

JOB SPECIAL PROVISIONS TABLE OF CONTENTS (ROADWAY)

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	<b>MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION</b> 105 W. CAPITOL AVE. JEFFERSON CITY, MO 65102 Phone 1-888-275-6636
	<b><i>Burns &amp; McDonnell Engineers, Inc.</i></b> <i>9400 Ward Parkway</i> <i>Kansas City, MO 64114</i> Certificate of Authority: 000165 Consultant Phone: 785.806.8546
	If a seal is present on this sheet, JSP's have been electronically sealed and dated.
	JOB NUMBER: J6S3569 ST. LOUIS COUNTY, MO DATE PREPARED: 1/9/2025
	ADDENDUM DATE: <b>R001 02/10/2026</b>
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.

Notice to Proceed: April 20, 2026  
Contract Completion Date: December 1, 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.

Project	Calendar Days	Daily Road User Cost
J6S3569	N/A	\$5,400

**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 **\$2,000** 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.

C. 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.

### **2.5.1 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 Transportation Management Plan.** The contractor Work Zone Specialist (WZS) shall review the Transportation Management Plan (TMP), found as an electronic deliverable on MoDOT's Online Plans Room and discuss the TMP with the engineer during the preconstruction conference. Throughout the construction project, the WZS is responsible for updating any changes or modifications to the TMP and getting those changes approved by the engineer a minimum of two weeks in advance of implementation. The WZS shall participate in the post construction conference and provide recommendations on how future TMPs can be improved.

### **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:

<b>When Independence Day falls on:</b>	<b>The Holiday is Observed on:</b>	<b>Halt Lane Closures beginning at:</b>	<b>Allow Lane Closures to resume at:</b>
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

**3.2** The contractor shall not perform any construction operation on the roadway, roadbed or active lanes, 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 Work Hour Restrictions**

**3.3.1** Any work requiring a reduction in the number of through lanes of traffic shall be completed during the following working hours for the roadway segments noted below. It shall be the responsibility of the engineer to determine weekend hours and if the work hours noted below may be modified.

Pershall Road (Eastbound) at Route I-270  
9:00 AM to 3:00 PM

Daily lane reductions can occur in both directions of travel of Route AC during the same period. The contractor may erect multiple lane reductions each day. A daily lane reduction can have a maximum closure length of 2000 feet. Daily lane reductions can be erected for all hours except from 3:00 PM to 6:00 PM.

**3.3.2** Roadway resurfacing operations identified in the project plans shall be completed during the following hours:

7:00 PM to 7:00 AM

**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.

### **4.3 Lane and Pedestrian Access Route Closures**

**4.3.1** 24-Hour lane closures will be allowed per segment – one segment at a time. 24-Hour lane closure can occur simultaneously in both the northbound and southbound directions of Route AC. When a 24-Hour lane closure is utilized, the Contractor shall complete all work in the segment including ADA ramps, sidewalk, drainage, and grading. Segments designated for 24-hour lane closures are:

Old Halls Ferry Road to Vorhof Drive  
Vorhof Drive to Hudson Road (East)  
Hudson Road (East) to Capitol Drive

**4.3.4.2** Contractor may close a maximum of 2000 linear feet of an existing pedestrian access route. This pedestrian access route closure shall only be allowed when permission granted by Engineer. For a pedestrian access route to be closed an alternate/detour pedestrian access route shall be provided and signed. This pedestrian access route closure and Contractor furnished pedestrian access route closure signage plan shall be provided by Contractor to Engineer for review at least 3-calendar days prior to the planned closure.

### **5.0 Allowable Work Zone Posted Speed Reductions**

**5.1** The current posted speed limit shall be used for erection and placement of all work zone temporary traffic control measures.

**5.2** The Contractor shall be allowed to reduce the posted speed limit by 5 miles per hour in segments of the project approved by the Engineer.

**6.0 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.

#### **D. 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 law enforcement or other emergency agencies for incident management. In case of traffic accidents or the need for law enforcement to direct or restore traffic flow through the job site, the contractor shall notify law enforcement 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 law enforcement services, the following agencies may also be notified for accident or emergency situation within the project limits.

Missouri Highway Patrol Troop C: (636) 300-2800	
City of Ferguson	City of Ferguson Fire House #2
Police: (314) 522-3100	Fire: (314) 521-1117
St. Louis County Police Department North Precinct: (315) 355-1200	

**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.

E. Project Contact for Contractor/Bidder Questions JSP-96-05A

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

Dan Savageau, PE  
Project Manager  
St. Louis District  
1590 Woodlake Drive  
Chesterfield, MO 63017

Telephone Number: 314-453-5089  
Email: [Daniel.Savageau@modot.mo.gov](mailto:Daniel.Savageau@modot.mo.gov)

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

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

**2.0** Upon award and execution of the contract, the successful bidder/contractor shall forward all questions and coordinate the work with the engineer listed below:

Dave Bauer, PE  
Resident Engineer  
St. Louis District  
2620 Adie Road

Maryland Heights, MO 63042

Telephone Number: 314.877.2770

Email: [David.Bauer@modot.mo.gov](mailto:David.Bauer@modot.mo.gov)

F. 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;
- (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.

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

<u>Utility Name</u>	<u>Known Required Adjustment</u>	<u>Type</u>
<b>Ameren Missouri</b> Zak Kaller Telephone: (636) 793-1487 Email: <a href="mailto:zkaller@ameren.com">zkaller@ameren.com</a>	Yes	Power
<b>AT&amp;T (Distribution)</b> Tonya Wells Telephone: (636) 448-9607 Email: <a href="mailto:tw2745@att.com">tw2745@att.com</a>	Yes	Communication
<b>Charter (Spectrum)</b> John Danowski Telephone: (636) 262-0395 Email: <a href="mailto:John.Danowski@charter.com">John.Danowski@charter.com</a>	Yes	Communication
<b>Lumen</b> Daniel Lewis Telephone: (913) 381-1170 Email: <a href="mailto:dlewis2@olsson.com">dlewis2@olsson.com</a>	No	Communication
<b>Missouri American Water</b> Lisa Schneider Telephone: (618) 610-0364 Email: <a href="mailto:lisa.schneider@amwater.com">lisa.schneider@amwater.com</a>	Yes	Water
<b>MCI / Verizon</b> Domenic Nicastro Telephone: (636) 459-1600 Email: <a href="mailto:domenic.nicastro@verizon.com">domenic.nicastro@verizon.com</a>	Yes	Communication
<b>Spire Missouri East</b> Nick Eggert Telephone: (314) 330-5720 Email: <a href="mailto:nicholas.eggert@spireenergy.com">nicholas.eggert@spireenergy.com</a>	Yes	Gas
<b>St Louis County Department of Transportation</b> Adam Spector Telephone: (314) 615-0215 Email: <a href="mailto:aspector@stlouiscountymo.gov">aspector@stlouiscountymo.gov</a>	No	Signals
<b>Segra (formerly Everstream)</b> Robert Sewell Telephone: (314) 546-7927 Email: <a href="mailto:Robert.Sewell@segrafiber.com">Robert.Sewell@segrafiber.com</a>	No	Communication

1.1 The existence and approximate location of utility facilities known to exist, as shown on the plans, are based upon the best information available to the Commission at this time. This information is provided by the Commission "as-is" and the Commission expressly disclaims any representation or warranty as to the completeness, accuracy, or suitability of the information for any use. Reliance upon this information is done at the risk and peril of the user, and the

Commission shall not be liable for any damages that may arise from any error in the information. It is, therefore, the responsibility of the contractor to verify the above listing information indicating existence, location and status of any facility. Such verification includes direct contact with the listed utilities.

## 2.0 Project Specific Provisions

**2.1 Ameren Missouri.** Ameren-Missouri has mostly existing aerial facilities within the project limits outside of their underground service lines. There are several locations that are in conflict with the proposed work.

**2.1.1. Conflicts.** The following locations are in conflict:

- The aerial power lines along the east side of Route AC at Hudson Drive are within the 10-ft OSHA clearance with the proposed signal mast arm.
- The aerial power lines along the east side of Route AC at Chambers are within the 10-ft OSHA clearance with the proposed signal mast arm on the NE and SE Corners.
- The aerial power lines along the east side of Route AC at Chambers are within the 10-ft OSHA clearance with the proposed streetlight on the SE corner.

**2.1.1.1 Schedule.** Ameren's relocation operation is tentatively scheduled to be completed by November 2026.

**2.1.2 Adjust to Grade.** No apparent adjustments are needed during construction.

**2.1.3 Other.**

**2.1.3.1 Lighting on Ameren utility poles.** Ameren-Missouri will also add new dusk to dawn lighting on behalf of MoDOT at the following locations:

- Existing utility pole near STA 392+50 RT (north of Chambers)
- Existing utility pole near on Route AC SE corner at Chambers

**2.1.3.2 Power Service.** The contractor shall coordinate with Ameren on the new power signal and lighting service hook-up at Old Pershall Road and at Chambers.

**2.1.3.3 Excavation Activities.** Any excavation within 10-ft of any utility pole will require a **minimum of two (2) weeks notice** to Ameren's representative. Ameren may elect to use their crews to "pole-hold" during the contractor's excavation. The contractor shall accommodate Ameren's crew within their work area until the proposed finished grade is achieved or until Ameren is satisfied with the stability of the utility pole.

**2.1.3.4** The contractor shall contact Ameren-Missouri directly to verify the locations of their facilities. The contractor shall coordinate with Ameren-Missouri as necessary and take measures to protect in place their existing facilities during construction. The contractor shall protect the integrity of any existing facility in close proximity to contract work while performing construction activities.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Ameren Missouri.

**2.2 AT&T Distribution.** AT&T Distribution (AT&T/D) has existing underground and aerial facilities within the project limits. Aerial facilities do not appear to be in conflict.

**2.2.1. Conflicts.**

- AT&T/D will remove stub utility pole near STA 397+10 LT (NE corner) which is in conflict with the proposed curb ramp on this corner. No aerial lines will be relocated.
- STA 360+00 LT – fiber line near 2 Type C signal bases (Hudson).

**2.2.1.1 Schedule.** AT&T/D's relocation operation is tentatively scheduled to be completed by June 2026.

**2.2.1.2 *The contractor shall protect the concrete encased 9-way ductbank running along Route AC east of the eastern curb line crossing Hudson during the installation of the proposed signal bases.***

**2.2.1.3 *The contractor shall protect the concrete encased 9-way ductbank running along Route AC and along Chambers during the installation of the proposed signal bases. The manhole on the NE corner of Route AC and Chambers and its vent which provide tunnel access to the manhole in the middle of the intersection shall be protected by the contractor and not disturbed.***

**2.2.2 Adjust to Grade.** Some manholes will need to be adjusted to grade within the sidewalk as shown on the plans. The contractor shall notify AT&T/D a **minimum of two (2) weeks** prior to starting work in these areas.

**2.2.3. Other.** The contractor shall directly contact AT&T/D to verify the locations of their facilities. The contractor shall coordinate with AT&T/D as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by AT&T Distribution.

**2.3 Charter (Spectrum).** Charter has aerial and underground existing facilities within the project limits that appear to be in conflict.

**2.3.1. Conflicts.**

- Charter has aerial lines at the same location as discussed in **Section 2.1 Ameren Missouri** and will relocate to follow Ameren.
- STA 360+00 LT – fiber line near 2 Type C signal bases (Hudson).

**2.3.1.1. Schedule.** Charter's relocation operation is tentatively scheduled to be completed by December 2026.

**2.3.2. Adjust to Grade.** There are also Charter handholes that need to be adjusted to grade at various locations as shown on the plans. The contractor shall provide Charter at least **two (2) weeks notice** before working near areas that need Charter coordination on the adjustment.

**2.3.3. Other.** The contractor shall contact Charter directly to verify the location of their facilities. The contractor shall coordinate with Charter as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Charter.

**2.4 Lumen.** Lumen has existing underground facilities within the project limit. There are no apparent conflicts with the proposed improvements.

**2.4.1 Conflicts.** There are no apparent conflicts.

**2.4.2 Adjust to Grade.** There are no apparent handholes to adjust to grade.

**2.4.3. Other.** The contractor shall contact Lumen directly to verify location of their facilities. The contractor shall coordinate with Lumen as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Lumen.

**2.5 Missouri American Water.** Missouri American Water has existing facilities within the project limits that are in conflict with the proposed improvements.

**2.5.1 Conflicts.** Missouri Ameren Water has a fire hydrant near STA 436+30 RT that is in conflict with the proposed sidewalk and will be relocated north behind the proposed sidewalk.

**2.5.1.1. Schedule.** Missouri American Water's hydrant relocation is tentatively scheduled to start April 2026 and be completed by June 2026.

**2.5.2 Adjust to Grade.** There are Missouri American Water valve boxes that need to be adjusted to grade during construction as shown on the plans. The contractor shall contact Missouri American Water Operation Supervisor, Tiffany Huey at (314) 239-4968. The contractor shall give Missouri Ameren Water two (2) weeks notification before the start of this work.

**2.5.3. Other.** The contractor shall contact Missouri Ameren Water directly to verify location of facilities and to have valves adjusted to grade. The contractor shall coordinate with Missouri American Water as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Missouri American Water.

**2.6 MCI / Verizon.** Verizon has existing underground facilities within the project limits.

**2.6.1. Conflicts.** Verizon's underground conflicts are at the following locations:

- Sta. 398+12 LT – fiber line near proposed Type A Base signal base at Chambers.

- Sta. 397+92 RT – fiber line near proposed Type C signal base at Chambers.

**2.6.1.1.** Schedule. Verizon’s relocation is scheduled to be completed by June 2026.

**2.6.2** Adjust to Grade. There are Verizon hand holes that need to be adjusted to grade during construction. The contractor shall give Verizon **two (2) weeks notification** before working in those areas.

