh, 21 gage or heavier, stainless steel or hot-dipped galvanized wire screen or approved equivalent.

**3.0 Construction Requirements.** Remove existing grout between concrete base and post base

plate. Install galvanized screen between the post base plate and concrete base as shown in the plans. The screen shall provide a friction-tight fit when installed.

**4.0 Basis of Payment.** All work, materials, and equipment necessary to complete the grout removal and mesh installation shall be paid for at the unit price per each for Sign Structure Base Mesh:

Item No.	Type	Description
910-99.02	Each	Sign Structure Base Mesh

J. Salvage Existing Sign Components

**1.0 Description.** Salvage existing DMS components and deliver the salvaged items to MoDOT.

**2.0 DMS Components.** Salvage the sign controller from inside the sign, the sign controller located in the cabinet, the pole-mounted cabinet, the ribbon control cables from LCA to pixel boards and the photo cells unless otherwise stated by the engineer.

**3.0 Packaging and Delivery.** Package all salvaged components in boxes that can be hand carried. Label each box with the type and number of components enclosed. Also note the date the components were salvaged on the label. Deliver the salvaged equipment to the Missouri Department of Transportation's maintenance facility located at 2309 Barrett Station Road, Ballwin, Missouri 63021. Notify MoDOT Signal Shop supervisors 24 hours prior to each delivery by emailing [SLTRS@modot.mo.gov](mailto:SLTRS@modot.mo.gov) with [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) copied and by calling Dennis Hixson at 314-205-7319. All items not specified to be salvage shall be recycled or disposed of by the contractor.

**4.0 Basis of Payment.** All work, materials, and equipment necessary to complete the salvaging of sign components shall be paid for at the unit price per each for Salvage Existing Sign Components:

Item No.	Type	Description
910-99.02	Each	Salvage Existing Sign Components

K. DMS Training

**1.0 Description.** Conduct a training course for MoDOT operations and maintenance staff on operating and maintaining the new DMS. Design the training course to ensure that MoDOT staff achieves a full knowledge and appreciation of the design, operation, and maintenance of equipment. Training may consist of field device operations and maintenance training, field communications operations and maintenance training and system operations and maintenance training.

**2.0 Materials.** Provide all training documentation, and coordination with the sign vendor to provide teaching staff. Provide the training to consist of lectures and demonstrations that shall provide practical (hands-on) training and experience. Provide five hard copies of the training manual and one electronic copy of the training manual.

Provide a detailed training plan and a syllabus for the course for the approval of the engineer. Include in the information: tentative dates for course, location, and an outline of topics and names of instructors. Provide this information to the engineer at least 30 days in advance of the training course.

**3.0 Construction Requirements.** Provide up to a two-day training class to train operations and field maintenance personnel. Include in-field demonstrations.

**4.0 Basis of Payment.** Payment for work covered by this specification includes equipment and materials, necessary to prepare for and conduct the training. Payment will be made as follows:

Item No.	Type	Description
910-99.01	Lump Sum	DMS Training

L. DMS Control Cable

**1.0 Description.** Furnish and install DMS control cable that is recommended by DMS vendor.

**2.0 Materials.** Provide DMS control cable that is recommended by the DMS vendor.

**3.0 Construction Requirements.** Install and terminate the DMS control cable between the cabinet and the new DMS in a manner recommended the sign vendor.

**4.0 Basis of Payment.** Measurement and payment for work covered by this specification includes equipment, tools, and materials, necessary to furnish and install DMS Control Cable. Payment will be made as follows:

Item No.	Type	Description
910-99.03	Linear Foot	DMS Control Cable

M. Replace Ethernet Switch

**1.0 Description.** Replace existing Ethernet switch with new Commission-furnished and programmed Ethernet switch in existing roadside cabinets. The switch replacement will also include replacement of the switch power supply and installation of an expansion module as shown in the plans. The replacement switch will be programmed before it is provided to the contractor. Connect replacement switch to power, network, and ground. Test the completed installation and report any problems to the engineer. Troubleshoot to the point of identifying the connection that is causing the communication problem. The old switch, power supply and expansion modules shall be recycled following appropriate e-waste protocols.

**2.0 Materials.**

**2.1** Cisco IE 3300 Ethernet switch, power supply and switch expansion module will be provided by the Commission. The switch will be programmed by the Commission.

**2.2** Existing small form-factor pluggable (SFP) optical transceivers will be reused in the new switch.

**2.3** Contractor shall provide all power cables and wires to connect the switch to power and ground the equipment per manufacturer's requirements.

**2.4** Fiber optic jumpers shall be contractor furnished. Jumpers shall meet the requirement provided in Section W.

**2.5** The contractor shall provide any other cables such as Category 5E patch cords, as required to replace cables damaged during the switch replacement.

### **3.0 Construction Requirements.**

**3.1 Schedule.** Provide to the engineer a schedule for when switch replacement will begin, at least 30 days before commencing this type of work. Additionally, provide the engineer a list of the switches to be replaced the next day the day before the replacements. The list should be emailed to [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov).

**3.2 Pickup.** The switches, power supplies and expansion modules shall be picked up from the MoDOT Gateway Guide Transportation Management Center located at 14301 South Outer Forty, Town and Country, MO 63017. All the switches shall be picked up the same day. Call Dennis Hixson at 314-205-7319 at least two days in advance to schedule the pickup day and time.

**3.3 Pre-installation.** Before disconnecting and removing the existing switch, take a picture of the cabinet with the door open and a picture of the switch face. Note the active network connections for use in confirming the replacement switch has reestablished all existing connections.

**3.4 Installation.** The switch and power supply shall be mounted on the existing DIN rail bracket the switch being replaced is mounted to. Confirm that with the switch mounted on the existing DIN rail the cabinet door can be closed without touching any of the cabling. If cables are touched by the closed door, install a deeper DIN rail to eliminate the conflict. Relocate the existing SFPs from the switch being replaced to the new switch. Install new fiber optic jumpers to connect the new switch to the existing patch panel. The new jumpers and existing patch panel ports shall be cleaned prior to installation of the new jumpers. If the connectors or pigtails in the existing patch panel are damaged, the contractor shall make the necessary repairs. Connect all existing copper patch cables. If a patch cable is damaged, the contractor shall replace it.

**3.5 Wiring.** Connect the switch power supply to the existing 120V IP Power Strip "Unswitched Outlets" (meaning it is always on and cannot be rebooted remotely). Ground the equipment as recommended by the manufacturer.

**3.6 Testing and Documentation.** Use notes and images taken of the existing switch to confirm all cables are connected and communication links are active that were active prior to the switch replacement. Take a picture of the cabinet with the door open and a picture of the switch face. Contact the STL ITS to confirm the replacement switch is performing as expected. Contact information will be provided at the pre-construction meeting.

**3.7 Troubleshooting.** If the replacement switch is not performing as expected remain on-site to assist the Commission staff in making the installed switch operational. If a problem occurs with a replacement switch within 5 business days of replacement, the contractor shall provide on-site troubleshooting assistance. Troubleshooting 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.

**3.8 Recycling.** The switches, power supplies and expansion module being replaced shall be recycled following state of Missouri e-waste recycling requirements. Recycling of the flash memory cards from each switch must also include a certified data destruction process. Provide the engineer the name of companies to be used for the data destruction and recycling of the electronics for approval. Provide a certificate of data destruction and written documentation that the electronics were recycled by the approved electronic waste recycling company.

**4.0 Basis of Payment.** Measurement and payment for Ethernet switch and expansion module replacement will be on a per device replaced basis. The unit price shall include patch cords, cabling, power supply installation, relocation of SFPs, assistance to Commission staff in getting the switch 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	Ethernet Switch Replacement
910-99.02	Each	Expansion Module Replacement

#### N. General Electrical Requirements

**1.0 Dissimilar Metals.** To prevent galvanic corrosion, avoid connections between dissimilar metals. Where this is not practical, 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.

**2.0 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.

**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.

**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.

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

**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.

**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.

**3.0 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 Basis of Payment.** No direct payment will be made for any materials, equipment or labor which is performed under this provision. All costs of compliance with this provision shall be considered included in the bid unit prices of the pay items included in the contract.

O. 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.

P. Erosion Control

**1.0 Description.** 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.

Q. 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.

## **2.0 Materials.**

**2.1** Use PVC conduit meeting the requirements of Sec 1060.

**2.2** Use HDPE conduit meeting the requirements of Sec 1060. Use orange conduit 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** Conduit coupling used for splicing conduit shall be designed for splicing together the type of conduits being joined together.

## **3.0 Construction Requirements.**

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

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

**3.1.3** HDPE duct shall not be spliced. All runs shall be continuous.

**3.1.4** Use an impact mole to install conduit under existing sidewalk unless otherwise indicated or unless the crossing is part of a longer bore or unless otherwise indicated in the plans. The portion installed using a mole will be paid for at the same price per foot as trenched conduit.