**2.6.3.** Other. The contractor shall contact Verizon directly to verify location of facilities. The contractor shall coordinate with Verizon as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Verizon.

**2.7 Spire Missouri East.** Spire has existing facilities within the project limits and some are in conflict with the proposed work.

**2.7.1** Conflict. The following facilities conflict with the proposed improvements:

- STA 359+85 LT – 1 two-inch steel valve & drip on NE corner of Hudson in ADA curb ramp.
- STA 360+50 LT – 1 two-inch steel line along Route AC and 1 four-inch steel line along Hudson near proposed Type C signal base on SE corner.
- STA 397+10 LT – 1 eight-inch steel valve on NE corner of Chambers in ADA curb ramp.
- STA 398+15 LT on SE Corner of Chambers
  - 1 8-inch steel valve in ADA curb Ramp
  - 1 8-inch steel line near mast arm signal base
  - 1 8-inch steel line near Type C signal base.
- STA 397+90 RT – 1 8-inch steel line near Type C Signal base on SW corner of Chambers.

**2.7.1.1** Schedule. Spire’s relocation operation is tentatively scheduled to be completed by September 2026.

**2.7.2.** Adjust to Grade. There are also Spire gas valves that need to be adjusted to grade in the sidewalk and driveways during construction at the locations shown on the plans. ***The contractor shall give Spire three (3) weeks notification before the start of this work.***

**2.7.3** Other. The contractor shall contact Spire directly to verify location of facilities and to have valves adjusted to grade. The contractor shall coordinate with Spire as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Spire.

**2.8 St. Louis County Department of Transportation.** St. Louis County DOT has an existing fiber cable crossing Route AC on the south of the south curb line of Chambers Road.

**2.8.1** Conflict. No apparent conflicts.

**2.8.1.1 The contractor shall protect the fiber line along the Chambers during during all signal and lighting construction.**

**2.8.2.** Adjust to Grade. No apparent handholes need to be adjusted to grade.

**2.8.3 Other.** The contractor shall contact St. Louis County DOT directly to verify location of facilities. The contractor shall coordinate with St. Louis County DOT as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by St. Louis County DOT.

**2.9 Segra (formerly Everstream).** Segra does not have any existing facilities within the project limits.

**2.9.1 Conflict.** No apparent conflicts.

**2.9.2** Adjust to grade. No apparent handholes need to be adjusted to grade.

**2.9.3 Other.** The contractor shall contact Segra directly to verify location of their facilities. The contractor shall coordinate with Segra as necessary and take measures to protect in place their existing facilities during construction.

There will be no direct pay for compliance with any of the above provisions.

The Commission cannot warrant the information above which was provided by Segra.

**3.0 Potholing Utility facilities.** As the first order of work, the contractor shall verify all signal and lighting locations with potholing their proposed location. The contractor shall notify the adjacent utility(ies) prior to potholing. The utility may want to have a representative on site to observe the contractor's pothole work. The contractor shall be responsible to pothole any existing utility facility under the pavement or outside the pavement, to verify the utilities depth and location for all the contractor's needs to construct the project. Core drilling pavement prior to potholing for utilities may be necessary. The contractor is responsible for the costs to repair any utility, St. Louis County, or MoDOT facility damaged by their work to pothole the utility. No direct payment will be made for potholing.

#### H. Coordination with Other Projects

**1.0 Description.** The contractor shall coordinate traffic management between the following projects within the same project vicinity:

Project J6I3618 - Culvert Improvements on J0888 under I-270 (Includes Channel Work west of Box A1107).

**1.1** This list of projects is not all inclusive. The contractor shall be aware that there may be other projects including, but not limited to, utility, St. Louis County, 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 one listed above may impact this project and work to coordinate construction and traffic management efforts between this project and any other project involved.

**2.0 Basis of Payment.** No direct payment or additional time 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 documents.

I. Liquidated Damages for Pedestrian Impacts

**1.0 Description.** Providing work zone protection for pedestrians will be a primary component of this project. This work shall consist of staging/managing construction timelines to minimize the project's impacts to pedestrian traffic where construction activities make walkways impassible. Nothing in this provision shall be construed to limit contractor innovation in mitigating pedestrian traffic impacts.

**2.0 Prosecution of Work.** At locations where construction makes walkways impassible, the contractor shall have all necessary personnel, equipment, and materials at hand for all work at each location before the work begins so that work may proceed without delay. Work requiring the mitigation of pedestrian traffic impacts includes, but shall not be limited to, removal of sidewalk, curb ramp, or other paved pedestrian pathway.

**3.0 Time of Disruption of Pedestrian Facilities.** Regardless of construction methods chosen, once a section of sidewalk has been closed to pedestrian traffic, the contractor shall prosecute the work as to minimize delays and inconvenience to the traveling public. The contractor, with approval from the engineer, shall specify the length of a given sidewalk section to be reconstructed. Once a corner has been closed to pedestrian traffic, the contractor shall have a maximum of three weeks, regardless of weather or other delays, to reopen that corner/section to pedestrian traffic.

**4.0 Work Area Safety.** The contractor shall maintain a work area that is safe for pedestrians. In order to provide this, the contractor shall work on only one side of Route AC at a given time to improve the sidewalks along either the north or south sides and to allow a walkable path on the other side during construction. The areas adjacent to the contractor's physical work site shall also be maintained to provide access to adjoining properties, regardless of whether a detour route is in place. All holes shall be covered with secured plywood or steel plates, and the work area walkways shall be free of trip hazards, loose debris, vehicles, materials, and equipment when the contractor is not in the work area. A 3' minimum path shall be maintained on any used-in-place walkway needed for access. The contractor shall not be permitted to park on any walkway.

**5.0 Liquidated Damages.** If work associated with new sidewalk or curb ramps along a given side of Route AC begins, but is not complete and open to pedestrian traffic within 3 weeks of commencement, 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, and pedestrian delay, with its resulting cost to the traveling public. 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 **\$500 per day** of delay that closes a walkway in excess of **3 weeks**. The contractor's superintendent

and the engineer shall be on site at the time of any closures and shall both record an agreed time when the walkway was closed. It shall be the responsibility of the engineer to determine the quantity of excess closure time.

**5.1** The said liquidated damages specified will be assessed regardless of whether it would otherwise be charged as liquidated damages under the Missouri Standard Specification for Highway Construction. There shall be no permitted excuse for delay of the work, including weather.

**6.0 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.

J. Winter Months Requirements JSP-15-07A

**1.0 Description.** This project contains work which spans the winter months.

**2.0 Work to be Completed.** When the contractor ceases operations for the winter months, any paving operation performed by the contractor shall not result in a lane height differential between adjacent lanes.

**3.0 Maintenance of Pavement Marking.** Prior to ceasing operations for winter months, a permanent or temporary stripe shall be provided on any completed length to the point that the original stripe was obliterated or obscured by the contractors' operation. Temporary striped areas shall be re-stripped with the remaining route upon performance of the final striping.

**4.0 Winter Related Maintenance Activities.** The contractor shall have the project in a condition as not to interfere with the plowing of snow. The contractor shall also provide a taper at the end of his paving that will not be damaged by the plowing of snow.

**5.0 Basis of Payment.** There will be no direct pay for compliance with this provision.

K. 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 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.

L. Special Consideration of Change Orders and Value Engineering JSP-21-07

**1.0 Description.** Increased Federal Share has been approved by the FHWA for an innovative technology or practice. The Commission will receive an additional five percent Federal Share of the overall contract value due to innovations within the following pay item(s).

Pay Item Number	Pay Item Description	Innovation
902-99.01	Traffic Signal Maintenance and Programming	See JSP - Traffic Signal Maintenance & Programming, Sections 4.12 (LPI) and 4.13 (Left-Protect)'

Due to the increased Federal Share, the project components related to the innovation(s) described above must be constructed with the materials, quantities, methods and innovations as shown on the project plans and specifications. If the contractor requests materials, quantities, methods or innovations other than those included in the plans and specifications, the request must be reviewed and approved by the Commission and FHWA. Approved changes to the innovation items above shall be at no additional cost to the Commission and shall not increase the contract time.

**2.0 Special Consideration of Change Orders and Value Engineering Change Proposals (VECP).** Change ordering and/or value engineering the pay item(s) listed in section 1.0 jeopardize the ability for the Commission to receive an additional Federal Share for the overall

contract value. Special consideration should be given to the change order value for removing or modifying such item(s) from the contract ensuring the benefit outweighs the cost.

**3.0 Contacting Financial Services.** If it is determined that the proposed change order and/or VECP outweighs the additional overall five percent Federal Share value, the Engineer shall notify the MoDOT project manager.

M. Adopt-A-Highway Signs

**1.0 Description.** The contractor shall remove Adopt-A-Highway signs as indicated in the plans and transport them to the following location.

Missouri Department of Transportation  
Bellefontaine Maintenance Facility  
10601 Lewis & Clark Boulevard  
Saint Louis MO, 63136

1.1 The contractor shall notify the Maintenance Supervisor at least 48 hours in advance of delivering the signs to the maintenance facility. The contractor shall exercise care when removing and transporting the signs to the maintenance facility. The contractor shall make arrangements for delivery during normal business hours. Contact information is:

Amir Ghaidi, Maintenance Superintendent  
Office: (314) 954-6879      Cell: (314)624-5348

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

N. Guardrail Requirements

**1.0 Safety Devices.** Before any guardrail, bridge approach transition sections, crashworthy end terminals or end anchors are installed, the contractor shall layout the proposed alignment in the field to ensure that each of these items can indeed be installed properly based upon the standard plans and the manufacturer's recommendations. The contractor shall notify the engineer when that field inspection will take place as to allow the engineer to be present at that time. In order to ensure that the crashworthy end terminal or crash cushion selected by the contractor can indeed be installed at each of the locations listed in the plans, the field inspection meeting mentioned above shall take place before the ordering of any crashworthy end terminal.

1.1 The length of the crashworthy end terminal is estimated in the plans to be 50 foot in length. If a length of crashworthy end terminal selected by the contractor has a length of less than 50 foot, than the contractor shall inform the Engineer as it may require the length of guardrail to be extended a short distance to meet design requirements.

**2.0 Basis of Payment.** The accepted guardrail, bridge approach transition sections, crashworthy end terminals and end anchors, complete in place, will be paid for by the contract unit bid price for the following items and will be full compensation for all labor, equipment and material to complete the above described work:

Item Number	Type / Description	Unit
606-10.60	MGS Guardrail	L.F.
606-10.80	MGS End Anchor	Each
606-30.14	Type A Crashworthy End Terminal (MASH)	Each

O. Soil Coring for Depth Verification prior to Guardrail Installation over Box Culvert

**1.0 Description.** Prior to removing the existing guardrail over MSD’s box culvert on the east side of Rte. AC north of Old Halls Ferry and connecting the rectangular concrete lined channel on either side of this box culvert, the contractor shall take a core on each side to determine the exact depth from the roadway down to the top of the box culvert. If new guardrail posts cannot be installed to the proper depth per the Standard Plans, the Contractor shall inform the Engineer so that a decision can be made of whether to UIP the existing guardrail over the box culvert. No direct pay shall be made to the Contractor to verify the existing depth between the roadway and the top of the box culvert.



**P. Shaping Slopes Class III (Modified Material Requirements) NJSP-20-03B**

**Delete Sec 215.1.3 and 215.1.3.1 and substitute the following:**

**215.1.3** Shaping Slopes, Class III, shall consist of providing rock fill material and shaping slopes to construct additional shoulder width for the installation of guardrail and Type A crashworthy end terminals in accordance with Missouri Standard Plans for Highway Construction. The rock fill material used shall meet the requirements specified in Sec 215.1.3.1. The shoulder surface shall be finished smooth such that it is traversable and without significant voids or depressions.

**215.1.3.1 Material Requirements.** Rock fill material used for Shaping Slopes, Class III, shall consist of a durable crushed stone, shot rock or broken concrete, with a predominant size of 3 inches and a maximum size of 6 inches. Acceptance by the engineer will be made by visual inspection.

**215.4 Basis of Payment.** The accepted quantity will be paid at the contract unit bid price.

Item Number	Type / Description	Unit
215-99.10	Misc. Shaping Slopes Class III – Modified Material Requirements	100 FT



Q. Optional Temporary Pavement Marking Paint NJSP-18-07G

**1.0 Description.** This provision provides the contractor with the option to either complete all Permanent Pavement Marking Paint (PPMP) prior to the time limits specified herein or to apply Temporary Pavement Marking Paint (TPMP) in accordance with Sec 620.10.2 (4 in. width) in all locations shown on the plans as PPMP and delay application of the PPMP until the spring of 2028, as allowed herein. PPMP is defined as Class 1 Pavement Marking Paint and Class 2 Pavement Marking Paint and does not include Sec 620.20.3 Durable Pavement Markings.

**1.1** No application of PPMP shall occur between October 1, 2027, and March 1, 2028, both dates inclusive, except as stated herein. When the contractor has begun application of PPMP prior to

October 1, 2027, and weather limitations stated in Sec 620.20.2.4 can be met, the contractor may complete the PPMP within the first seven (7) calendar days of October. If all (100%) of the PPMP is not completed on or before October 7, 2027, all previously applied PPMP, including any painted markings applied prior to October 1, shall be considered TPMP, and the contractor shall complete the remaining marking with TPMP, and then re-apply PPMP in all planned locations after March 1, 2028. All PPMP shall be completed prior to June 1, 2028. No additional payment will be made for PPMP that is later determined to be TPMP due to the contractor's failure to complete the PPMP within the time specified.

**1.2 Use of TPMP Prior to October 1.** The contractor has the option to apply TPMP in lieu of PPMP prior to October 1, 2027, even when there is sufficient time to complete the PPMP prior to October 1, 2027. For example, the contractor may choose to use TPMP as a base coat for the PPMP on open-graded surfaces in order to achieve higher retroreflectivity readings on the surface coat as compared to a single application.