**3.1.5** Trenching and pushing conduit installation shall be with the following minimum depth:

- Conduit under paved areas including roadway, shoulders, paved medians and sidewalks for pushed method shall be 42 inches below top of the paved areas.
- Conduit under non-paved areas for trench method shall be 30 inches of cover.

## **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 Fluid ("Slurry").** 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 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 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 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. This requirement also applies to slurry resulting from vacuum excavation to locate underground utilities.

**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 Intercept Existing Conduit with Proposed Pull Box.**

**3.3.1** Determine whether the conduit is occupied. If so, disconnect the cables at one end of the cables and pull them back so that they are not damaged when the conduit is cut. Alternatively, they can be removed entirely and replaced with new, identical cables. Notify the engineer if any of the cables appear to be in poor condition.

**3.3.2** Excavate a pit big enough for the pull box and drain material, with at least an additional foot on each side with conduit.

**3.3.3** Install the drain material. From the top of the drain material, measure the vertical distance to the bottom the conduit at the points corresponding to the walls of the box.

**3.3.4** If the conduit is PVC or metal, cut it in two places such that the distance between the cuts is longer than the box. Be sure the ends are cut squarely. If the conduit is HDPE, cut it in the center of the pit. Ensure that the pit is long enough that the conduit can be bent out of the way when the box is installed, and can be bent enough to insert the conduit through the wall of the box.

**3.3.5** Make a hole in the wall of the box at each point that the conduit will enter. Use the distances measured earlier to determine how far from the box's bottom to make the holes.

**3.3.6** Set the pull box in the pit with the holes aligned with the conduits.

**3.3.7** Pass the conduits through the wall of the box so that they end about one inch inside the wall. For PVC conduit, extend the existing conduit using a short length of new PVC conduit that includes a socket end. For metal conduit, thread the existing conduit, apply a threaded coupling, and add a short length of new conduit. For HDPE, bend the existing conduit to pass through the box wall, then cut it to length inside the box.

**3.3.8** Use non-shrink grout to completely fill the space between the conduit and box wall.

**3.3.9** Backfill the pit and restore the area as with any pull box installation.



**3.3.10** Reinstall, reconnect, and test the cables that were pulled back at the beginning of the procedure. Alternatively, replace them in kind and test them.

### **3.4 Install Conduit into Existing Pull Box.**

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

**3.4.2** Make the appropriately 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.

**3.4.3** Install the conduit.

**3.4.4** 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.

**3.4.5** Backfill shall be carefully tamped in place. All disturbed areas shall be restored.

### **3.5 Conduit Splicing**

**3.5.1** Where shown in the plans splice a new conduit to an existing conduit using a mechanical coupling. Expose the existing conduit where it is to be spliced.

**3.5.2** Cut the conduits so the ends are clean and perpendicular to the axis of the conduit.

**3.5.3** The outside edges of the conduits being joined shall be beveled or chamfered to facilitate insertion into the coupler and prevent damage to the gasket. The inside edges of the conduits shall also be beveled or chamfered to provide a smooth transition and internal alignment so no sharp edge might catch or damage the cable during installation.

**3.5.4** Align the axes of the two conduits being joined to facilitate good splice.

**3.5.5** Backfill shall be carefully tamped in place. All disturbed areas shall be restored.

### **4.0 Basis of Payment.**

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

**4.2** 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.

**4.3** Payment for Intercept Conduit with Pull Box includes only that work that would not be incurred in a normal pull box installation. The cost of the box and its installation will be paid for separately.

**4.4** Measurement and payment for work covered by this specification includes equipment, tools, materials, necessary to install conduit. It includes excavation and site restoration. Payment will be made as follows:

Item No.	Type	Description
910-52.01	Linear Foot	Conduit, 3 in., Rigid, In Trench
910-99.02	Each	Intercept Conduit with Pull Box
910-99.02	Each	Install Conduit into Existing Pull Box

## R. ITS Pull Box

**1.0 Description.** Furnish and install ITS Pull Boxes with concrete pads as shown on the plans.

### 2.0 Materials.

**2.1 Pull Box.** ITS pull boxes shall meet the requirements in Section 1062 of the Missouri Standard Specifications for Highway Construction.

**2.2 Ground Rod.** Ground rods shall be listed according to UL requirements as detailed in the standard UL 467, Grounding and Bonding Equipment, and meet the requirements of NEC 250. Use electrodes that are solid copper or copper-bonded steel.

**2.3 Concrete Pad.** The contractor shall install a non-reinforced concrete pad around the ITS pull box as shown in the plans. The concrete used shall be a Class 'B' concrete as described within Sec 501 of the Standard Specifications.

**3.0 Construction.** Install ITS pull boxes as shown in the plans. Provide a concrete pad around the pull boxes as shown in the plans. Install a ground rod in the Class 5 pull boxes nearest ITS or signal cabinets.

**3.1** If grading will result in an existing fiber pull box not being flush with the final grading, the pull box elevation should be adjusted to match the final ground surface. If the existing pull box is in a condition that can be adjusted without damage, it can be reused. If a pull box is raised, a split duck system shall be used to protect the cable into the adjusted pull box and the void below the box shall be backfilled and the stone drain installed. If the pull box is lowered, the stone drain shall be provided as shown on the pull box detail. Installing a new pull box or concrete sonotube over the existing ITS pull box is NOT allowed. A concrete pad shall also be installed around the adjusted box. If site conditions do not allow these construction requirements to be met, the contractor shall suspend such a work and notify MoDOT ITS group via an email to [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) and carbon copy MoDOT construction inspector immediately for approval of any alternative fiber adjustment option.

**4.0 Basis of Payment.** Measurement and payment for ITS Pull Boxes with a concrete pad includes excavation, materials, construction, backfill and all miscellaneous hardware required for a fully operational system. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	ITS Pull Box with Concrete Pad, Preformed Class 2
910-99.07	CUYD	Replace Pull Box Concrete Pad

**S. Remove and Reinstall Cable**

**1.0 Description.** Pull fiber optic (FO) or power cables out of the sign structure, cabinet, and conduits without damaging the cables. Reinstall the cables as shown on the plans.

**2.0 Construction Requirements.** Remove the cable carefully. Replace any cables damaged by the removal operation. Notify the engineer if any of the removed cables appear to be damaged by other causes. Meet typical slack requirements when reinstalling cables. Dispose of any length of cable made unnecessary by this project. Protect all cables until they are reinstalled.

**3.0 Method of Measurement.** Remove and Reinstall FO Cable and Remove and Reinstall Power Cable will be measured in units of linear feet of fiber optic or power cable pulled back.

**4.0 Basis of Payment.** The payment covers all labor, equipment, and material to complete the work. It covers removing the cables, protecting the cables, and reinstalling the cables.

Item No.	Type	Description
910-99.03	Linear Foot	Remove and Reinstall FO Cable
910-99.03	Linear Foot	Remove and Reinstall Power Cable

**T. Fiber Optic Cable**

**1.0 Description.** This work shall consist of installing, splicing, and terminating fiber optic cables. The fiber optic cable may be new or existing cable relocated as shown on the plans. Fiber optic cable relocation requires existing cable to be removed from an existing conduit system and installed in a new or existing conduit system per plans. Relocated cable must be carefully removed from the existing conduit system without being damaged. No direct pay shall be paid for relocating the existing fiber optic cable into new ITS or signal cabinet. If the existing fiber cable is removed, that length shall be paid separately per plans.

**2.0 Materials.** Some of the below noted materials may not be applicable on this project. See the plans and below quantities for applicable materials.

**2.1 Cable.** Fiber optic cable shall be of loose tube construction. Provide certification by an independent testing laboratory that the cable meets all requirements of Rural Utilities Service Bulletin 1753F-601a *Minimum Performance Specification for Fiber Optic Cables* ([https://www.rd.usda.gov/files/UTP\\_Bulletins\\_1753F-601a.pdf](https://www.rd.usda.gov/files/UTP_Bulletins_1753F-601a.pdf)). The cable shall be gel free, all dielectric, and have 12 fibers per tube. The cable sheath shall have length markings in feet and shall indicate that the unit of measure is feet. The cable shall have single mode fibers whose attenuation does not exceed 0.35 dB/km and 0.25 dB/km for 1310 nm and 1550 nm signals, respectively. The optical fibers used in the cable shall meet or exceed the International Telecommunication Union ITU-T G.652.D requirements.

**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.** LC connectors shall be used for all cabinet terminations and patch panel connections unless the plans indicate otherwise. Connectors shall have ceramic ferrules and be

suitable for ITS field cabinets. If any equipment requires a different connector type, a hybrid jumper may be used (LC-to-ST or LC-to-SC) to match that device

**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. 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. Length shall suffice to provide approximately five feet of slack after installation.