**1.2.1** The contractor has the option of using TPMP in lieu of Temporary Raised Pavement Markers if applied each day that existing markings are obliterated.

**2.0 Construction Requirements.** TPMP shall be accurately placed in the final planned location and shall be completely covered by the final application of PPMP. Any failure to comply with this requirement shall be corrected by removal of the misplaced pavement markings at the contractor's expense and without marring of the pavement surface.

**2.1** Prior to application of the PPMP on TPMP, TPMP shall be fully cured in accordance with the manufacturer's recommendation, or for a period of 12 hours, whichever is greater.

**3.0 Weather Limitations.** All weather limitations specified in Sec 620 for PPMP and TPMP shall apply. Cold Weather Pavement Marking Paint, in accordance with Sec 620.10.6, shall be used for TPMP when specified weather limitations do not allow the use of waterborne paint. No additional payment will be made for the use of Cold Weather Pavement Marking Paint as TPMP. Cold Weather Pavement Marking Paint is not an allowable substitute for PPMP and shall subsequently be covered with PPMP.

**4.0 Time Exception.** If application of PPMP is to be delayed to the spring of 2027, the contractor shall submit a request to the engineer for a time exception and shall provide a revised work schedule that shows the planned completion of the PPMP.

**4.1** Upon receipt of the time exception request in Section 4.0, the engineer will list "Application of Permanent Pavement Marking Paint" as an exception on the Semi-Final Inspection form, thus granting an exception to the count of contract time thru June 1, 2027, solely for the purpose of delaying application of PPMP. This time exception shall not apply to any time needed to complete any other work items. Liquidated Damages, as specified elsewhere in this contract, shall remain in effect for all other work items not completed by the contract time limits, as specified elsewhere in this contract, and for PPMP not completed by June 1, 2027.

**5.0 Method of Measurement.** No final measurement will be made for TPMP.

**6.0 Basis of Payment.** Full payment for TPMP will be made at the contract lump sum price even when PPMP is completed prior to the time limitation and TPMP is not used or only partially used.

**6.2** If a \$0 bid is entered for TPMP, no payment will be made should TPMP become necessary.

Item Number	Description	Unit
6209901	TEMPORARY PAVEMENT MARKING PAINT	LS

R. Removal and Delivery of Existing Signs JSP-12-01C

**1.0 Description.** All Commission-owned signs removed from the project shall be disassembled, stored, transported, and disposed of as specified herein. Sign supports, structures and hardware removed from the project shall become the property of the contractor.

**2.0 Disassembly and Delivery.**

**2.1** All Commission-owned signs, (excluding abandoned billboard signs), designated for removal in the plans, or any other signs designated by the Engineer, shall be removed from the sign supports and structures, disassembled, stored, transported, and delivered by the contractor to the recycling center for destruction.

**2.2** The contractor shall coordinate and make arrangements with the recycling center for delivery of the signs. Sign panels shall be disassembled and/or cut into sizes as required by the recycling center.

**2.3** The contractor shall provide the Engineer with a "Sign Delivery Certification" attesting to completion of delivery of all existing sign material from the project to the recycler. In addition, the contractor shall provide to the Engineer a final "Sign Certification of Destruction" from the recycler that documents the total pounds of scrap sign material received from the project and attests that all such material will not be re-purposed and will be destroyed in a recycling process. The contractor can locate the required certification statements from the Missouri Department of Transportation website:

<https://www.modot.org/forms-contractor-use>

**2.4** Funds received from the disposal of the signs from the recycling center shall be retained by the Contractor.

**3.0 Basis of Payment.** All costs associated with removing, disassembling and/or cutting, storing, transporting, and disposing of signs shall be considered as completely covered by the contract unit price for Item No. 202-20.10, "Removal of Improvements", per lump sum.

S. Tree Clearing Restriction

**1.0 Description.** The project is within the known range of several federally protected bat species. These bats are known to roost in trees with suitable habitat characteristics during summer months.

**1.1** MoDOT has determined that suitable trees for one or more of these bat species exist within the project area.

**1.2** To avoid negative impacts to these bat species, removal of any trees/limbs greater than three (3) inches in diameter shall only occur between October 16 and March 31.

**1.0 Basis of Payment.** No direct pay shall be provided for any labor, equipment, time, or materials necessary to complete this work.

T. Karst Streams near Project Area

**1.0 Description.** The project crosses, or is in the vicinity of, a losing stream that feeds groundwater. To avoid negative impacts to water quality and any sensitive species present in the watershed, water quality shall be protected from construction impacts.

**1.1** The contractor shall prevent any debris and materials from construction activities from entering streams and other waterbodies, even if they are devoid of water. If debris or materials do enter waterbodies, and if deemed necessary by the engineer or MoDOT's environmental personnel, it shall be removed as directed by the engineer at the contractor's expense.

**2.0 Basis of Payment.** No direct payment will be made for any expense incurred by the contractor by reason of compliance with the specific requirements of the provision, including any delay, inconvenience, or extra work except for those items for which payment is included in the contract.

U. Drainage Maintenance During Construction

**1.0 Description.** The contractor's attention is called to the drainage construction. The Contractor is required to maintain drainage during construction and to ensure that the existing drainage system continues to convey all storm water until the new structures and pipes are in place.

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

V. Metropolitan Sewer District of St. Louis Permit No. 25MSD-00247

**1.0 Description.** Metropolitan St. Louis Sewer District (MSD) has issued permit 25MSD-00247 for improvements associated with project J6S3569. Copy of the approved plans and permit requirements are available for download at <https://aca3.accela.com/STLMSD/>.

**2.0** The Contractor shall comply with all General Construction Permitting Requirements indicated in the approved permit to include payment of all permit fees.

**2.1** The Contractor shall coordinate with MSD for inspection of existing sewer structures to be modified as part of the project. MSD has identified the following sewer structure modification permits will require inspection. The plans include notation that MSD inspection is required.

10G3-063S	11G2-0168D	11G2-0157D	11F4-070S
11G3-0128D	11F4-061D	11F4-065D	11F4-060D
11F4-0194D	11F4-064S	12F1-069S	12F1-172D
12F1-094D	12F1-095D	12F1-097D	12F1-077S

12F1-083S  
12F1-112S

12F1-111S  
12F4-085S

12F1-110S

12F1-175SD

**3.0** 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 documents.

W. Metropolitan Sewer District of St. Louis As-Built Submittals (Permit No. 25MSD-00247)

**1.0 Description.** Metropolitan St. Louis Sewer District (MSD) requires as-built drawings of the constructed drainage facilities to be submitted for their records. The contractor shall perform all work necessary to produce and submit the final as-built drainage plans to MSD, per MSD's as-built submittal requirements. The contractor shall submit the MSD as-built drawings for MSD P No. 23MSD-00482 and subsequent revisions after all drainage structures related to the project have been constructed or adjusted.

**1.1 MSD Electronic Plans Submittal Process.** MSD requires that permits be submitted electronically using their new online paperless system Accela. The contractor will be required to login on to this system and upload as-builts and/or shop drawings as necessary. Additional information can be found here:

<https://msdprojectclear.org/doing-business/development-review/>

A direct link to the new online system can be found here:

<https://aca3.accela.com/STLMSD/Login.aspx>

In order to access the permit, the contractor will first need to call MSD in order to obtain access for the particular job mentioned above.

**1.2** The contractor shall provide a copy of the as-built drainage plans to the MoDOT engineer at the time of the MSD submittal.

**2.0** The Contractor shall comply with all General Construction Permitting Requirements indicated in the approved permit, which includes payment of all permit fees.

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

X. Existing Irrigation Systems

The contractor shall be made aware that existing residents and businesses along Route AC may have irrigation systems which extend into existing MoDOT Right of Way. The contractor may contact the residents and businesses to have the existing irrigation pipes located in the field as they are not part of the MO 1 Call System, however, they may be unresponsive. The contractor shall then exercise reasonable care installing any new equipment (signals, signing, ITS etc.) as shown in the plans. Irrigation systems that are discovered on MoDOT Right of Way that are damaged shall be capped by the contractor at the Right of Way Line. If this occurs, the contractor shall notify the property owner and inform them the irrigation system will need to be repaired at

the property owner's expense and kept of MoDOT's Right of Way. No direct payment shall be provided for compliance with this provision.

Y. Contractor Designed, Furnished and Installed Shoring for Excavation

**1.0 Description.** This Section addresses sheeting, bracing, and all operations necessary for the preparation of trenches for bedding of pipes and pipe appurtenances, conduit, and buried cable.

**2.0 Materials.** All materials shall be in accordance with Division 1000.

**3.0 Execution.** Where selecting an option for excavation, trenching, and shoring in compliance with local, state, or federal safety regulations such as "OSHA Part 1926" or successor regulations, which require design by a registered professional engineer, submit (for information only and not for Engineer approval) the following:

- A. Copies of design calculations and notes for sloping, benching, support systems, shield systems, and other protective systems prepared by or under the supervision of a professional engineer legally authorized to practice in the jurisdiction where the Project is located.
- B. Documents provided with evidence of registered professional engineer's seal, signature, and date in accordance with appropriate state licensing requirements.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
- D. Shore, support, and protect utilities encountered.
- E. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
- F. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Engineer and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- G. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- H. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- I. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

**4.0 Quality Assurance.** The contractor shall conduct a pre-installation meeting at the project site to review methods and procedures related to excavation support and protection systems including, but not limited to:

- a. Existing utilities and subsurface conditions.
- b. Proposed excavations.
- c. Proposed equipment.
- d. Monitoring of excavation support and protection system.
- e. Working area location and stability.
- f. Coordination with traffic control movements of general public.

**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.

Z. Contractor Designed, Furnished and Installed Steel Plates

**1.0 Description.** The Contractor may elect to utilize steel plating to cover open trenches on Route AC or in adjacent paved areas to mitigate overnight roadside hazards. Steel plates shall be secured from lateral movement while in use. Steel plates shall withstand H-20 traffic loading.

**2.0 Materials.** All materials shall be in accordance with Division 1000, Material Details, as specified in the Missouri Highway and Transportation Commission's current edition of Missouri Standard Specifications for Highway Construction.

**3.0 Construction Requirements.**

**3.1** Contractor shall provide asphalt wedging transitions for traffic and pedestrians at plate edges as detailed in the plans. Asphalt wedging transition for pedestrians shall comply with ADA pedestrian access routes as identified by Engineer. No direct pay for asphalt wedging or tack coat.

**3.2** Contractor shall document by evidence of registered professional engineer's seal, signature, and date in accordance with appropriate state licensing requirements showing the design and placement of the steel plating meets loading requirements.

**3.3** The Contractor shall conduct a pre-installation conference with the Engineer to review methods and procedures related to excavation support and protection. The pre-installation conference will address:

- Existing utilities and subsurface conditions.
- Proposed excavations.
- Proposed equipment.
- Monitoring of excavation support and protection system.
- Working area location and stability.
- Coordination with traffic control movements of general public.
- Removal of plating systems.

**4.0 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. Utilization of steel plating, asphalt wedging and tack cost is considered incidental to the Lump Sum Temporary Traffic Control pay item.

AA. Concrete Manhole Apron

**1.0 Description.** The Contractor shall install a reinforced concrete apron around a manhole frame and cover or utility valve as indicated in the plans and as approved by the Engineer.

**2.0 Material.** All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Reinforcing Steel for Concrete	1036

**2.1** Concrete used for manhole apron shall be the same used for full depth pavement repairs as specified in Section 613.10 of the Standard Specifications.

**3.0 Construction Requirements.** Manhole aprons shall be provided in locations within the plans or as directed by the Engineer but generally shall be located where a manhole is adjusted to grade due to the cold-milling and overlaying of an existing roadway. The use of an apron can also be considered for new installations within new full depth asphalt pavement.

**3.1 Steel Plate.** If approved by the Engineer, a steel plate may be installed over the void created by the removal of pavement next to a manhole or utility valve prior to the installation of the manhole apron concrete. Asphalt wedging surrounding the steel plate shall be included when using a steel plate. No direct payment shall be made to provide this steel plate and asphalt wedging.

**3.2 Joint Sealing.** Per MoDOT Standard Specification 613.3.3, the contractor shall seal the joint between the asphalt surface and the new concrete apron along with seal any overcut created from the sawcutting operation when removing the portion of pavement to be replaced with manhole apron concrete. This joint shall be filled with either an expansive mortar, epoxy, polyester or joint material as approved by the Engineer. In addition, the contractor shall install tar paper between the new concrete and the existing manhole frame and cover as directed by the Engineer.

**4.0 Method of Measurement.** Measurement for installation of a reinforced concrete manhole apron will be made per each.

**5.0 Basis of Payment.** Payment for the installation of a reinforced concrete manhole apron, including all materials, equipment, labor, saw cuts before and/or after installation and all necessary work shall be completely covered by the contract unit price paid for the item listed below. Adjusting to grade the actual frame and cover shall be paid for separately. Please see JSP – Adjusting Manholes, Valves and Pullboxes for additional details regarding the adjustment to grade for those items.

Item No.	Type	Description
604-99.02	Each	Concrete Manhole Apron

BB. Drainage Flume

**1.0 Description.** This work shall consist of constructing drainage flumes to carry pedestrian over the openings to existing drainage inlets at the locations shown on the plans.

**2.0 Material requirements.** All materials shall be in accordance with Sec 703 & 706 except as noted on the plans.

**3.0 Construction Requirements.** All work performed shall be done in accordance with Sec 703 and 706 except as noted on the plans.

**4.0 Basis of Payment.** All labor, equipment, and materials necessary to comply with the provisions above shall be completely compensated at the contract unit price for:

ITEM NUMBER	DESCRIPTION	UNIT
706-99.02	7 FT X 4 FT Drainage Flume	Each
706-99.02	7 FT X 8 FT Drainage Flume	Each
706-99.02	Drainage Flume (Closed Flume) Type I	Each

CC. Convert Drop Inlet to Manhole

**1.0 Description.** This work shall consist of **removing and replacing** existing inlet tops and surrounding concrete and installing manhole segments, frame and cover. The existing inlets shall remain in place. The locations of for converting a drop inlet to a manhole are shown within the plans.

**2.0 Construction Requirements.** The contractor shall field verify the size of the inlet and requirements for conversion to a manhole prior to ordering the replacement frame and cover. If needed, the inlet shall be adjusted to the proper elevation. The contractor shall also repair any damage to the inlet, inlet invert, or pipe connection to the inlet.

**3.0 Method of Measurement.** Measurement for replacing drop inlet tops will be per each and will include **full depth saw cutting**, removing pavement, removing existing inlet tops and any necessary surrounding concrete as well as furnishing and installing the new manhole segments, frame and cover.

**4.0 Basis of Payment.** Payment for furnishing the labor, materials, equipment, and excavation necessary to convert the drop inlet to a manhole shall be paid for by the contract unit price for the following pay items:

Item No.	Type	Description
706-99.02	Each	Convert Drop Inlet to Manhole

DD. Bus Service

**1.0** The contractor shall be aware Metro Bus Service operates several different routes along various portions of Route AC with bus stops located along the entire corridor. The contractor shall maintain pedestrian access to each bus stop at all times, unless approved by the Engineer and Metro. All active bus stop signs shall remain visible at all times during construction. Should any

of the existing bus stop signs or posts be damaged by the contractor's negligence, they shall be replaced at the contractor's expense. The contractor shall contact Roderick Thomas of Metro at 314-923-3000 (office), 314-280-3622 (mobile), or [rthomas@metrostlouis.org](mailto:rthomas@metrostlouis.org) regarding the requirements of this section.

EE. Coordination with Metro Transit

**1.0 Description.** The contractor shall be required to coordinate with Metro Transit where construction operations will involve work on or around existing transit stops. It is requested that the coordination begin prior to the project Preconstruction Conference to ensure minimal disruption in service on Metro's system.

**2.0 Construction Requirements.** All Metro Transit stops within the project limits shall remain open and operational throughout the duration of the project. In locations where the contractor's operations will involve work in proximity to a transit stop location, the contractor shall notify Metro Transit through the contacts listed below, not later than 72 hours prior to beginning work at that location. The contractor shall also take care to minimize exposure of transit users to construction hazards in proximity to all transit stops that are in service during work operations.

**2.1 Project Contacts.** The contractor shall notify the following contacts at Metro Transit coordinate scheduling throughout the project with them or their designated representative(s).

Mr. Roderick Thomas, Senior Planner  
Office: (314) 923-3000  
Email: [rthomas@metrostlouis.org](mailto:rthomas@metrostlouis.org)

Ms. Natalie Siebert, Senior Planner Transit Operations  
Office: (314) 982-1400 x1816  
Cell: (314) 497-4916  
Email: [nmsiebert@MetroStLouis.org](mailto:nmsiebert@MetroStLouis.org)

Mr. Lance Peterson, Director of Service Planning  
Office: (314) 982-1520  
Cell: (314) 220-6756  
Email: [llpeterson@MetroStLouis.org](mailto:llpeterson@MetroStLouis.org)

**3.0 Temporary Facilities.** In locations where the contractor's operations may affect a transit stop location, a temporary stop may be required. Signage of the temporary stop shall be in accordance with Specification Section 104.10.2, and placement shall be coordinated with Metro Transit. All temporary transit stops shall be located in proximity to the existing stop it is representing, accessible, clear and conspicuous to both the transit rider and facility operator, and be located where it is safe from hazards within the work area.

**4.0 Basis of Payment.** No direct payment will be made for any labor, equipment, materials, and time required to comply with this provision.

FF. Parked Vehicles

**1.0 Description.** Along certain portions of the project, on-street parking is permitted. It will be necessary for the contractor to coordinate with the various police departments in the area along with MoDOT Maintenance to arrange for proper posting of temporary “No Parking” signs, and for any required towing of vehicles to allow the project to be completed in a sequential manner.

In addition to the on-street parking, there are numerous parking lots and car dealerships along the project with parked vehicles. If any of these vehicles interferes with the work, the Contractor shall notify, in writing, the owners of such vehicles, advising them of the nature of the interference and shall arrange and cooperate with them for the protection or disposition of such vehicles. The Contractor shall furnish the Engineer with copies of such notifications and with copies of any agreement between the Contractor and the property owners concerning such protection or disposition.

The Contractor shall take all necessary precautions for the protection of the parked vehicles contiguous to the work.

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

#### GG. Resident Parking

**1.0 Description.** Along portions of the project, specifically from Old Halls Ferry to Capitol Drive, numerous private entrances provide the only means of access to residences along the corridor.

The contractor shall be allowed to permanently close lanes on Route AC in segments referenced in the Work Zone Traffic Management Plan. As a condition of this closure plan, the contractor shall allow parking along the side of Route AC being worked on to provide access for residents while entrances are being reconstructed, if continuous access cannot be maintained. The contractor shall include a buffer area between ongoing working operations and allowed parking locations.

The contractor shall be allow to permanently close lanes on Route AC in segments referenced in the Work Zone Management Plan. As a condition of this closure plan, the contractor shall allow parking along the side of Route AC being worked on to provide access for residents while entrances are being reconstructed, if continuous access cannot be maintained. The contractor shall include a buffer area between ongoing working operations and allowed parking locations.

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

#### HH. Expiration of Temporary Construction Easements

**1.0 Description.** The temporary construction easements (TCE's) acquired by the Commission are a valid property right for a two-year period. Beyond two years, the temporary property right acquired by the Commission will expire. The two-year period begins on the day Commission provides the notice to proceed.

**2.0 Construction Requirement.** The contractor shall have all work requiring access to the TCE's completed within a two-year period.

**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. If work is incomplete and the contractor needs access to TCE's past the two-year period, the Contractor shall be responsible for all costs associated with obtaining a new temporary construction easement by others.

II. Property Owner Notification

**1.0 Description.** It shall be the contractor's responsibility to inform and notify the adjacent property owner 48 hours prior to starting any construction activities that may impact driveway and parking lot access or occur along the frontage of the property owner's parcel. Notification shall be in written form and include the contractor's contact information, the Engineer's contact information, and an estimated schedule of work and the associated impacts.

**2.0 Basis of Payment.** No direct payment will be made to the contractor for the labor, equipment, material, or time required to comply with this provision.

JJ. Access to Commercial and Private Entrances

**1.0 Description.** While working on entrances or adjacent properties, the contractor shall make every reasonable effort to minimize any interference to the properties and to complete the work diligently. Under no circumstances shall the contractor block ingress/egress to and from businesses during the normal business hours of each business unless as approved by the property owner and engineer.

**2.0 Construction Requirements.** On all commercial entrances or private entrances greater than 20' wide, the contractor shall keep one-half of the entrance open at all times. On commercial entrances less than 20' wide it may be necessary for the contractor to provide temporary aggregate to provide access to the property. The contractor shall remove and dispose of the temporary aggregate following completion of the entrance. For properties with more than one entrance the contractor may construct one entire entrance at a time with the approval of the property owner and the engineer.

**2.1** The contractor shall complete the entrances as quickly as possible and shall take no longer than 4 weeks to complete any one entrance over 20' wide. The contractor shall take no longer than 5 days to complete any one private or commercial entrance with a width less than 20'.

**3.0 Property Owner Agreements.** Agreements made with property owners during the negotiations of easements and rights of way listed in the Property Owner Agreements special provision shall be adhered to and shall supersede the requirements in the Access to Commercial and Private Entrances special provision.

**4.0 Basis of Payment.** No direct payment will be made to the contractor for any expenses incurred for compliance with this provision.

1 REVISED

## KK. Delayed Access to Parcels Pending Acquisition

**1.0 Description.** Acquisition is pending for the parcels listed below on the project. The contractor shall not be permitted to begin work within any designated Permanent Easement or Temporary Easement on any of these parcels until the Easement acquisition has been completed. An anticipated date of possession has been provided for each parcel to assist with scheduling purposes.

**2.0 Construction Requirements.** The contractor shall verify with the engineer prior to beginning work on any of the parcels listed in this provision. The contractor will not be permitted access to work on any of these parcels until notification has been given by the engineer that the parcel has been cleared from this list.

**3.0 Parcels.** The following is the list of the parcels where acquisition is pending.

Parcels 1, 7, 10, 11, 13, 17, 18, ~~22~~, 23, 25, 27, 31: Anticipated possession by the contractor notice to proceed date of April 20, 2026.

Parcels 2, ~~9~~, ~~12~~, 15, ~~16~~, 19, ~~20~~, 28: Anticipated possession by June 30, 2026.

1 REVISED

## LL. Property Owner Agreements

**1.0 Description.** During the negotiations of easements and rights of way, MoDOT entered into agreements with certain property owners. The Contractor shall abide by the following commitments.

**A) Parcel 01, 10751 Old Halls Ferry Road**

- Driveway entrance centered at Station 329+39.14 LT is to be constructed one-half at a time.

**B) Parcel 03, 10554 Halls Ferry Road**

- Driveway entrance centered at Station 341+60.54 LT will be closed entirely during construction of this entrance. Temporary parking will be provided via a dropped lane in front of the property.

**C) Parcel 04, 10548 Halls Ferry Road**

- Driveway entrance centered at Station 342+37.19 LT will be closed entirely during construction of this entrance. Temporary parking will be provided via a dropped lane in front of the property.

**D) Parcel 05, 10542 Halls Ferry Road**

- Driveway entrance centered at Station 342+94.79 LT will be closed entirely during construction of this entrance. Temporary parking will be provided via a dropped lane in front of the property.

**E) Parcel 06, 10536 Halls Ferry Road**

- Driveway entrance centered at Station 343+59.85 LT will be closed entirely during construction of this entrance. Temporary parking will be provided via a dropped lane in front of the property.

F) **Parcel 18, 2202 Chambers Road**

- Driveway entrance centered at Station 400+79.88 LT is to be constructed one-half at a time.

G) **Parcel 21, 2140 Chambers Road**

- The Contractor shall install a temporary entrance between the two existing entrances off Chambers Road prior to beginning the reconstruction of the existing entrances centered at Station 13+80.11 LT and centered at Station 14+41.87 LT and prior to installing new sidewalk along Chambers Road as shown in the plans.
- The Contractor shall keep at least 1 of the existing entrances open at all times along with the temporary entrance in between the two existing entrances to allow vehicles to enter and exit the property.
- Prior to beginning work near Parcel 21, the Contractor shall contract the Parcel owner at the following number: Dorothy Miller 314-869-0515.

H) **Parcel 30, 9800 Halls Ferry Road**

- Driveway entrance centered at Station 429+75.41 LT and driveway entrance centered at Station 430+60.92 LT is to be constructed entirely one at a time. Only 1 entrance can be under construction at any time.

MM. Liquidated Damages related to Property Owner Agreements

**1.0 Description.** After the pre-construction meeting, the contractor shall work with the Engineer so that a meeting can be scheduled with MoDOT Right-of-Way staff to walk through the job and identify parcels noted in JSP – Property Owner Agreements. **The contractor shall not begin construction until such a meeting is held.**

**1.1** If the agreements, listed in JSP – Property Owner Agreements, are not followed to the satisfaction of the Engineer, the Commission and the impacted property owner will be damaged in various ways, including but not limited to, increased construction administration cost and potential liability, with its resulting cost to the traveling public. 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 **\$1,000 per case** for each case that the agreement listed in JSP – Property Owner Agreements, is not followed to the satisfaction of the Engineer. It shall be the responsibility of the engineer to determine the number of cases where the agreement was not followed.

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

NN. Site Restoration

**1.0 Description.** Restore to its original condition any disturbed area at sites including, but not limited to, guardrail, 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** If the contractor elects and receives approval from the engineer for alternate trench and/or pull box locations, any areas of concrete slope protection, sidewalk, pavement, shoulders, islands and medians – as well as any similar improvements consisting of asphaltic concrete materials – removed in conjunction with their construction shall be replaced with improvements of similar composition and thickness. Removals shall be achieved by means of full depth saw cuts, the resulting subgrade compacted to minimum density requirements and topped with 4 inches of compacted aggregate base course prior to replacement of surface materials. Concrete materials used in replacement, shall be approved by the engineer. A commercial asphalt mix may be used for replacement of asphaltic surfacing upon approval of the engineer.

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

**2.2** Sidewalks and sidewalk ramps that are disturbed as described in this provision shall be replaced to meet current ADA standards at the contractor's expense.

**2.2** Areas that are used by the contractor for jobsite trailers, equipment and materials storage, or used for project staging areas that are disturbed shall be cleaned up and restored to a condition that is both acceptable to the engineer and, at a minimum, equivalent to the existing site condition.

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

OO. Removal of Unhoused Encampment under Bridges

**1.0 Description.** This work pertains to the removal and the maintenance thereof of encampment of the unhoused currently located under the I-270 Bridges A8968 & A8969.

**2.0 Coordination.** Three (3) weeks prior to the planned start date for work on Bridge A0223, the Contractor shall contact the Resident Engineer and coordinate the efforts of removing the various items under the bridge. An initial, onsite meeting to discuss the extent and process for removals will be held with MoDOT Area Team members, members from MoDOT Environmental, the Resident Engineer and their assigned personnel, and the Contractor and its assigned personnel.

**2.1** The removals shall be coordinated to be in close proximity to the Contractor's start date so that construction fencing can be installed (by Contractor) and when construction activity and contractor presence will be regular.