**2.6 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, un-terminated.

The enclosure shall be made of powder-coated metal. It shall have provisions for cable strain relief and for connector labeling. The enclosure's patch panel shall have at least 24 positions. Provide enough splice trays for all splices made in the interconnect center. Provide patch panel modules that are compatible with the connectors specified in section 2.3 of this provision.

**2.6.1 Wall-Mounted Interconnect Center.** The enclosure shall be designed for wall or panel mounting and occupy no more than 350 square inches of wall space. It shall have a gasketed, hinged door. It shall hold at least six splice trays. These enclosures are typically used in signal cabinets.

**2.6.2 Rack-Mounted Interconnect Center.** 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 hold at least four splice trays. These enclosures are typically used in ITS device cabinets.

**2.7 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. These enclosures are typically used in network node cabinets.

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

**2.7.2** The enclosure shall include splice trays as specified in section 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.

**2.8 Rack-Mounted Patch Panel 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. Provide patch panel modules that are compatible with the connectors specified in section 2.3 of this provision, as needed. These enclosures are typically used in network node cabinets.

**2.9 Underground Splice Closure.** Closures for underground fiber splices include all materials necessary to make, organize, and protect the splices.

**2.9.1** The closure shall supply environmental protection of cable and splices from water and dirt. It shall be designed for splicing fiber-optic cables underground in pull boxes and to be submersed in water.

**2.9.2** Provide certification by an independent testing laboratory that the closure meets all requirements of Telcordia GR-771 for environmentally sealed closures for buried installation.

**2.9.2** The closure shall be re-enterable without any special tools.

**2.9.3** The closure shall be able to accommodate at least four fiber optic cables.

**2.9.4** The closure shall accommodate 144 single mode fiber splices.

**2.9.5** It shall be possible to remove any splice tray without disturbing the others.

**2.9.6** Splice trays in the closure need not be of the type specified in 2.2, above.

**2.9.7** Designed for butt splicing.

**2.9.8** No encapsulated materials shall be allowed.

**2.10 Tracer Wire.** A jacketed #14 AWG XHHW-2 standard blue tracer wire (also known as the locator wire) shall be provided in the conduit within the project limits unless it exists.

### **3.0 Construction Requirements.**

**3.1 Pre-Installation Cable Inspection and Testing.** Prior to installation, confirm that the cable is in good condition and complies with the specifications. The contractor shall perform fiber testing (see below requirements) of new fiber on the reel and existing fiber before it is removed. Notify the SLITS Group about any fiber anomalies and submit fiber testing reports to the SLITS Group for review and approval. Any defects found after installation will be deemed the fault of the contractor.

### **3.2 Cable Installation.**

**3.2.1** The ITS and network devices located within the project limits are a crucial part of the traffic operation system for this area. It is imperative that the network downtime be kept to a minimum when adding, removing, or modifying any existing ITS and network devices. This may require the contractor to perform work that will affect existing network devices during nighttime and/or weekend hours, at the discretion of the Engineer. Allowable timeframes for this work will be subject to the need for ITS devices in the area to be used to manage other traffic impacting work zones.

**3.2.2** In case of fiber optic cable replacement, all new fiber cable must be installed, spliced, terminated and go online before removing the old cable.

**3.2.3** Remove existing cable to be relocated and install 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.

**3.2.4** Before any cable installation is performed, provide the engineer with four copies or an electronic copy, as required by the engineer, 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.

**3.2.5** 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.

**3.2.6** 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.

**3.2.7** 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.

**3.2.8** When installing new fiber optic cable store 30 feet of slack fiber in every intermediate pull box, unless otherwise noted on plans. 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, unless otherwise noted on plans. 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, unless otherwise noted on plans. Store slack cable neatly on the walls of the pull box using racking hardware acceptable to the engineer. If the length of fiber optic cable being relocated does not allow for fully meeting these slack requirements, maximize fiber slack at cabinets before providing slack in pull boxes.

**3.2.9** While pulling and until splicing seal the fiber optic cable ends to prevent the escape of filling compound and the entry of water.

**3.3 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.

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

**3.3.2** 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.

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

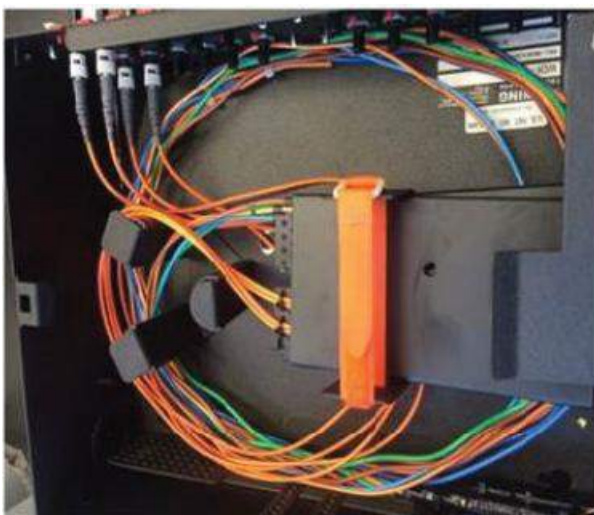
**3.3.4** Use a different splice tray for each buffer tube color. If an enclosure contains multiple buffer tubes of the same color, but none of the fibers in one of the tubes are spliced to fibers in other tubes of the same color, use a separate splice tray for that tube.

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

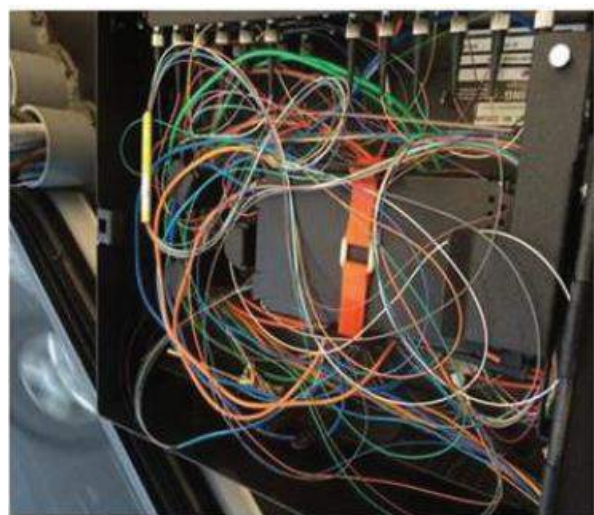
**3.5 Tracer Wire.** The contractor shall install a jacketed #14 AWG XHHW-2 standard blue tracer wire (also known as the locator wire) in conduit with new or replaced fiber optic cable(s). In the pull box nearest to the ITS or signal cabinet connect the tracer wire to a ground rod with a ground rod clamp and provide five feet of slack, as shown on the ITS pull box detail. In other fiber pull boxes provide five feet of slack, but a ground rod shall not be installed. Secure the tracer wire slack in individual coils to the inside wall of each pull box. If the tracer wire already exists, the contractor shall ensure it is connected to the ground rod properly in the pull box nearest to the ITS or signal cabinet and demonstrate a locate signal will transmit along the tracer wire. When fiber optic cable is relocated, existing tracer wire may be reused.

Prior to final acceptance and transition of ownership, the contractor shall meet with the Engineer to demonstrate the tracer-wire and locate system is working properly throughout the entire fiber, tracer wire and locate system.

**3.6 Fiber Management.** Fiber in splice trays along with pigtails and buffer tubes in the interconnect center or splice closures shall be neatly looped and restrained following telecom industry standard fiber and cable management practice and enclosure manufacturer's recommendations. Shown below are examples of acceptable and unacceptable fiber and cable management. Work will not be accepted unless good fiber management practices are followed.



Acceptable



Unacceptable

**3.7 Required Fiber Splicing, Installation and Testing Experience.** Submit resumes, certificates and references detailing fiber installation, splicing and testing for on-site personnel to

the engineer for approval. Subcontractors used on the project are considered part of the contractor's team and are also required to submit resumes, certificates and references. Submit to the engineer references including client project manager, phone number and project experience. Demonstrate successful completion of fiber optic cable installation and splice training courses by providing certificates of completion. Failure to comply may result in a declaration of noncompliance.

In addition, ensure a number of the contractor's team approved by the engineer that has at least two years of experience in the installation, splicing and testing of the fiber optic cable is on site at all times during the fiber optic cable installation and fiber optic splicing work until successful completion of the work. Receive approval from the engineer for any substitution of this individual. The engineer may stop the work activity on this project as a result of the absence of these on-site personnel from the project and may continue to charge time to the contractor and will not grant a time extension.

**3.8 Existing Fiber Replacement.** When plans show new fiber being installed to replace existing fiber, the existing fiber should remain in service until the new fiber is installed and is ready for splicing to minimize network downtime.

**3.9 Fiber Relocation.** The fiber optic cable is a crucial part of the traffic operation system. It is imperative that the downtime be kept to a minimum when relocating fiber optic cable. When existing fiber is disconnected for relocation, the relocation and fiber splicing of the relocated fiber shall progress continuously to minimized downtime.

**3.10** If grading will result in an existing fiber pull box not being flush with the final grading, the pull box elevation should be adjusted to match the final ground surface. If the existing pull box is in a condition that can be adjusted without damage, it can be reused. If a pull box is raised, a split duck system shall be used to protect the cable into the adjusted pull box and the void below the box shall be backfilled and the stone drain installed. If the pull box is lowered, the stone drain shall be provided as shown on the pull box detail. Installing a new pull box or concrete sonotube over the existing ITS pull box is NOT allowed. A concrete pad shall also be installed around the adjusted box. If site conditions do not allow these construction requirements to be met, the contractor shall suspend such a work and notify MoDOT ITS group via an email to SLITS@modot.mo.gov and carbon copy MoDOT construction inspector immediately for approval of any alternative fiber adjustment option.

#### **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 report 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 an electronic copy of the report to the engineer, along with the calculations for the maximum allowable loss. Submit the report including 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.** New 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 Basis of Payment.** Measurement and payment for items covered by this specification include all items listed below, acceptance testing and tracer wire within new, existing or relocated conduit used for the fiber optic cable in addition to all materials, labor and equipment necessary for a fully operational system. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Fiber Optic Fusion Splice
910-99.02	Each	Fiber Optic Pigtail
910-99.02	Each	Fiber Optic Jumper
910-99.02	Each	Rack-Mounted Interconnect Center

U. ITS Cabinets

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

**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 Modified Type 7 Cabinet.**

**2.1.1** Provide a two door, NEMA 3R, aluminum cabinet. The aluminum shall be at least 0.188 inches thick, except that the doors and top need be only 0.125 inches thick. The cabinet shall be approximately 36 inches high, 20 inches wide, and 22 inches deep. The cabinets shall be designed for mounting on a concrete base. The cabinet shall have both front and back doors with three-point door latches. It shall also have provisions for padlocking the doors. The door hinges 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 rack 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 GFI outlet.

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:** Designed to be mounted on a concrete foundation.

### **3.0 Construction Requirements.**

**3.1 Base Adapter and Cabinet Installation.** Prior to bolting the base adapter to the foundation, apply silicone sealant to the mating surface of the adapter to prevent water from seeping between the adapter and foundation. Likewise, prior to bolting the cabinet to the base adapter, apply silicone sealant to the mating surface of the cabinet to prevent water entry. Ensure that the cabinet is plumb, using shims if necessary, and ensure that it is properly aligned with the front edge of the base adapter.

**3.2 Bonding and Grounding.** Bond pole-mounted cabinets to the pole and ensure that the pole is connected to a ground rod. Connect base-mounted cabinets directly 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	Modified Type 7 Cabinet

V. 120 Volt Power Strip

**1.0 Description.** All new cabinets require the addition of one 120V power strip that is hardwired inside the cabinet.

**2.0 Requirements.** Shall have a circuit breaker rated at least 15 amps, on/off switch and six grounded outlets for AC plugs. Mounting shall be on the left side panel of the cabinet above the detector panel attached to two rails, with the power cable facing away from the door. Hardwire interconnect panel, if present in existing cabinet, should be removed to make room. A plastic wire tie shall secure any transformer packs plugged into this unit. Power source shall be hardwired to cabinet auxiliary breaker.

**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.** No direct payment. Payment to be included as part of Modified Type 7 cabinet installation.

W. Install MoDOT Furnished IP-Addressable Power Strip

**1.0 Description.** The contractor shall install the Commission furnished and programmed IP-Addressable Power Strip(s) in the ITS and/or signal cabinets as shown of the plans. The IP-Addressable Power Strip(s) shall be approved by the ITS group prior to installation.

**2.0 Installation Requirements.** The contractor:

- Shall email the SL ITS Group at [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) two business days in advance of installation and include MoDOT Job # and the location of the ITS or Signal Cabinets.
- Shall mount the power strip on the back side of the ITS Type 7 ITS cabinet (or any open space of other ITS cabinets away from the door) and on any open space of the signal cabinet with the power cable facing away from the door or other devices.
- Should remove and dispose the old power strip as well as any other inactive devices, if present, to make room.
- Should contact MoDOT Signal Shop Supervisor and/or SL ITS group if they have questions regarding the inactive devices.
- Should hard-wired the power source to the cabinet auxiliary breaker. No plug in to any cabinet outlet allowed to the Power Strip..

**3.0 Acceptance Testing.** The contractor shall contact MoDOT St. Louis ITS staff ([SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov)) to verify remote communication to the power strip upon installation and while still on-site. They also shall provide a list of devices and designated port assignments to the ITS group so they can update that port description in the power strip software.

**4.0 Basis of Payment.** Measurement and payment for Install MoDOT Furnished IP-Addressable Power Strip Installation includes the removal of the old and inactive power strip or other devices to make space for new power strip, installation of new power strip, grounding, testing and all miscellaneous hardware required for a safe, fully operational Power Strip. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Install MoDOT Furnished IP-Addressable Power Strip

X. Install New or Relocate Existing Communication Equipment

**1.0 Description.** The contractor shall install MoDOT furnished ethernet network switch or relocate all existing network equipment from existing ITS or signal cabinet into new cabinet, make necessary connections and test for proper network connection. This work shall be coordinated with MoDOT SLITS Group via an email to SLITS@modot.mo.gov.

**2.0 Materials.**

**2.1** The Contractor shall install MoDOT furnished Ethernet network switch(es) or relocate the existing Ethernet network switch(es), video encoders, cellular modem and other existing or new network devices inside the new ITS or signal cabinet as shown on the detail communication plans. These will include power cables and network device surge arresters. Relocating the existing CCTV camera(s) and network radios(s) shall be paid under separate pay items.

**2.2** The Contractor shall furnish and install any other cables such as Category 5E patch cords, coax patch cords, and short serial cables, etc. as required for the new location connections.

**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** The Contractor shall NOT move any cables from port to port on the network switches without prior MoDOT approval. 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 Commission approved 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.

**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.

**3.4 Cisco Ethernet Switch.** Prior to the beginning of the project, the Contractor shall verify the correct switch type and model including any additional necessary Cisco supported equipment with MoDOT St. Louis ITS department. Additional equipment may include but is not limited to the power supply, DIN rails, and any applicable Cisco supported SFPs (Small Form-factor Pluggable transceivers), or expansion modules. For signal cabinets, the switch shall be mounted on the left side panel above the 120V IP Power Strip. Attach unit to 2 rails of the side panel, with the power cable facing away from the cabinet door. The Cisco switch shall be powered from the 120V IP Power Strip. The Cisco Ethernet Switch including the additional Cisco supported equipment shall be delivered to Commission's ITS Engineer for programming at least 2 weeks prior to the field installation.

**3.5 Cellular Modem.** If present, the contractor shall provide before and after documents on cellular modem signal strength. The new cellular modem signal strength shall be equivalent or better than existing. Contractor shall be responsible for installation or relocation of cellular antenna to achieve acceptable signal strength.

**3.6 Other Agency's Devices on MoDOT Right-Of-Way and Facilities.** If other agency's devices such as emergency pre-emption system, CCTV Camera, etc. exist within MoDOT Right-Of-Way and must be relocated onto the new MoDOT facilities, the contractor must notify MoDOT SLITS Group via an email to [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) and MoDOT area traffic engineer in the early stage of the construction. MoDOT SLITS Group and MoDOT area traffic engineer will coordinate the removal and re-installation of those devices with responsible agency.

**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
910-99.02	Each	Relocate Existing Communication Equipment

Y. Cabinet Base

**1.0 Description.** Provide a concrete base for a Modified Type 7 cabinet. See the detail in the plans.

**2.0 Basis of Payment.** Payment for Cabinet Base includes all excavation, foundation construction, ground rod, anchor bolts, materials, equipment, tools, labor, and work incidental thereto. Payment will be made as follows:

Item No.	Type	Description
910-91.00	Cu. Yd.	Base, Concrete
910-99.07	Cu. Yd.	Replace Maintenance Pad

Z. ITS Asset Management Tool

**1.0 Description.** For all locations where any MoDOT and other agency's ITS (Intelligent Transportation System) components are modified or added, the contractor shall be responsible for populating and updating the Commission's ITS and Signal Network Asset Management Tool (currently NexusWorx) to reflect the final condition of the entire ITS system within the project limits as shown on the plans. Updating shall be performed by the Commission approved staff (currently the Byers Engineering; Doug Stanford at [Doug.Stanford@BYERS.COM](mailto:Doug.Stanford@BYERS.COM)).