**2.2** The initial removal of the items shall be completed by MoDOT forces. The Contractor shall be present for a pre-final walkthrough of the area after removals have occurred to confirm / accept that the extent of the removals allows them the access and working room necessary for them to safely complete their construction activities.

**2.3** Upon Contractor acceptance of the removal, the responsibility of maintaining the jobsite from similar encampments will be the Contractors.

**3.0 Basis of Payment.** No direct payment will be made to the Contractor to recover costs of the equipment, labor, materials, or time required for this coordination or maintenance of the above removals.

PP. Remove and Reinstall Mailboxes

**1.0 Description.** The Contractor shall be made aware that there are several mailboxes that will be impacted along Route AC during construction operations. The Contractor shall ensure that a mailbox is available for mail to be delivered to the property owner throughout the project's entire duration. This may require the Contractor to provide a temporary mailbox within close proximity to the existing mailbox.

**1.1** The Contractor shall contact the Engineer if he or she has any concerns regarding any existing mailboxes.

**1.2** The Contractor shall reinstall impacted mailboxes as shown in the plans. The Contractor is encouraged to reuse existing mailboxes where possible.

**2.0 Method of Measurement.** Measurement will be made per each mailbox reinstalled.

**3.0 Basis of Payment.** Payment for Mailbox Reinstallation will be made at the contract unit price. Payment shall include all excavation, compaction, saw cuts, and all materials, equipment, tools, labor, and work incidental thereto, and shall be considered to be completely covered by the contract unit price for items listed below as indicated in the plans.

Item Number	Unit	Description
202-99.02	EA	Mailbox Reinstallation

QQ. Linear Grading Class 2 – Modified

**1.0 Description.** Modified Linear Grading, Class 2 shall consist of any necessary clearing and grubbing in accordance with Sec 201, preparing the subgrade for shoulder, pavement widening, sidewalk, curb and gutter, paved approaches, roadside retaining wall, or other roadside appurtenance by excavating, compacting, fine-grading, and shaping existing shoulder and ditch fore-slope, conforming to the typical section shown on the plans. It may be necessary to haul material.

**2.0 Construction Requirements.** The shoulder, pavement widening, sidewalk, curb and gutter, roadside retaining wall, or other roadside appurtenance shall be excavated and graded as shown on the typical section with minimal disturbance of the existing sub-grade and fore slope. Density shall be obtained from reasonable compactive efforts consisting of no less than three passes with a roller until no further visible compaction can be achieved, or by other methods approved by the Engineer. Subgrade preparation and compaction shall also be in accordance with Sections 203, 209 and 210.

**2.1** All ditches shall be graded to drain and maintain existing flow capacity, unless approved by the engineer. If fill material for the shoulder widening work impacts the ditch capacity, the contractor shall re-grade the backslope to maintain the flow capacity of the ditch. Fore slopes and back slopes shall be constructed at a 3:1, except as noted on the plans or approved otherwise by the engineer.

**2.2** It may be necessary to go outside the limits of the right of way to obtain additional material or to dispose of excess material. All costs for providing additional material or disposing of excess material shall be included at the contract unit price for pay item 207-99.09, Modified Linear Grading, Class 2. All contractor furnished material shall be approved by the Engineer prior to being incorporated into the project. Quarry screenings will not be considered an approved contractor furnished material.

**2.3 Included in this work is any pavement edge treatment that might be necessary to stay in compliance with the Standard Plans.** The need for edge treatment is determined by the contractor's method of operations.

**3.0 Method of Measurement.** Measurement will be made to the nearest 1/10 station separately for the length of pavement edge along each side of the roadway, measured along centerline of the traveled way and totaled to the nearest Station for the sum of all segments in accordance with Section 207.

**4.0 Basis of Payment.** Payment for Modified Linear Grading, Class 2 as described in this provision will be made at the contract unit price for:

Item Number	Unit	Description
207-99.09	Station	Linear Grading Class 2, Modified

RR. ADA Compliance and Final Acceptance of Constructed Facilities JSP-10-01C

**1.0 Description.** The contractor shall comply with all laws pertaining to the Americans with Disabilities Act (ADA) during construction of pedestrian facilities on public rights of way for this project. An ADA Checklist is provided herein to be utilized by the contractor for verifying compliance with the ADA law. The contractor is expected to familiarize himself with the plans involving pedestrian facilities and the ADA Post Construction Checklist prior to performing the work.

**2.0 ADA Checklist.** The contractor can locate the ADA Checklist form on the Missouri Department of Transportation website:

<https://www.modot.org/forms-contractor-use>

**2.1** The ADA Checklist is not to be considered all-inclusive, nor does it supersede any other contract requirements. The ADA checklist is a required guide for the contractor to use during the construction of the pedestrian facilities and a basis for the commission's acceptance of work. Prior to work being performed, the contractor shall bring to the engineer's attention any planned work that is in conflict with the design or with the requirement shown in the checklist. This notification shall be made in writing. Situations may arise where the checklist may not fully address all requirements needed to construct a facility to the full requirements of current ADA law. In those situations, the contractor shall propose a solution to the engineer that is compliant with current ADA law using the following hierarchy of resources: 2010 ADA Standards for Accessible Design, Draft Public Rights of Way Accessibility Guidelines (PROWAG) dated November 23, 2005, MoDOT's Engineering Policy Guidelines (EPG), or a solution approved by the U.S. Access Board.

**2.2** It is encouraged that the contractor monitor the completed sections of the newly constructed pedestrian facilities in attempts to minimize negative impacts that his equipment, subcontractors or general public may have on the work. Completed facilities must comply with the requirements of ADA and the ADA Checklist or have documented reasons for the non-compliant items to remain.

### **3.0 Coordination of Construction.**

**3.1** Prior to construction and/or closure on an existing pedestrian path of travel, the contractor shall submit a schedule of work to be constructed, which includes location of work performed, the duration of time the contractor expects to impact the facility and an accessible signed pedestrian detour compliant with MUTCD Section 6D that will be used during each stage of construction. This plan shall be submitted to the engineer for review and approval at or prior to the pre-construction conference. Accessible signed detours shall be in place prior to any work being performed that has the effect of closing an existing pedestrian travel way.

**3.2** *When consultant survey is included in the contract, the contractor shall use their survey crews to verify that the intended design can be constructed to the full requirements as established in the 2010 ADA Standards. When 2010 ADA Standards do not give sufficient information to construct the contract work, the contractor shall refer to the PROWAG.*

**3.3** When consultant survey is not included in the contract, the contractor shall coordinate with the engineer, prior to construction, to determine if additional survey will be required to confirm the designs constructability.

**4.0 Final Acceptance of Work.** The contractor shall provide the completed ADA Checklist to the engineer at the semi-final inspection. ADA improvements require final inspection and compliance with the ADA requirements and the ADA Checklist. Each item listed in the checklist must receive either a "YES" or an "N/A" score. Any item receiving a "NO" will be deemed non-compliant and shall be corrected at the contractor's expense unless deemed otherwise by the engineer. Documentation must be provided about the location of any non-compliant items that are allowed to remain at the end of the construction project. Specific details of the non-compliant items, the ADA requirement that the work was not able to comply with, and the specific reasons that justify the exception are to be included with the completed ADA Checklist provided to the engineer.

**4.1** Slope and grade measurements shall be made using a properly calibrated, 2 foot long, electronic digital level approved by the engineer.

**5.0 Basis of Payment.** The contractor will receive full pay of the contract unit cost for all sidewalk, ramp, curb ramp, median, island, approach work, cross walk striping, APS buttons, pedestrian heads, detectible warning systems and temporary traffic control measures that are completed during the current estimate period as approved by the engineer. Based upon completion of the ADA Checklist, the contractor shall complete any necessary adjustments to items deemed non-compliant as directed by the engineer.

**5.1** 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 documents.

SS. ADA Material Testing Frequency Modifications JSP-23-01A

*1.0 Description. This provision revises the Inspection and Testing Plan (ITP) for the construction of ADA compliant features to better match the nature of the work. The minimum Quality Control (QC) testing frequencies shall be as stated in these provisions.*

*2.0 Compaction Test on Base Rock Under Sidewalk, Curb Ramps and Paved Approaches. (Revises ITP Sec 304.3.4) The required test frequency shall be one per 600 tons.*

*3.0 Gradation Test on Base Rock Under Sidewalk, Curb Ramps and Paved Approaches. (Revises ITP Sec 304.4.1) The required frequency shall be one per 500 tons.*

*4.0 Concrete Plant Checklists. (Revises ITP Sec 501) Submittal of the 501 Concrete Plant Checklist shall be once per week when the contractor is only pouring curb, sidewalk, paved approaches, and curb ramps.*

*5.0 Concrete Median, Median Strip, Sidewalk, Curb Ramps, Steps and Paved Approaches. The required frequency shall remain as stated in ITP Sec 608 and further detailed in Sec 608.3.7.*

*6.0 Concrete Curb. (Revises ITP Sec 609 only for Concrete Curb) For concrete curb, the required frequency shall be equivalent to ITP Sec 608 (concrete median, median strip, sidewalk, curb ramps, steps, and paved approaches), and Sec 608.3.7.*

TT. ADA Curb Ramp – St. Louis District Version 01-17-24

**1.0 Description.** This work shall consist of constructing new concrete curb ramps that are compliant with current Americans with Disabilities Act (ADA) and MoDOT guidelines at locations shown on the plans and as directed by the engineer.

**1.1** The contractor shall ensure that the persons establishing the grades of the ADA facilities have a copy of ADA related provisions at hand for reference. If it is found that written provisions for ADA facilities are not at hand, the engineer may cause ADA work to be ceased until a copy arrives.

**2.0 Construction Requirements.** Except as noted herein, all applicable provisions in Sec 608 of the Standard Specifications shall apply to the construction of the curb ramps.

**2.1** The following shall be included in the cost of a new ADA ramp:

- Excavation and preparing of the subgrade prior to placement of the aggregate base
- 4" Type 5 Aggregate Base underneath the new ramp
- Everything shown in the various figures of ADA ramp curb types on Standard Plan 608.50 shall be poured as 7" concrete. This includes all area of ramp, level landing pads and any flares included in the per each ADA Ramp.
- Variable height curb along the roadway within the limits of the new ADA ramp
- Variable height curb along the backside of the new ADA ramp
- Concrete median used to separate direction of travel within a dual perpendicular ramp
- Furnishing and installing any reinforcement needed as shown in the plans for curbs taller than 8"
- Tinting of concrete surface as required in the plans
- Saw Cuts needed for the removal of the existing concrete area where the new ADA ramp is being constructed
- Removal of the existing concrete area where the new ADA ramp is being constructed

**2.1.1** Regardless of the number of ramp areas or surfaces having a maximum ramp slope of 1V:12H (8.33%) that are constructed for a particular type of ADA Curb Ramp, the contractor **will not** be paid for additional number of ramps at that location. See special sheet for curb ramp pay limits. Exception: **Dual Perpendicular Ramps and Blended Transitions** will be paid as 2 each.

**2.2** The following shall be paid for separately in the cost of a new ADA ramp:

- Truncated Domes

**2.2.1** Detectable warning surfaces shall be provided, where a curb ramp, landing, or blended transition connects to a street. Where commercial or private driveways are provided with traffic control devices or otherwise are permitted to operate like public streets, detectable warnings should be provided at the junction between the pedestrian route and the street. See plans for additional details.

**2.2.2** The truncated domes shall come from Materials' Pre-Qualified List FS-1067 Table 1 from the following link:

<https://www.modot.org/materials>

**2.3 Gutter Correction.** The contractor shall establish the grade of the flow line of the gutter before establishing the grades of ADA facilities. The gutter line shall be free flowing with no ponding next to the curb. Under-performing gutters shall be replaced with a concrete curb and gutter or a minimum 1.75-inch thick asphalt mill and fill. Running or standing storm water shall not be pushed out into the roadway where it may be splashed on pedestrians by passing vehicles or cause a hydroplaning hazard. An asphalt mill and fill shall be a minimum of 1.75 inches thick and the edges shall be at a smooth milled butt joint. The contractor shall use an approved BP-1 mix for all corner asphalt mill and fill work unless another surface asphalt mix is specified elsewhere in the contract. Asphalt mill and fill is included in the work of ADA Curb Ramps. If asphalt mill and fill is needed at a corner without any other ADA work, it will be found as a separate line item in this contract.

## 2.4 Design Plans

**2.4.1** Recommendations for the design type of each curb ramp to be built on this project are shown on the plans. Curb ramps constructed by the contractor may vary from the original design, with approval from the engineer, in size, shape, and location as necessary to comply with ADA laws. It is the contractor's responsibility to inspect locations in the field before bidding to verify quantities needed to satisfy this provision. No additional pay will be made to the contractor if the original design is adjusted, and a different ramp type is constructed instead of the recommended/suggested in the plans.

**2.4.2** ADA provides some exceptions to ramp slope where space limitations exist. The apparent construction limits shown on the plans are not considered a space limitation. The contractor shall not place any ADA exceptions without consulting the Engineer on a case-by-case basis.

**2.4.3 Special Sheet.** A special sheet shows the pay limits for each standard ADA ramp type used by MoDOT. This special sheet is not intended to replace the Standard Plans, Standard specifications or MoDOT's ADA checklist but is intended only to provide consistency regarding pay lengths/limits within the St. Louis District.

As shown on this special sheet, 15 feet beyond the landing is considered part of the ADA ramp. Payment for the ramp will be 15 feet beyond the landing and no adjustment in sidewalk length/quantity will be made if this 15-foot ramp length is adjusted by the contractor in the field.