**2.0 Construction Requirements.**

**2.1** The Contractor shall provide the final construction as-built plans and any relevant notes to the Commission approved contractor (currently the Byers Engineering) via an email and carbon copy the SL Construction staff and ITS group at [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) for input into the ITS

Asset Management Tool. The relevant notes for each modified or new location shall aid in the understanding of the device configuration and location details. At a minimum, this will include providing the required latitude and longitude coordinates of each pull box, DMS, CCTV, cabinet, conduit, cable, and fiber, along with any serial numbers and/or identification information for any new, relocated or otherwise changed by this project. The Contractor shall locate the conduit every 100 feet using a GPS locating device that is accurate to the nearest foot. The Contractor shall provide a GIS based map of the conduit route and a complete listing of all of map coordinates in an electronic format. Population of the ITS Asset Management Tool will be required for all new, relocated and modified devices improved under this contract.

**2.2** Other agency's ITS assets such as conduit, fiber cable, Cat-E cable, cabinet, pull box, etc. within MoDOT Right-Of-Way shall be highlighted including in a polygon in the ITS Asset Management Tool so it can be clearly identified for future references.

**2.3** The contractor shall furnish to Commission approved staff a copy of the final plans relevant to all of the ITS components in Visio and/or Microstation formats, if relevant.

**2.4** The contractor shall be provided one licensed read-only access login by Commission before work begins.

**2.5** A PDF and Visio format of all relevant fiber splicing drawings shall be provided to the Commission approved contractor for posting into the ITS Asset Management Tool's perspective ITS and Signal cabinets.

### **3.0 Acceptance.**

**3.1** All entries and updates shall be completely entered and available for use within 30 days from substantial completion of construction of the project.

**3.2** Commission staff shall verify population of the ITS Asset Management Tool within 10 working days, including accuracy and completeness of details for each component prior to acceptance and payment.

**4.0 Measurement and Payment.** Measurement and Payment for items covered by this specification include the population and correction of inaccuracies, in addition to all materials and equipment necessary complete the updates to the ITS Asset Management Tool which shall be coordinated and paid to the Commission approved staff (currently the Byers Engineering).

Item No.	Type	Description
910-99.01	Lump Sum	ITS Asset Management Tool

#### **AA. Coordination with ITS Staff and Utility Locates**

**1.0 Description.** Any work that will impact the existing communications network must be coordinated with the Commission's St. Louis District ITS staff. This includes but not limited to removal and replacement of any existing communications equipment, adding new devices and changes to power sources or disconnects. Minor modifications to the existing communications network can have significant impacts on the system and operation of other ITS and traffic signal systems.



**1.1** MoDOT is a member of MO-One-Call System. Prior to any excavation or work within MoDOT Right-Of-way, the contractor must contact MO-One Call at 1-800-DIG-RITE and request for Utility Locates within noted project limits. If the scope of work contains modification, addition and/or expansion of existing underground MoDOT ITS, lighting, or signal facilities, the contractor must notify the MoDOT Utilities Locate staff prior to any work, in order for MoDOT to update MoDOT utility location records with Missouri One Call.

**2.0 Contact.** The contractor shall notify the ITS group via an email to [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) at least 2 days before any work that may impact the existing network communications. The contractor shall include the Job Number, location and brief scope of work in the email's subject line. The engineer shall be notified prior to making contact with ITS staff. For MoDOT Utility location updates, the contractor must contact MoDOT TMC at 314-275-1500 and ask for Utility Locate Section at least seven calendar days before performing any work.

**3.0** The ITS and network devices located within the project limits are a crucial part of the traffic operation system for this area. It is imperative that the downtime be kept to a minimum when adding, removing, or modifying any existing ITS and network devices. This may require the contractor to perform work that will affect existing network devices during nighttime and/or weekend hours, at the discretion of the Engineer. Allowable timeframes for this work will be subject to the need for ITS devices in the area to be used to manage other traffic impacting work zones.

**4.0 Basis of Payment.** No direct payment shall be made for compliance with this provision.

#### **BB. Utilities**

**1.0** 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.

**2.0** The contractor shall be aware there are numerous utilities present along the route in this contract. Utility locates were not performed during the design phase of the project; therefore, the extent of conflicts with utilities are unknown.

**2.1** There may be underground utilities that run parallel or cross the route that are in close proximity to the proposed work locations. The contractor shall take necessary precautions and measures to verify locations and depths of utilities by any necessary means to determine exact impacts to their work.

**2.2** If utility facilities are found and discovered, the engineer will determine whether relocation of the utility is necessary to accommodate construction or if the work can be installed in accordance with Missouri Standard Plans for Highway Construction for the item of work specified.

**3.0 Overhead Power Lines.** In the event that any work is required within 25' of an existing Ameren power line, the contractor shall discuss the planned work as it relates to any energized power lines with Ameren Missouri and coordinate with Ameren Missouri for the installation of any insulation covers over the lines and/or any other designated requirements. Please note Ameren Missouri has revised the policy regarding the charges for placement, length of use and relocation of covers. The contractor is advised to contact Ameren Missouri regarding the current policy and so the anticipated cost to the contractor can be estimated and when payment is required. The Contractor shall contact Ameren Missouri at least two weeks in advance of when construction work is scheduled to begin to request covers to be placed at a given location. **The contractor is responsible for any charges from Ameren Missouri for this provision and payment will be directly to Ameren Missouri.**

**4.0 Basis of Payment.** There is no direct pay for complying with this provision.

CC. Contractor Quality Control NJSP-15-42

**1.0** The contractor shall perform Quality Control (QC) testing in accordance with the specifications and as specified herein. The contractor shall submit a Quality Control Plan (QC Plan) to the engineer for approval that includes all items listed in Section 2.0, prior to beginning work.

**2.0 Quality Control Plan.**

- (a) The name and contact information of the person in responsible charge of the QC testing.
- (b) A list of the QC technicians who will perform testing on the project, including the fields in which they are certified to perform testing.
- (c) A proposed independent third-party testing firm for dispute resolution, including all contact information.
- (d) A list of Hold Points, when specified by the engineer.
- (e) The MoDOT Standard Inspection and Testing Plan (ITP). This shall be the version that is posted at the time of bid on the MoDOT website ([www.modot.org/quality](http://www.modot.org/quality)).

**3.0 Quality Control Testing and Reporting.** Testing shall be performed per the test method and frequency specified in the ITP. All personnel who perform sampling or testing shall be certified in the MoDOT Technician Certification Program for each test that they perform.

**3.1 Reporting of Test Results.** All QC test reports shall be submitted as soon as practical, but no later than the day following the test. Test data shall be immediately provided to the engineer upon request at any time, including prior to the submission of the test report. No payment will be made for the work performed until acceptable QC test results have been received by the engineer and confirmed by QA test results.

**3.1.1** Test results shall be reported on electronic forms provided by MoDOT. Forms and Contractor Reporting Excel2Oracle Reports (CRE2O) can be found on the MoDOT website. All required forms, reports and material certifications shall be uploaded to a Microsoft SharePoint® site provided by MoDOT and organized in the file structure established by MoDOT.

**3.2 Non-Conformance Reporting.** A Non-Conformance Report (NCR) shall be submitted by the contractor when the contractor proposes to incorporate material into the work that does not

meet the testing requirements or for any work that does not comply with the contract terms or specifications.

**3.2.1 Non-Conformance Reporting** shall be submitted electronically on the Non-Conformance Report form provided on the MoDOT Website. The NCR shall be uploaded to the MoDOT SharePoint® site and an email notification sent to the engineer.

**3.2.2** The contractor shall propose a resolution to the non-conforming material or work. Acceptance of a resolution by the engineer is required before closure of the non-conformance report.

#### **4.0 Work Planning and Scheduling.**

**4.1 Two-week Schedule.** Each week, the contractor shall submit to the engineer a schedule that outlines the planned project activities for the following two-week period. The two-week schedule shall detail all work and traffic control events planned for that period and any Hold Points specified by the engineer.

**4.2 Weekly Meeting.** When work is active, the contractor shall hold a weekly project meeting with the engineer to review the planned activities for the following week and to resolve any outstanding issues. Attendees shall include the engineer, the contractor superintendent or project manager and any foreman leading major activities. This meeting may be waived when, in the opinion of the engineer, a meeting is not necessary. Attendees may join the meeting in person, by phone or video conference.

**4.3 Pre-Activity Meeting.** A pre-activity meeting is required in advance of the start of each new activity, except when waived by the engineer. The purpose of this meeting is to review construction details of the new activity. At a minimum, the discussion topics shall include safety precautions, QC testing, traffic impacts, and any required Hold Points. Attendees shall include the engineer, the contractor superintendent and the foreman who will be leading the new activity. Pre-activity meetings may be held in conjunction with the weekly project meeting.

**4.4 Hold Points.** Hold Points are events that require approval by the engineer prior to continuation of work. Hold Points occur at definable stages of work when, in the opinion of the engineer, a review of the preceding work is necessary before continuation to the next stage.