**2.4.4** When a project is **only** replacing ADA Curb Ramps at intersections, a warping panel shall be included and considered incidental to the cost of the new ADA Curb Ramp. When a project is also constructing new sidewalk tied into the new ADA Curb Ramp, this warping panel shall be paid for within the sidewalk pay item. A warping panel consists of tying in an ADA compliant cross slope to an existing cross slope.

**2.5 Median or Median Island Cut-throughs.** If there is an actual ramp with a slope not exceeding 8.33% (1V:12H) that provides access to the **raised portion** of the island or median instead of cutting through a portion of the island or median, then that area of concrete will be paid for separately as an ADA Curb Ramp, per each, as noted below. If the pedestrian path cuts through an island or median, then this area is not considered a ramp and will be paid for with individual items necessary to construct this pedestrian path.

**2.6 Prosecution of Work.** The contractor shall have all necessary personnel, equipment, and materials at hand for all work at each location before the work begins so that work may proceed without delay.

**3.0 Method of Measurement.** Final measurement will not be made for each ramp except for authorized changes during construction or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

**4.0 Basis of Payment.** The accepted quantity of ADA compliant curb ramps will be paid at the contract unit price for the following items:

Pay Item Number	Type / Description	Unit
608-10.12	Truncated Domes	SF

608-99.02	ADA Curb Ramp	Each
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UU. Concrete Sidewalk and Curb Jointing at Utility Poles

**1.0 Description.** Contractor shall provide longitudinal and transverse jointing for concrete sidewalk and concrete curbing to direct pedestrians around utility poles. The longitudinal and transverse jointing shall be completed to provide separation from the pedestrian access route on the sidewalk from utility poles.

**2.0 Construction Requirements.** At each utility pole located within the sidewalk or curbing adjacent to sidewalk, concrete jointing/edging shall be provided to a depth of ¾-inch. The jointing shall be as per direction of Engineer.

**2.1** Jointing to be completed to guide sidewalk users around utility poles. The length of longitudinal joints shall be a length of 10-feet (maximum length of 15-feet) at each utility pole. Transverse short jointing shall be completed within the longitudinal joint at 12-inch intervals.

**2.2** Jointing pattern shall be approved by Engineer as part of the pre-concrete placement conference.

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

VV. Non-Tracking Tack JSP-24-02A

**1.0 Description.** This work requires application of tack in accordance with Sec 407 and prevention of tack loss from the surface as specified herein. Tack loss prevention shall be accomplished with successful usage of a MoDOT-approved non-tracking tack, or other acceptable non-tracking means, as approved by the engineer.

**2.0 MoDOT-Approved Non-Tracking Tack.** A list of MoDOT-approved non-tracking tack products is available at MoDOT.org under the Materials Qualified List. Upon request from the contractor, the MoDOT Division of Construction & Materials will consider allowance of other non-tracking products. To be approved, the contractor must successfully demonstrate that the proposed product meets the non-tracking requirements specified in section 3.0. The location of a contractor demonstration will only be allowed in areas approved by the engineer. The engineer will make final determination of product acceptance based on observation of the results of the contractor's demonstration.

**2.1** Products on the Qualified List have demonstrated successful non-tracking performance on previous projects; however, the Commission does not endorse nor guarantee success of any of the listed products. Success is dependent on the contractor choosing a product that can achieve the desired results while also taking into consideration all factors, including, but not limited to, cure time, weather conditions, surface prep, surface type, material properties, and adherence to manufacturer's instructions. The contractor is responsible for monitoring adherence of the tack to the pavement surface and shall cease operations when tack first begins to show signs of not meeting the requirements of Section 3.0. Corrective action shall be made prior to resuming tacking operations.

**3.0 Non-Tracking Requirements.** Non-tracking tack shall remain adhered to the pavement surface when exposed to any wheeled or tracked vehicles. The tack shall not track off the surface within 30 minutes of being applied, and shall not stick to the tires, tracks or other parts of paving equipment or vehicles such that the underlying surface becomes visible or void of tack prior to the placement of the hot mix asphalt. The tack shall not track onto any adjacent lanes, pavement markings, driveways, sideroads, etc.

**3.1** The contractor shall be responsible for cleaning all tracked tack from adjacent lanes, driveways, sideroads, etc., and shall replace all pavement markings that become coated with tracked tack. This cleaning and replacement requirement applies to both approved and proposed non-tracking products.

**4.0 Basis of Payment.** Measurement and payment shall be in accordance with Sec 407. The accepted quantity of non-tracking tack coat will be paid for per gallon at the contract unit price. No additional payment will be made for the cost to demonstrate proposed products, for cleaning surfaces due to tracking of tack, or for replacement of pavement marking damaged by tracked tack.

Item No.	Type	Description
407-10.07	Gal	Tack Cost – Non-Tracking

WW. Asphalt Coldmilling / Paving Requirement

**1.0 Description.** Asphalt coldmilling / paving requirement for the project.

**2.0 Construction Requirements.** Asphalt coldmilled pavement areas shall be filled with the corresponding asphaltic concrete mixture during the same work shift.

**2.1** The contractor shall provide a material transfer vehicle during asphalt paving operations to ensure a consistent temperature of the asphalt throughout paving and to prevent segregation of the mix in order to produce an uniform final product.

**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.

XX. Balanced Mix Design Requirements for Sec 403 Asphalt JSP-24-01C

**1.0 Description.** Balanced Mix Design (BMD) and Paver-Mounted Thermal Profiles (PMTP), as specified herein, are required on this project for all Sec 403 asphaltic concrete pavement surface and base course mixes. BMD shall be in accordance with section 2.0. PMTP shall be in accordance with section 3.0. No additional payment will be made for compliance with these provisions.

**1.1 Rapid Penetrating Emulsion.** Should use of Rapid Penetrating Emulsion (RPE) be necessary for corrective action of longitudinal joint density, as specified elsewhere in section 2.0, RPE shall be in accordance with MoDOT JSP2303 Rapid Penetrating Emulsion (available at: [https://epg.modot.org/index.php/Job\\_Special\\_Provisions](https://epg.modot.org/index.php/Job_Special_Provisions)), except that no payment will be made for use of RPE.

2.0 Delete Sec 403 in its entirety and substitute the following:

**403 ASPHALTIC CONCRETE PAVEMENT with Balanced Mix Design**

**403.1 Description.** This work shall consist of providing a bituminous mixture to be placed in one or more courses on a prepared base or underlying course as shown on the plans or as directed by the engineer. The contractor shall be responsible for QC of the bituminous mixture, including the design, and control of the quality of the material incorporated into the project. The engineer will be responsible for QA, including testing, to assure the quality of the material incorporated into the project.

**403.1.1 Naming Convention.** The nomenclature of Superpave bituminous mixture names, such as SP125CLP, will be as follows. When only the aggregate size is shown, such as SP125, the specifications shall apply to all variations of that size, such as SP125B, SP125C, SP125CLP, etc. When "x" is indicated, such as SP125xLP, specifications shall apply to all variations of mixture designs. Stone Matrix Asphalt will be generally referred to as SMA and designated by SM or SMR.

<b>Superpave Nomenclature</b>	
<b>SP</b>	<b>Superpave</b>
048	4.75mm (No. 4) nominal aggregate size
095	9.5 mm (3/8 inch) nominal aggregate size
125	12.5 mm (1/2 inch) nominal aggregate size
190	19.0 mm (3/4 inch) nominal aggregate size
250	25.0 mm (1 inch) nominal aggregate size
x	Mixture design: B, C, E or F (as described below)
LP	Limestone porphyry (when designated)
SM	Stone Matrix Asphalt (when designated)
SMR	Stone Matrix Asphalt limestone/non-carbonate (when designated)

**403.1.2 Design Levels.** The following cumulative equivalent single axle loads (ESALs) shall be used for the specified mix design. The same size aggregate mix design at a higher design traffic may be substituted at the contractor's expense for the contract specified mixture design with the approval from the engineer. Substitutions shall be done uniformly and project mixing of various designs for the same work will not be permitted. For example, an SP125B mixture may be substituted for an SP125C mixture, or SP190C for SP190E, etc. Mixture design substitution will be limited to one design level higher than that specified in the contract.

<b>Design Traffic (ESALs)</b>	<b>Design</b>
< 300,000	F
300,000 to < 3,000,000	E
3,000,000 to < 30,000,000	C
≥ 30,000,000	B

**403.2 Material.** All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Aggregate	1002
Asphalt Binder, Performance Graded (PG)*	1015
Fiber Additive	1071
Anti-Strip Additive	1071

\*The grade of asphalt binder will be specified in the contract.

**403.2.1 Stone Matrix Asphalt.** In addition to other requirements, material for SMA mixtures shall meet the following. Coarse aggregate shall consist of crushed limestone and either porphyry or steel slag in accordance with the quality requirements of [Sec 1002](#), except as follows. The Los Angeles (LA) abrasion, when tested in accordance with AASHTO T 96, shall not exceed 40 percent based on initial ledge approval and source approval. The percent absorption, when tested in accordance with AASHTO T 85, shall not exceed 3.5 percent based on the individual fractions. The amount of flat and elongated particles, measured on material retained on a No. 4 sieve, of the blended aggregate shall not exceed 20 percent based on a 3:1 ratio or 5 percent based on a 5:1 ratio.

**403.2.2 Filler Restriction.** Rigden void content determined in accordance with MoDOT Test Method TM-73 shall be no greater than 50 percent.

**403.2.3 Fibers.** A fiber additive shall be used as a stabilizer in SMA Mixtures. Fibers shall be uniformly distributed by the end of the plant mixing process. The dosage rate for fibers shall be no less than 0.3 percent by weight of the total mixture for cellulose and no less than 0.4 percent by weight for mineral fibers.

**403.2.4 Reclaimed Asphalt.** A maximum of 30 percent virgin effective binder replacement may be used in mixtures without changing the grade of binder. The asphalt binder content of recycled asphalt materials shall be determined in accordance with AASHTO T 164, ASTM D 2172 or other approved method of solvent extraction. A correction factor for use during production may be determined for binder ignition by burning a sample in accordance with AASHTO T 308 and subtracting from the binder content determined by extraction. The aggregate specific gravity shall be determined by performing AASHTO T 209 in accordance with [Sec 403.19.3.1.2](#) and calculating the  $G_{se}$  to which a 0.98 correction factor will be applied to obtain the  $G_{sb}$  as follows:

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}} \qquad \text{RAP } G_{sb} = \text{RAP } G_{se} \times 0.98$$

**403.2.5 Reclaimed Asphalt Pavement.** Reclaimed Asphalt Pavement (RAP) may be used in any mixture, except SMA mixtures. Mixtures may be used with more than 30 percent virgin effective binder replacement provided testing according to AASHTO M 323 is included with the job mix formula that ensures the combined binder meets the grade specified in the contract. All RAP material, except as noted below, shall be tested in accordance with AASHTO T 327, *Method of Resistance of Coarse Aggregate Degradation by Abrasion in the Micro-Deval Apparatus*. Aggregate shall have the asphalt coating removed either by extraction or binder ignition during production. The material shall be tested in the Micro-Deval apparatus at a frequency of once per 1500 tons. The percent loss shall not exceed the Micro-Deval loss of the combined virgin material

by more than five percent. Micro-Deval testing will be waived for RAP material obtained from MoDOT roadways. All RAP material shall be in accordance with [Sec 1002](#) for deleterious and other foreign material.

**403.2.6 Reclaimed Asphalt Shingles.** Reclaimed Asphalt Shingles (RAS) may be used in any mixture specified to use PG 64-22 in accordance with AASHTO PP 53 except as follows: When the ratio of virgin effective binder to total binder in the mixture is between 60 and 70 percent, the grade of the virgin binder shall be PG 52-28 or PG 58-28. Shingles shall be ground to 3/8-inch minus. Waste, manufacturer or new, shingles shall be essential free of deleterious materials. Post-consumer RAS shall not contain more than 1.5 percent wood by weight or more than 3.0 percent total deleterious by weight. Post-consumer RAS shall be certified to contain less than the maximum allowable amount of asbestos as defined by national or local standards. The gradation of the aggregate may be determined by solvent extraction of the binder or using the following as a standard gradation:

<b>Shingle Aggregate Gradation</b>	
<b>Sieve Size</b>	<b>Percent Passing by Weight</b>
3/8 in.	100
No. 4	95
No. 8	85
No. 16	70
No. 30	50
No. 50	45
No. 100	35
No. 200	25

**403.3 Composition of Mixtures.**

**403.3.1 Gradation.** Prior to mixing with asphalt binder, the combined aggregate gradation, including filler if needed, shall meet the following gradation for the type of mixture specified in the contract. A job mix formula may be approved which permits the combined aggregate gradation during mixture production to be outside the limits of the master range when the full tolerances specified in [Sec 403.5](#) are applied.

<b>Percent Passing by Weight</b>							
<b>Sieve Size</b>	<b>SP250</b>	<b>SP190</b>	<b>SP125</b>	<b>SP095</b>	<b>SP048</b>	<b>SP125xSM(R)</b>	<b>SP095xSM(R)</b>
1 1/2 in.	100	---	---	---	---	---	---
1 in.	90 - 100	100	---	---	---	---	---
3/4 in.	90 max.	90 - 100	100	---	---	100	---
1/2 in.	---	90 max.	90 - 100	100	---	90-100	100
3/8 in.	---	---	90 max.	90-100	100	50-80	70-95
No. 4	---	---	---	90 max.	90-100	20 - 35	30-50
No. 8	19 - 45	23 - 49	28 - 58	32-67	---	16 - 24	20-30
No. 16	---	---	---	---	30-60	---	21 max.
No. 30	---	---	---	---	---	---	18 max.
No. 50	---	---	---	---	---	---	15 max.
No. 100	---	---	---	---	---	---	---
No. 200	1 - 7	2 - 8	2 - 10	2-10	7-12	8.0-11.0	8.0-12.0

**403.3.2 Anti-Strip Agent.** An anti-strip will be allowed by the engineer to improve resistance to stripping. Anti-strip agents and application rates shall be from a list approved in accordance with [Sec 1071](#).