**4.4.1** A list of typical Hold Point events is available on the MoDOT website. Use of the Hold Point process will only be required for the project-specific list of Hold Points, if any, that the engineer submits to the contractor in advance of the work. The engineer may make changes to the Hold Point list at any time.

**4.4.2** Prior to all Hold Point inspections, the contractor shall verify the work has been completed in accordance with the contract and specifications. If the engineer identifies any corrective actions needed during a Hold Point inspection, the corrections shall be completed prior to continuing work. The engineer may require a new Hold Point to be scheduled if the corrections require a follow-up inspection. Re-scheduling of Hold Points require a minimum 24-hour advance notification from the contractor unless otherwise allowed by the engineer.

**5.0 Quality Assurance Testing and Inspection.** MoDOT will perform quality assurance testing and inspection of the work, except as specified herein. The contractor shall utilize the inspection

Job No.: JSL0203

Route: Various

County: Various

checklists provided in the ITP as a guide to minimize findings by MoDOT inspection staff. Submittal of completed checklists is not required, except as specified in 5.1.

**5.1** Inspection and testing required in the production of concrete for the project shall be the responsibility of the contractor. Submittal of the 501 Concrete Plant Checklist is required.

**6.0 Basis of Payment.** No direct payment will be made for compliance with this provision.

DD. MoDOT ITS Equipment within Project Limits

**1.0 Description.** MoDOT owned fiber optic cable and conduit, critical MoDOT power supplies and power cables, and pull boxes for fiber and power cabling, are present within the limits of this project. Damage or interruption of these items can cause extensive outages to the MoDOT network.

**2.0 Construction Requirements.** The contractor shall exercise reasonable care while completing work near these facilities and shall take steps necessary to protect these facilities from damage for all items that are not specifically identified as being removed and/or relocated in the plans. Should any of the existing wiring or conduit be damaged by the contractor, it shall be replaced at the contractor's expense and the system in full operation within 4 hours of when the damage occurred. If it is mutually agreed upon between the Commission and the Contractor that the repairs will require more than 4 hours to complete, a mutually agreed upon time for repairs to be complete will be determined.

**2.1** The contractor shall not modify any existing network or electrical connections within equipment cabinets, unless coordinated with MoDOT ITS staff. Existing connections include, but are not limited to, fiber jumpers, CAT5(e) cables, power supplies and power strips. The connection to specific fiber and copper ports on network equipment shall also not be modified, unless coordinated with MoDOT ITS staff, as the network equipment has been configured specifically for each equipment cabinet. Significant network outages and unnecessary troubleshooting to investigate outages can occur, even with minor changes to existing connections within the cabinet.

**3.0 Liquidated Damages.** In the event of damage, if the system is not repaired and in full operation within 4 hours of the damage occurring, or within the timeframe agreed upon, the contractor will be charged with a liquidated damage specified in the amount of \$100 per hour for each full hour that the system is not fully operational. This damage will be assessed independently of the liquidated damages specified elsewhere in the contract.

**3.1** The MoDOT engineer will also have the option of issuing a work order for MoDOT's on-call ITS maintenance contractor to make repairs, if it is the engineer's opinion that the contractor creating the damage will not be able to make repairs in a timely manner. The ITS maintenance contractor will then bill the contractor causing the damage directly.

**4.0 Basis of Payment.** No direct payment shall be made for compliance with this provision.

EE. Lump Sum Temporary Traffic Control JSP-22-01B

**1.0 Delete Sec 616.11 and insert the following:**

**616.11 Method of Measurement.** Measurement for relocation of post-mounted signs will be made to the nearest square foot of sign area only for the signs designated for payment on the plans. All other sign relocations shall be incidental. Measurement for construction signs will be made to the nearest square foot of sign area. Measurement will be made per each for each of the temporary traffic control items provided in the contract.

**616.11.1 Lump Sum Temporary Traffic Control.** No measurement will be made for temporary traffic control items grouped and designated to be paid per lump sum. The list of lump sum items provided in the plans or contract is considered an approximation and may be subject to change based on field conditions. This is not a complete list and may exclude quantities for duplicate work zone packages used in simultaneous operations. The contractor shall provide all traffic control devices required to execute the provided traffic control plans for each applicable operation, stage, or phase. No measurement will be made for any additional signs or devices needed except for changes in the traffic control plan directed by the engineer.

## **2.0 Delete Sec 616.12 and insert the following:**

**616.12 Basis of Payment.** All temporary traffic control devices authorized for installation by the engineer will be paid for at the contract unit price for each of the pay items included in the contract. Whether the devices are paid individually, or per lump sum, no direct payment will be made for the following:

- (a) Incidental items necessary to complete the work, unless specifically provided as a pay item in the contract.
- (b) Installing, operating, maintaining, cleaning, repairing, removing, or replacing traffic control devices.
- (c) Covering and uncovering existing signs and other traffic control devices.
- (d) Relocating temporary traffic control devices, including permanent traffic control devices temporarily relocated, unless specifically included as a pay item in the contract.
- (e) Worker apparel.
- (f) Flaggers, AFADs, PFDs, pilot vehicles, and appurtenances at flagging stations.
- (g) Furnishing, installing, operating, maintaining, and removing construction-related vehicle and equipment lighting.
- (h) Construction and removal of temporary equipment crossovers, including restoring pre-existing crossovers.
- (i) Provide and maintaining work zone lighting and work area lighting.

**616.12.1 Lump Sum Temporary Traffic Control.** Traffic control items grouped together in the contract or plans for lump sum payment shall be paid incrementally per Sec 616.12.1.1. Alternately, upon request from the contractor, the engineer will consider a modified payment schedule that more accurately reflects completion of traffic control work. No payment will be made for any additional signs or devices needed except for changes in the traffic control plan directed

by the engineer. Additional items directed by the engineer will be paid for in accordance with Sec 109.4. No adjustment to the price will be made for overruns or underruns of other work or for added work that is completed within existing work zones.

**616.12.1.1 Partial payments.** For purposes of determining partial payments, the original contract amount will be the total dollar value of all original contract line items less the price for Lump Sum Temporary Traffic Control (LSTTC). If the contract includes multiple projects, this determination will be made for each project. Partial payments will be made as follows:

- (a) The first payment will be made when five percent of the original contract amount is earned. The payment will be 50 percent of the price for LSTTC, or five percent of the original contract amount, whichever is less.
- (b) The second payment will be made when 50 percent of the original contract amount is earned. The payment will be 25 percent of the price for LSTTC, or 2.5 percent of the original contract amount, whichever is less.
- (c) The third payment will be made when 75 percent of the original contract amount is earned. The payment will be 20 percent of the price for LSTTC, or two percent of the original contract amount, whichever is less.
- (d) Payment for the remaining balance due for LSTTC will be made when the contract has been accepted for maintenance or earlier as approved by the engineer.

**616.12.1.2** Temporary traffic control will be paid for at the contract lump sum price for Item:

Item No.	Unit	Description
616-99.01	Lump Sum	Misc. Lump Sum Temporary Traffic Control

FF. Truck Mounted Attenuator (TMA) for Stationary Activities

**1.0 Description.** Provide and maintain Truck Mounted Attenuators (TMA) in accordance with Sec 612 and as specified herein.

**2.0 Construction Requirements.** Truck Mounted Attenuators (TMA) shall be used for the work activities indicated in the plans or specified herein.

**2.1 DMS Replacement Lane Closure.** A TMA or TMAs shall be used for lane closures implemented to allow for the six DMS replacements. The number of TMAs required will depend on the number lanes being closed as shown in the temporary traffic control details.

**3.0 Method of Measurement.** No measurement will be made for Truck Mounted Attenuators (TMA).

**4.0 Basis of Payment.** Delete Sec 612.5.1 and substitute with the following:

**612.5.1** No payment will be made for truck mounted attenuators (TMAs) used in mobile operations or for any TMAs designated as optional.

**612.5.1.1** Payment for TMAs required for stationary work activities will be paid for at the contract unit bid price for Item 612-30.01, Truck Mounted Attenuator (TMA), per lump sum. The lump sum payment includes all work activities that require a TMA, regardless of the number of deployments, relocations, or length of time utilized. No payment will be made for repair or replacement of damaged TMAs.

GG. Supplemental Revisions JSP-18-01KK

- Compliance with [2 CFR 200.216 – Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment](#).

The Missouri Highways and Transportation Commission shall not enter into a contract (or extend or renew a contract) using federal funds to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as substantial or as critical technology as part of any system where the video surveillance and telecommunications equipment was produced by Huawei Technologies Company, ZTE Corporation, Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

- Stormwater Compliance Requirements

**1.0 Description.** This provision requires the contractor to provide a Water Pollution Control Manager (WPCM) for any project that includes land disturbance on the project site and the total area of land disturbance, both on the project site, and all Off-site support areas, is one (1) acre or more. Regardless of the area of Off-site disturbance, if no land disturbance occurs on the project site, these provisions do not apply. When a WPCM is required, all sections within this provision shall be applicable, including assessment of specified Liquidated Damages for failure to correct Stormwater Deficiencies, as specified herein. This provision is in addition to any other stormwater, environmental, and land disturbance requirements specified elsewhere in the contract.