**403.3.3 Porphyry Mixtures.** For LP and SMA mixtures, at least 50 percent by volume of the aggregate shall be crushed porphyry retained on the following sieves: No. 30 for SP048, No. 16 for SP095 and No. 8 for SP125. Depending on the actual gradation of porphyry aggregate furnished, the amount of crushed porphyry required may vary, however at least 40 percent by weight of crushed porphyry will be required. Steel slag may be substituted for porphyry in LP and SM mixtures, except at least 45 percent by weight of crushed porphyry and/or slag will be required. The engineer may approve the use of other hard, durable aggregate in addition to porphyry and steel slag. When an SMR mixture is designated, the mixture shall contain aggregate blends with at least 30 percent non-carbonate material in accordance with [Sec 403.3.5](#).

**403.3.4 Minimum Stone Matrix Asphalt Binder.** The percent asphalt binder for SMA mixtures shall not be less than 6.0 percent unless otherwise allowed by the engineer.

**403.3.5 Surface Mixtures.** Design level B surface mixtures and SP048NC, except as described in [Sec 403.15.3](#), containing limestone coarse aggregate shall contain a minimum amount of non-carbonate aggregate. The LA abrasion values, AASHTO T 96, of the limestone will determine the type and amount of non-carbonate aggregate required as shown in the table below. The LA abrasion value will be determined from the most recent source approval sample. In lieu of the above requirements, the aggregate blend shall have an acid insoluble residue (AIR), MoDOT Test Method TM 76, meeting the plus No. 4 criteria of crushed non-carbonate material. Non-carbonate aggregate shall have an AIR of at least 85 percent insoluble residue.

Coarse Aggregate (+ No. 4)	Minimum Non-Carbonate by Volume
Limestone, LA ≤ 30	30% Plus No. 4
Limestone, LA > 30	20% Minus No. 4*
Dolomite	No Requirement

\*Use for all SP095 and SP048NC containing limestone.

**403.4 Job Mix Formula.** At least 30 days prior to placing any mixture on the project, the contractor shall submit a mix design for approval to Construction and Materials. The mixture shall be designed in accordance with AASHTO R 35 or R 46 and shall be tested in accordance with AASHTO T 312 except as noted herein. A detailed description of the mix design process shall be included with the job mix formula (JMF). Representative samples of each ingredient for the mixture shall be submitted with the mix design.

**403.4.1 Proficiency Sample Program.** Laboratories that participate in and achieve a score of three or greater in the AASHTO proficiency sample program for T 11, T 27, T 84, T 85, T 166, T 176, T 209, T 304 (ASTM C 1252), T 308 and T 312 will have the mixture verification process waived. The mix design shall be submitted to Construction and Materials for approval at least seven days prior to mixture production.

**403.4.2 Required Information.** The mix design shall include raw data from the design process and contain the following information:

- (a) All possible sources intended for use, and grade and specific gravity of asphalt binder.

- (b) Source, type (formation, etc.), ledge number if applicable, gradation, and deleterious content of each aggregate fraction.
- (c) Bulk and apparent specific gravities and absorption of each aggregate fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate including all raw data.
- (d) Specific gravity of hydrated lime, mineral filler or baghouse fines, if used, in accordance with AASHTO T 100.
- (e) Percentage of each aggregate component.
- (f) Combined gradation of the job mix.
- (g) Percent asphalt binder, by weight, based on the total mixture and percent asphalt binder contributed by reclaimed asphalt materials.
- (h) Bulk specific gravity ( $G_{mb}$ ) by AASHTO T 166 Method A of a laboratory compacted mixture compacted at  $N_{design}$  gyrations.
- (i) Percent air voids ( $V_a$ ) of the laboratory compacted specimen compacted to  $N_{design}$  gyrations.
- (j) Voids in the mineral aggregate (VMA) and volume of Effective Asphalt ( $V_{be}$ ) at  $N_{design}$  gyrations.
- (k) Theoretical maximum specific gravity ( $G_{mm}$ ) as determined by AASHTO T 209, in accordance with [Sec 403.19.3](#), after the sample has been short term aged in accordance with AASHTO R 30.
- (l) The tensile strength ratio as determined by AASHTO T 283 including all raw data.
- (m) The gyratory sample weight to produce a 115 mm minimum height specimen.
- (n) Mixing temperature and gyratory molding temperature.
- (o) Number of gyrations at  $N_{design}$ .
- (p) Dust proportion ratio ( $-200/P_{be}$ ).
- (q) Bulk specific gravity ( $G_{sb}$ ) of the combined aggregate.
- (r) Percent chert contained in each aggregate fraction.
- (s) Percent of  $G_{mm}$  at  $N_{initial}$  and  $N_{maximum}$ .
- (t) Voids in coarse aggregate (VCA) for both the mixture and dry-rodded condition for SMA mixtures.
- (u) Draindown for SMA mixtures.

(v) Performance testing results for Cracking Tolerance Index ( $CT_{Index}$ ), Long-Term aged Cracking Tolerance Index ( $CT_{Index, Long-Term Aged}$ ), Hamburg Wheel Tracking Test (HWTT), and Rutting Tolerance Index ( $RT_{Index}$ ).

(w) Baghouse fines added for design.

(i) Batch and continuous mix plants – Indicate which aggregate fraction to add baghouse percentage during production.

(ii) Drum mix plants – Provide cold feed settings with and without baghouse percentage.

**403.4.3 Approval.** No mixture will be accepted for use until the JMF for the project is approved by Construction and Materials.

**403.4.4 Mix Formula Modification.** The JMF approved for each mixture shall be in effect until modified in writing by the engineer. When unsatisfactory results occur or should a source of material be changed, a new JMF may be required.

**403.4.4.1 Asphalt Binder Source Change.** When an asphalt binder source change includes a binder grading that differs from the original grade on the JMF, new performance testing values ( $CT_{Index}$  and  $RT_{Index}$ ) shall be provided prior to use.

**403.4.4.2 Additive Source Change.** When rejuvenators, warm mix additives, anti-strip additive, or other additives sources change; new performance testing values ( $CT_{Index}$  and  $RT_{Index}$ ) shall be provided.

**403.4.5 Design Gyration.** The minimum number (N) of gyrations required for gyratory compaction shall be as follows:

Design	$N_{design}^a$
F	35
E	50
C	60
B	65

<sup>a</sup> SMA mixtures shall have  $N_{design}$  equal to 100.

**403.4.6 Mixture Characteristics.** When compacted in accordance with AASHTO T 312, the mixture shall meet the following criteria.

**403.4.6.1 Air Voids ( $V_a$ ).** Design air voids for SuperPave mixtures at all traffic levels shall be between 3.0 and 5.0 percent. SMA mixtures shall have a design air void of 4.0 percent.

**403.4.6.2 Voids in the Mineral Aggregate (VMA).** SuperPave mixtures shall have a minimum volume of effective asphalt, equal to the VMA minus the air voids, as shown in the chart below, with design air voids between 3.0 to 5.0 percent for SuperPave and shall be 4.0 percent for SMA. The minimum VMA shall be equal to the minimum volume of effective binder ( $V_{be}$ ) plus design air voids.

Mixture	V <sub>be</sub> Minimum (percent)
SP250	9.0
SP190	10.0
SP125 (except for SMA)	11.0
SP095 (except for SMA)	12.0
SP048	13.0
SMA	13.0

**403.4.7 Dust to Binder Ratio.** For all mixtures except SMA and SP048, the ratio of minus No. 200 material to effective asphalt binder (P<sub>be</sub>) shall be between 0.8 and 1.6. For SP048, the ratio of minus No. 200 material to effective asphalt binder (P<sub>be</sub>) shall be between 0.9 and 2.0.

**403.4.8 Moisture Susceptibility.** For all mixtures except SMA, the mixture shall have a tensile strength ratio (TSR) greater than 85 percent (80 percent if an approved anti-strip agent is used) when compacted to 3.7 inches with 7 ± 0.5 percent air voids and tested in accordance with AASHTO T 283. SMA mixtures shall have a TSR greater than 85 (80 percent if an approved anti-strip agent is used) percent when compacted to 3.7 inches with 6 ± 0.5 percent air voids and tested in accordance with AASHTO T 283.

**403.4.8.1 Minimum Tensile Strength.** All mixtures shall have a minimum allowable conditioned tensile strength of 60 psi.

**403.4.8.2 Liquid Anti-Strip Dosage.** The liquid anti-strip dosage shall be in the range recommended by the manufacturer and provided on the JMF.

**403.4.9 Draindown.** AASHTO T 305, Draindown Test, shall be performed on all SMA mixtures prior to job mix approval. The mixture shall be stabilized in such a way that the draindown of the asphalt binder shall not exceed 0.3 percent by weight of mixture.

**403.4.10 Voids in Coarse Aggregate.** The percent VCA<sub>MIX</sub> of SMA mixtures shall be less than or equal to the VCA<sub>DRC</sub> as determined using AASHTO T 19. This may be calculated using the following equations:

$$VCA_{DRC} = 100 \times (G_{CA}Y_w - Y_s) / G_{CA}Y_w$$

$$VCA_{MIX} = 100 - (P_{bp} \times G_{mb} / G_{CA})$$

$$P_{bp} = P_s \times PA_{bp}$$

Where:

- G<sub>CA</sub> = bulk specific gravity of the combined coarse aggregate (AASHTO T 85),
- Y<sub>s</sub> = unit weight of coarse aggregate in the dry-rodded condition (DRC) (lb/ft<sup>3</sup>) (AASHTO T 19),
- Y<sub>w</sub> = unit weight of water (62.34 lb/ft<sup>3</sup>),
- P<sub>bp</sub> = percent aggregate by total mixture weight retained on No. 4 sieve and
- PA<sub>bp</sub> = percent aggregate by total aggregate weight retained on No. 4 sieve\*.

\*Use No. 8 sieve for SP095xSM

**403.4.11 Mix Design Performance Testing.** Acceptable test results meeting the criteria for the following performance tests shall be submitted with the mix design for approval. Test specimens shall be compacted to an air void content of  $7.0 \pm 0.5$  percent or  $6.0 \pm 0.5$  percent for SMA mixtures.

**403.4.11.1 Cracking Tolerance Index (CT<sub>Index</sub>) Testing.** The CT<sub>Index</sub> testing shall be completed in accordance with ASTM D8225 and at a test temperature of  $25 \pm 0.5$  C.

Mix Type	Minimum CT <sub>Index</sub>	CT <sub>Index,(Long-Term Aged)*</sub>
Non-SMA	50	Informational Only
SMA	135	Informational Only

\*Long-Term Aged defined as loose mix aging for 20 hours at 115 C.

**403.4.11.2 Rutting Tolerance Index (RT<sub>Index</sub>) Testing.** The RT<sub>Index</sub> testing shall be completed in accordance with ASTM D8360 and at a test temperature of  $50 \pm 1$  C.

PG Grade High Temperature*	Minimum RT <sub>Index</sub>
58-28H / 64-22	50
64-22H / 70-22	65
64-22V / 76-22	80

\*Determined by the binder grade specified in the contract.

**403.4.11.3 Hamburg Wheel Track (HWT).** HWT testing will be completed in accordance with AASHTO T324 at test temperature of  $50 \pm 1$  C and 2.44 inch specimen height.

PG Grade High Temperature *	Minimum Wheel Passes	Maximum Rut Depth (in.)
58-28H / 64-22	7,500	0.38
64-22H / 70-22	15,000	0.38
64-22V / 76-22	20,000	0.38

\*Determined by the binder grade specified in the contract.

**403.5 Mixture Production Specification Limits.**

**403.5.1 Gradation and Deleterious Content Control.** The gradation of the aggregate shall be determined from samples taken from the hot bins on batch-type or continuous mixing plants or from the composite cold feed belt on drum mix plants. The gradation may also be obtained by sampling the mixture and testing the residual aggregate. The deleterious content of the aggregate shall be determined from samples taken from the composite cold feed belt. Aggregate samples shall be taken in accordance with AASHTO R 90. The RAP shall be sampled from the RAP feeding system on the asphalt plant. Gradation and deleterious shall be taken when directed by the engineer.

**403.5.1.1 Stone Matrix Asphalt Tolerances.** In producing mixtures for the project, the plant shall be operated such that no intentional deviations from the job mix formula are made. The maximum deviation from the approved job mix formula shall be as follows for SMA mixtures:

Sieve	Max. Tolerance	
	SP095	SP125
3/4 in.	---	---
1/2 in.	---	±4
3/8 in.	±4	±4
No. 4	±3	±3
No. 8	±3	±3
No. 200	±2	±2

**403.5.1.2 Mixture Tolerance.** For all other SP mixtures, the percent passing the first sieve size smaller than the nominal maximum size shall not exceed 92.0 percent, a tolerance not to exceed 2.0 percent on the No. 8 sieve from the table in [Sec 403.3.1](#), and within the range listed in [Sec 403.3.1](#) for the No. 200 sieve. The deleterious content of the material retained on the No. 4 sieve shall not exceed the limits specified in [Sec 1002.2](#).

**403.5.2 Density.** The final, in-place density of the mixture shall be 92.5 to 98.0 percent of the theoretical maximum specific gravity for all mixtures except SMA. SMA mixtures shall have a minimum density of 94.0 percent of the theoretical maximum specific gravity. The theoretical maximum specific gravity shall be determined from a sample representing the material being tested. Tests shall be taken not later than the day following placement of the mixture. The engineer will randomly determine test locations.