**1.1 Definitions.** The project site is defined as all areas designated on the plans, including temporary and permanent easements. The project site is equivalent to the “permitted site”, as defined in MoDOT’s State Operating Permit. An Off-site area is defined as any location off the project site the contractor utilizes for a dedicated project support function, such as, but not limited to, staging area, plant site, borrow area, or waste area.

**1.2 Reporting of Off-Site Land Disturbance.** If the project includes any planned land disturbance on the project site, prior to the start of work, the contractor shall submit a written report to the engineer that discloses all Off-site support areas where land disturbance is planned, the total acreage of anticipated land disturbance on those sites, and the land disturbance permit number(s). Upon request by the engineer, the contractor shall submit a copy of its land disturbance permit(s) for Off-site locations. Based on the total acreage of land disturbance, both on and Off-site, the engineer shall determine if these Stormwater Compliance Requirements shall apply. The Contractor shall immediately report any changes to the planned area of Off-site land disturbance. The Contractor is responsible for obtaining its own separate land disturbance permit for Off-site areas.

**2.0 Water Pollution Control Manager (WPCM).** The Contractor shall designate a competent person to serve as the Water Pollution Control Manager (WPCM) for projects meeting the description in Section 1.0. The Contractor shall ensure the WPCM completes all duties listed in Section 2.1.

**2.1 Duties of the WPCM:**

- (a) Be familiar with the stormwater requirements including the current MoDOT State Operating Permit for construction stormwater discharges/land disturbance activities; MoDOT's statewide Stormwater Pollution Prevention Plan (SWPPP); the Corps of Engineers Section 404 Permit, when applicable; the project specific SWPPP, the Project's Erosion & Sediment Control Plan; all applicable special provisions, specifications, and standard drawings; and this provision;
- (b) Successfully complete the MoDOT Stormwater Training Course within the last 4 years. The MoDOT Stormwater Training is a free online course available at [MoDOT.org](http://MoDOT.org);
- (c) Attend the Pre-Activity Meeting for Grading and Land Disturbance and all subsequent Weekly Meetings in which grading activities are discussed;
- (d) Oversee and ensure all work is performed in accordance with the Project-specific SWPPP and all updates thereto, or as designated by the engineer;
- (e) Review the project site for compliance with the Project SWPPP, as needed, from the start of any grading operations until final stabilization is achieved, and take necessary actions to correct any known deficiencies to prevent pollution of the waters of the state or adjacent property owners prior to the engineer's weekly inspections;
- (f) Review and acknowledge receipt of each MoDOT Inspection Report (Land Disturbance Inspection Record) for the Project within forty eight (48) hours of receiving the report and ensure that all Stormwater Deficiencies noted on the report are corrected as soon as possible, but no later than stated in Section 5.0.

**3.0 Pre-Activity Meeting for Grading/Land Disturbance and Required Hold Point.** A Pre-Activity meeting for grading/land disturbance shall be held prior to the start of any land disturbance operations. No land disturbance operations shall commence prior to the Pre-Activity meeting except work necessary to install perimeter controls and entrances. Discussion items at the pre-activity meeting shall include a review of the Project SWPPP, the planned order of grading operations, proposed areas of initial disturbance, identification of all necessary BMPs that shall be installed prior to commencement of grading operations, and any issues relating to compliance with the Stormwater requirements that could arise in the course of construction activity at the project.

**3.1 Hold Point.** Following the pre-activity meeting for grading/land disturbance and subsequent installation of the initial BMPs identified at the pre-activity meeting, a Hold Point shall occur prior to the start of any land disturbance operations to allow the engineer and WPCM the time needed to perform an on-site review of the installation of the BMPs to ensure compliance with the SWPPP is met. Land disturbance operations shall not begin until authorization is given by the engineer.

**4.0 Inspection Reports.** Weekly and post run-off inspections will be performed by the engineer and each Inspection Report (Land Disturbance Inspection Record) will be entered into a web-



based Stormwater Compliance database. The WPCM will be granted access to this database and shall promptly review all reports, including any noted deficiencies, and shall acknowledge receipt of the report as required in Section 2.1 (f.).

**5.0 Stormwater Deficiency Corrections.** All stormwater deficiencies identified in the Inspection Report shall be corrected by the contractor within 7 days of the inspection date or any extended period granted by the engineer when weather or field conditions prohibit the corrective work. If the contractor does not initiate corrective measures within 5 calendar days of the inspection date or any extended period granted by the engineer, all work shall cease on the project except for work to correct these deficiencies, unless otherwise allowed by the engineer. All impact costs related to this halting of work, including, but not limited to stand-by time for equipment, shall be borne by the Contractor. Work shall not resume until the engineer approves the corrective work.

**5.1 Liquidated Damages.** If the Contractor fails to complete the correction of all Stormwater Deficiencies listed on the MoDOT Inspection Report within the specified time limit, the Commission will be damaged in various ways, including but not limited to, potential liability, required mitigation, environmental clean-up, fines, and penalties. These damages are not reasonably capable of being computed or quantified. Therefore, the contractor will be charged with liquidated damages specified in the amount of \$2,000 per day for failure to correct one or more of the Stormwater Deficiencies listed on the Inspection Report within the specified time limit. In addition to the stipulated damages, the stoppage of work shall remain in effect until all corrections are complete.

**6.0 Basis of Payment.** No direct payment will be made for compliance with this provision.

- **Delete Sec 106.9 in its entirety and substitute the following:**

**106.9 Buy America Requirements.**

Buy America Requirements are waived if the total amount of Federal financial assistance applied to the project, through awards or subawards, is below \$500,000.

**106.9.1 Buy America Requirements for Iron or Steel Products.**

The contractor's attention is directed to Title 23 CFR 635.410 *Buy America Requirements*. Where articles, materials or supplies that consist wholly or predominantly of iron or steel or a combination of both are to be permanently incorporated into the contract work, steel and iron material shall be manufactured, from the initial melting stage through the application of coatings, in the USA except for "minimal use" as described herein. Predominantly of iron or steel or a combination of both means that the cost of the iron and steel content exceeds 50 percent of the total cost of all its components. Under a general waiver from FHWA the use of pig iron and processed, pelletized, and reduced iron ore manufactured outside of the USA will be permitted in the domestic manufacturing process for steel or iron material.

**106.9.1.1** Any sources other than the USA as defined will be considered foreign. The required domestic manufacturing process shall include formation of ingots and any subsequent process. Coatings shall include any surface finish that protects or adds value to the product.

**106.9.1.2** "Minimal use" of foreign steel, iron or coating processes will be permitted, provided the cost of such products does not exceed 1/10 of one percent (0.1 percent) of the total contract cost or \$2,500.00, whichever is greater. If foreign steel, iron, or coating processes are used, invoices

to document the cost of the foreign portion, as delivered to the project, shall be provided and the engineer's written approval obtained prior to placing the material in any work.

**106.9.1.3** Buy America requirements include a step certification for all fabrication processes of all steel or iron materials that are accepted per Sec 1000. The AASHTO Product Evaluation and Audit Solutions compliance program verifies that all steel and iron products fabrication processes conform to 23 CFR 635.410 Buy America Requirements and is an acceptable standard per 23 CFR 635.410(d). AASHTO Product Evaluation and Audit Solutions compliant suppliers will not be required to submit step certification documentation with the shipment for some selected steel and iron materials. The AASHTO Product Evaluation and Audit Solutions compliant supplier shall maintain the step certification documentation on file and shall provide this documentation to the engineer upon request.

**106.9.1.3.1** Items designated as Category 1 will consist of steel girders, piling, and reinforcing steel installed on site. Category 1 items require supporting documentation prior to incorporation into the project showing all steps of manufacturing, including coating, as being completed in the United States and in accordance with CFR Title 23 Section 635.410 Buy America Requirements. This includes the Mill Test Report from the original producing steel mill and certifications documenting the manufacturing process for all subsequent fabrication, including coatings. The certification shall include language that certifies all steel and iron materials permanently incorporated in this project was procured and processed domestically and all manufacturing processes, including coating, as being completed in the United States and in accordance with CFR Title 23 Section 635.410.

**106.9.1.3.2** Items designated as Category 2 will include all other steel or iron products not in Category 1 and permanently incorporated in the project. Category 2 items shall consist of, but not be limited to items such as fencing, guardrail, signing, lighting and signal supports. The prime contractor is required to submit a material of origin form certification prior to incorporation into the project from the fabricator for each item that the product is domestic. The Certificate of Materials Origin form ([link to certificate form](#)) from the fabricator must show all steps of manufacturing, including coating, as being completed in the United States and in accordance with CFR Title 23 Section 635.410 Buy America Requirements and be signed by a fabricator representative. The engineer reserves the right to request additional information and documentation to verify that all Buy America requirements have been satisfied. These documents shall be submitted upon request by the engineer and retained for a period of 3 years after the last reimbursement of the material.

**106.9.1.3.3** Any minor miscellaneous steel or iron items that are not included in the materials specifications shall be certified by the prime contractor as being procured domestically. Examples of these items would be bolts for sign posts, anchorage inserts, etc. The certification shall read "I certify that all steel and iron materials permanently incorporated in this project during all manufacturing processes, including coating, as being completed in the United States and in accordance with CFR Title 23 Section 635.410 Buy America Requirements procured and processed domestically in accordance with CFR Title 23 Section 635.410 Buy America Requirements. Any foreign steel used was submitted and accepted under minor usage". The certification shall be signed by an authorized representative of the prime contractor.

**106.9.1.4** When permitted in the contract, alternate bids may be submitted for foreign steel and iron products. The award of the contract when alternate bids are permitted will be based on the lowest total bid of the contract based on furnishing domestic steel or iron products or 125 percent of the lowest total bid based on furnishing foreign steel or iron products. If foreign steel or iron

products are awarded in the contract, domestic steel or iron products may be used; however, payment will be at the contract unit price for foreign steel or iron products.

**106.9.2 Buy America Requirements for Construction Materials other than iron or steel products.**

Construction materials mean articles, materials, or supplies that consist of only one of the items listed. Minor additions of articles, materials, supplies, or binding agents to a construction material do not change the categorization of the construction material. Upon request by the engineer, the contractor shall submit a domestic certification for all construction materials listed that are incorporated into the project.

- (a) Non-ferrous metals
- (b) Plastic and Polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables)
- (c) Glass (including optic glass)
- (d) Fiber optic cable (including drop cable)
- (e) Optical fiber
- (f) Lumber
- (g) Engineered wood
- (h) Drywall

**106.9.3 Buy America Requirements for Manufactured Products.**

Manufactured products mean articles, materials or supplies that have been processed into a specific form and shape, or combined with other articles, materials or supplies to create a product with different properties than the individual articles, materials or supplies. If an item is classified as an iron or steel product, an excluded material, or other product category as specified by law or in 2 CFR part 184, then it is not a manufactured product. However, an article, material or supply classified as a manufactured product may include components that are iron or steel products, excluded materials, or other product categories as specified by law or in 2 CFR part 184. Mixtures of excluded materials delivered to a work site without final form for incorporation into a project are not a manufactured product.

**106.9.3.1** Produced in the United States, in the case of manufactured products, means:

(A) For projects obligated on or after October 1, 2025, the product was manufactured in the United States; and

(B) For projects obligated on or after October 1, 2026, the product was manufactured in the United States and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product.

**106.9.3.2** (i) With respect to precast concrete products that are classified as manufactured products, components of precast concrete products that consist wholly or predominantly of iron or steel or a combination of both shall meet the requirements of paragraph (b) of this section. The cost of such components shall be included in the applicable calculation for purposes of determining whether the precast concrete product is produced in the United States.

(ii) With respect to intelligent transportation systems and other electronic hardware systems that are installed in the highway right of way or other real property and classified as manufactured products, the cabinets or other enclosures of such systems that consist wholly or predominantly of iron or steel or a combination of both shall meet the requirements of paragraph (b) of this section. The cost of cabinets or other enclosures shall be included in the applicable calculation

for purposes of determining whether systems referred to in the preceding sentence are produced in the United States.

**106.9.4 Waiver for De Minimis Costs for Manufactured and Construction Materials other than iron or steel products.**

“The total value of the non-compliant products is no more than the lesser of \$1,000,000 or 5% of total applicable costs for the project.” The contractor shall submit to the engineer any non-domestic materials and their total material cost to the engineer. The contractor and the engineer will both track these totals to assure that the minimal usage allowance is not exceeded.

- Third-Party Test Waiver for Concrete Aggregate

**1.0 Description.** Third party tests may be allowed for determining the durability factor for concrete pavement and concrete masonry aggregate.

**2.0 Material.** All aggregate for concrete shall be in accordance with Sec 1005.

**2.1** MoDOT personnel shall be present at the time of sampling at the quarry. The aggregate sample shall be placed in an approved tamper-evident container (provided by the quarry) for shipment to the third-party testing facility.

**2.2** AASHTO T 161 Method B Resistance of Concrete to Rapid Freezing and Thawing, shall be used to determine the aggregate durability factor. All concrete beams for testing shall be 3-inch wide by 4-inch deep by 16-inch long or 3.5-inch wide by 4.5-inch deep by 16-inch long. All beams for testing shall receive a 35-day wet cure fully immersed in saturated lime water prior to initiating the testing process.

**2.3** Concrete test beams shall be made using a MoDOT approved concrete pavement mix design.

**3.0 Testing Facility Requirements.** All third-party test facilities shall meet the requirements outlined in this provision.

**3.1** The testing facility shall be AASHTO accredited.

**3.1.1** For tests ran after January 1, 2025, accreditation documentation shall be on file with the Construction and Materials Division prior to any tests being performed.

**3.1.2** Construction and Materials Division may consider tests completed prior to January 1, 2025, to be acceptable if all sections of this provision are met, with the exception of 3.1.1. Accreditation documentation shall be provided with the test results for tests completed prior to January 1, 2025. No tests completed prior to September 1, 2024, will be accepted.

**3.2** The testing facility shall provide their testing process, list of equipment, equipment calibration documentation, and testing certifications or qualifications of technicians performing the AASHTO T 161 Procedure B tests. The testing facility shall provide details on their freezing and thawing apparatus including the time and temperature profile of their freeze-thaw chamber. The profile shall include the temperature set points throughout the entirety of the freeze-thaw cycle. The profile shall show the cycle time at which the apparatus drains/fills with water and the cycle time at which the apparatus begins cooling the specimens.

**3.3** Results, no more than five years old, from the third-party test facility shall compare within  $\pm 2.0$  percent of an independent test from another AASHTO accredited test facility or with MoDOT test records, in order to be approved for use (e.g. test facility results in a durability factor of 79, MoDOT's recent durability test factor is 81; this compared within +2 percent). The independent testing facility shall be in accordance with this provision. The comparison test can be from a different sample of the same ledge combination.

**3.4** When there is a dispute between the third party durability test results and MoDOT durability test results, the MoDOT durability test result shall govern.

**3.5** Test results shall be submitted to MoDOT's Construction and Materials division electronically for final approval. Test results shall include raw data for all measurements of relative dynamic modulus of elasticity and percent length change for each individual concrete specimen. Raw data shall include initial measurements made at zero cycles and every subsequent measurement of concrete specimens. Raw data shall include the cycle count and date each measurement was taken. Test results shall also include properties of the concrete mixture as required by AASHTO T 161. This shall include the gradation of the coarse aggregate sample. If AASHTO T 152 is used to measure fresh air content, then the aggregate correction factor for the mix determined in accordance with AASHTO T 152 shall also be included.

**4.0 Method of Measurement.** There is no method of measurement for this provision. The testing requirements and number of specimens shall be in accordance with AASHTO T 161 Procedure B.

**5.0 Basis of Payment.** No direct payment will be made to the contractor or quarry to recover the cost of aggregate samples, sample shipments, testing equipment, labor to prepare samples or test samples, or developing the durability report.

- **Delete paragraph 15.0 of the General Provision Disadvantaged Business Enterprise (DBE) Program Requirements and substitute the following:**

**15.0 Bidder's List Quote Summary.** MoDOT is a recipient of federal funds and is required by 49 CFR 26.11 to provide data about its DBE program. All bidders who seek to work on federally assisted contracts must submit data about all DBE and non-DBEs in accordance with Sec 102.7.9. MoDOT will not compare the submitted Bidder's List Quote Summary to any other documents or submittals, pre or post award. All information will be used by MoDOT in accordance with 49 CFR 26.11 for reporting to USDOT and to aid in overall DBE goal setting.

- **Add Sec 102.7.9 to include the following:**

**102.7.9 Bidder's List Quote Summary.** Each bidder shall submit with each bid a summary of all subcontractors, material suppliers, and service providers (e.g. hauling) considered on federally funded projects pursuant to 49 CFR 26.11. The bidder will provide the firm's name, the corresponding North American Industry Classification System (NAICS) code(s) the firm(s) were considered for, and whether or not they were used in the bid. The information submitted should be the most complete information available at the time of bid. The information shall be disclosed on the Bidder's List Quote Summary form provided in the bidding documents and submitted in accordance with Sec 102.10. Failure to disclose this information may result in a bid being declared irregular.