**403.5.2.1 Shoulder Density.** Density on non-integral shoulders shall be in accordance with [Sec 403.15.3](#).

**403.5.2.2 Integral Shoulder.** When shoulders are placed integrally with the traveled way, tests shall be taken on the traveled way.

**403.5.2.3 Longitudinal Joint Density.** Density along longitudinal joints shall be in accordance with [Sec 403.16.1](#). Pay shall be in accordance with [Sec 403.23.4.1](#).

**403.5.3 Asphalt Content.** The asphalt content (AC) shall be within ± 0.3 percent of the approved mix design.

**403.5.4 Air Voids.** Air voids shall be within ± 1.0 percent of the approved mix design at  $N_{des}$  gyrations.

**403.5.5 Cracking Tolerance Index.** Minimum  $CT_{Index}$  shall be 50 for all mixtures except SMA. SMA mixtures shall have a minimum  $CT_{Index}$  of 135.

**403.5.6 Rutting Tolerance Index.** Minimum  $RT_{Index}$  shall be based upon the high temperature asphalt binder grade in the contract in accordance with the following:

<b>PG Grade High Temperature*</b>	<b>Minimum RT<sub>Index</sub><sup>(a)</sup></b>
58-28H / 64-22	50
64-22H / 70-22	65
64-22V / 76-22	80

\*Determined by the binder grade specified in the contract.

<sup>(a)</sup>Mixtures not meeting the minimum RT<sub>Index</sub> shall be tested by the Hamburg Wheel Track Test and meet a minimum of 1/2" rutting at the number of wheel passes required by the contract grade of the mixture.

**403.5.7 Tensile Strength Ratio (TSR).** The TSR shall be greater than or equal to 75 percent as determined from loose mixture taken from the plant and tested in accordance with AASHTO T 283. The minimum allowable conditioned tensile strength of the mixture shall be 60 psi. The liquid anti-strip dosage during production shall match the dosage listed on the JMF.

**403.5.8 Fibers.** The fiber proportioning and delivery system for SMA mixtures shall have an accuracy of 10 percent by weight of the material actually being measured in any given period of time.

**403.5.9 Moisture Content.** The asphaltic concrete mixture, when sampled and tested in accordance with AASHTO T 329, shall not contain more than 0.5 percent moisture by weight of the mixture.

**403.5.10 Contamination.** The asphaltic concrete mixture shall not be contaminated with deleterious agents such as unburned fuel, objectionable fuel residue or any other material not inherent to the job mix formula.

**403.6 Field Laboratory.** The contractor shall provide a Type 3 field laboratory in accordance with [Sec 601](#). The contractor shall furnish the bituminous mixture equipment to perform all required test methods for QC and QA work. The gyratory compactor shall be evaluated in accordance with AASHTO PP 35. An approved list will be maintained by Construction and Materials. All other equipment shall be capable of performing tests in accordance with the approved test methods.

**403.7 Bituminous Mixing Plants.** Bituminous mixing plants and preparation of material and mixtures shall be in accordance with [Sec 404](#).

**403.8 Hauling Equipment.** Trucks used for hauling bituminous mixtures shall be in accordance with [Sec 404](#).

**403.9 Pavers.** Bituminous pavers shall be self-contained units, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing asphaltic concrete in lane widths applicable to the specified typical sections and thicknesses shown on the plans.

**403.10 Construction Requirements.**

**403.10.1 Weather Limitations.** No mixture shall be placed on any wet or frozen surface. No mixture shall be placed when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 40 F. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

**403.10.2 Substitutions.** With approval from the engineer, the contractor may substitute a smaller nominal maximum size mixture for a larger sized mixture. Specifications governing the substitute mixture shall apply. Except for a single surface layer, the total pavement thickness shall be maintained when the substitute mixture layer is reduced as allowed in [Sec 403.13](#) by increasing the thickness of other layers or courses. The contract unit price for the original mixture shall be used.

**403.11 Field Adjustments of Job Mix Formulas.** When test results indicate the mixture produced does not meet the specification requirements, the contractor may field adjust the job mix formula as noted herein. Field adjustments may consist of changing the percent binder as listed on the original approved job mix by no more than 0.3 percent. Additional fractions of material or new material will not be permitted as field adjustments. The engineer shall be notified immediately when any change is made in the cold feed settings, the hot bin settings or the binder content. A new  $G_{sb}$  shall be calculated using the new aggregate percentages. The gradation of the adjusted mixture shall meet the requirements of the mixture type specified in the contract. When the binder content is adjusted more than 0.3 percent, the mixture will be considered out of specification, and a new mix design shall be established.

**403.11.1 Field Mix Redesign.** When a new mix design will be required, the contractor will be permitted to establish the new mix design in the field. The mixture shall be designed in accordance with AASHTO R 35 or AASHTO R 46 and shall meet the mix design requirements, including performance testing and TSR requirements. A representative sample of the mixture shall be submitted with the new mix design to the Central Laboratory for mixture verification. The amount of mixture submitted for verification shall weigh at least 50 pounds.

**403.11.1.1 Approval.** New mix designs established in the field shall be submitted for approval to Construction and Materials. Upon approval, Construction and Materials will assign a new mix number to the mixture.

**403.11.1.2 Resume Production.** No mixture shall be placed on the project until the new field mix design is approved.

**403.12 Application of Prime or Tack.** The prime coat, if specified, shall be applied in accordance with [Sec 408](#). A tack coat is required on all existing pavement and shoulder surfaces that will be overlaid with a bituminous mixture. A tack coat is also required between all lifts of bituminous pavements placed within the driving and turn lanes, unless otherwise specified in the contract. All construction requirements of a tacked surface shall be in accordance with [Sec 407](#), and specified herein. The tack coat shall be applied uniformly and shall completely cover the surface upon which the bituminous mixture is to be placed. Placement of a bituminous mixture shall not be placed upon a tacked surface that is not uniformly covered or surfaces that have experienced excessive loss of tack due to tracking. Re-application of tack due to excess tracking or non-uniform coverage shall be at the contractor's expense.

**403.13 Spreading and Finishing.** The base course, primed or tacked surface, or preceding course or layer shall be cleaned of all dirt, packed soil or any other foreign material prior to spreading the asphaltic mixture. If lumps are present or a crust of mixture has formed, the entire load will be rejected. The thickness and width of each course shall conform to the typical section in the contract. The contractor may elect to construct each course in multiple layers. The minimum compacted thickness shall be 0.75 inches for SP048, 1.25 inches for SP095, 1.75 inches for SP125, 2 inches for SP190, and 3 inches for SP250.

**403.13.1 Paving Widths.** The following shall apply for roadways constructed under traffic. For pavements having a width of 16 to 24 feet, inclusive, the asphaltic concrete pavement shall be laid in lanes approximately one half the full width of the completed pavement, and the full width shall be completed as soon as practical. Unless otherwise permitted, a single lane of any course shall not be constructed to a length that cannot be completed to full width of the pavement the succeeding operating day. For pavements greater than 24 feet wide, single lane width construction shall be limited to one day's production and completion to full width shall be accomplished as soon as practical. Uneven pavement shall be left in place for no more than seven days, unless approved by the engineer. Removal of pavement to be in accordance with this specification shall be at the contractor's expense.

**403.13.2 Segregation.** No thermal or physical mix segregation will be permitted in handling the mixture at the plant, from the truck or during spreading operations on the roadbed.

Paver Mounted Thermal Profiling (PMTP) shall be conducted in accordance with Sec 406.

All layers shall be feathered out, by hand raking, if necessary, in transitioning the depth of the surface to meet present grades at bridges or ends of projects, to provide a uniform, smooth riding surface free of irregularities. Where only the top layer of the surfacing continues across a bridge, the bottom layers shall be feathered out.

Any visual/physical segregation shall be tested in accordance with MoDOT Test Method TM 75. Mixture production shall immediately cease if either criteria of MoDOT Test Method TM 75 fail. Segregated mixture shall be removed and replaced to the limits determined by the engineer.

**403.13.3 Release to Traffic.** If the asphaltic concrete construction consists of more than a single layer, each layer shall be compacted as specified and allowed to cool to the ambient temperature before the next layer is placed. The contractor shall keep traffic off the asphaltic concrete until the surface of the asphaltic concrete is 140 F or below and the asphaltic concrete has cooled sufficiently to prevent flushing of the asphalt binder to the surface, marking or distorting the surface or breaking down the edges.

**403.13.4 Draindown.** Evidence of asphalt binder separation or draindown at delivery will be cause for rejection.

**403.13.5 Shoulder Substitution.** When a [Sec 403](#) mixture is specified for traffic lanes, the same mixture may be used for the adjacent shoulder, subject to the density requirements in [Sec 403.5.2](#).

**403.14 Spot Wedging and Leveling Course.** The engineer will specify the locations and thickness of spot wedging and the thickness of leveling course to obtain the smoothest possible riding surface. This procedure may result in spot wedging operations over small areas with feather-edging at high points and ends of wedge areas. Rigid control of the placement thickness of the leveling course shall be required. Leveling course, consisting of a layer of asphaltic concrete of variable thickness used to superelevate curves and eliminate irregularities in the existing base, shall be spread uniformly to the specified profile grade and cross section. The mixture shall be uniformly spread and compacted, with only minor segregation as accepted by the engineer. Type SP125 or finer mixtures, as applicable, shall be used for the spot wedging and for the leveling course. Mixtures used as spot wedging and leveling courses shall be accepted in accordance with [Sec 403.23.8.3](#).

**403.15 Compaction.** After the asphaltic mixture has been spread, struck off and surface irregularities adjusted, the asphaltic mixture shall be compacted thoroughly and uniformly by rolling to obtain the required compaction while the mixture is in a workable condition. Excessive rolling, to the extent of aggregate degradation, will not be permitted. Rollers shall not be used in the vibratory mode when the mixture temperature is below 225 F. When warm mix technology is used, as approved by the engineer, rollers shall not be used in the vibratory mode when the mixture temperature is below 200 F.

**403.15.1 Rolling.** Any displacement occurring as a result of starting, stopping or changing direction of a roller, or from other causes, shall be avoided. Excess liquid, to prevent adhesion of the mixture to the rollers, will not be permitted. Diesel fuel, fuel oil or other detrimental products shall not be used as wetting agents. Along forms, curbs, headers, walls, and other places not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons or with mechanical tampers.

**403.15.2 Defective Mixture.** Any mixture that becomes loose and broken, mixed with dirt or is in any way defective shall be removed and replaced with fresh, hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of asphalt binder shall be removed and replaced.

**403.15.3 Non-Traffic Areas.** [Sec 403](#) mixtures used for surfacing medians and similar areas, shoulders adjacent to rigid or flexible pavement and shoulders adjacent to resurfaced pavement shall be compacted to the specified densities for the mixture. Once an established rolling pattern has been demonstrated to provide the required density for shoulders, at the engineer's discretion, the pattern may be used in lieu of density tests provided no changes in the material, typical location or temperatures are made. Regardless of the method, density will still be required and subject to testing as deemed necessary by the engineer. In lieu of roller and density requirements, temporary bypasses to be maintained at the expense of the contractor shall be thoroughly compacted. The rolling shall be performed at proper time intervals and shall be continued until there is no visible evidence of further consolidation.

**403.15.4 Density Measurement.** Measurements for determining the in-place density of the mixture shall be taken no later than the day following placement. Measurements not obtained within the prescribed time limits shall be subject to the requirements of [Sec 403.22](#).

**403.15.4.1 Density Cores.** If a core is taken, material from underlying layers that remain adhered to the core shall be removed in a manner that does not harm the integrity of the specimen. If the contractor elects to place a lift of mixture greater than six times the nominal maximum aggregate size, cores shall be cut in half and the density of each half determined separately.

**403.15.4.2 Nuclear/Alternative Methods.** In-place asphalt density may be obtained by nuclear or alternative methods in accordance with MoDOT TM-41. The nuclear/alternative calibration locations shall be conducted within a trial section in accordance with [Sec 405.4.8](#).

**403.15.5 Intelligent Compaction.** Intelligent Compaction requirements in accordance with Section 405 shall not apply unless required by job special provision. Intelligent compaction shall be conducted on the traveled way to monitor the optimum roller passes at a mean temperature above 180 F in accordance with [Sec 405](#). Passing Segments shall have a minimum of 85 percent coverage at or above the optimum number of passes. Segments with between 85 percent and 70 percent coverage will be called moderate segments. Any segment with less than 70 percent coverage at the optimum number of passes shall be a Deficient Segment. If 70 percent of the

target IC-MV is not obtained, the segment shall be flagged accordingly in the Veta project file. All segments with a mean temperature of less than 180 F at the optimum pass shall be considered deficient.

**403.15.6 Surface Smoothness.** The finish of the pavement surface shall be substantially free from waves or irregularities and shall be true to the established crown and grade. The pavement surface shall be thoroughly tested for smoothness by profiling or straight edging in accordance with [Sec 610](#).

**403.16 Joints.** Transverse joints shall be formed by any method that will produce a dense, vertical section for use when laying is resumed. When a transverse vertical edge is to be left and opened to traffic, a temporary depth transition shall be built as approved by the engineer. The joint formed when the fresh mixture is placed shall be dense, well sealed, and the grade, line and surface texture of the succeeding surface shall conform to that of the joined surface. If directed by the engineer, the transverse joint shall be painted with a light coating of liquid asphalt. Hand manipulation of the mixture shall be minimized to avoid unsightly surface texture.

**403.16.1 Joint Composition.** Longitudinal joints shall be formed by the use of an edging plate fixed on both sides of the finishing machine. Care shall be taken to obtain a well bonded and sealed longitudinal joint by placing the hot mixture in a manner ensuring maximum compaction at this point. If directed by the engineer for properly sealing the longitudinal joint, a light coating of bituminous material shall be applied to the exposed edge before the joint is made. Each side of the joint shall be flush and along true lines.

**403.16.2 Joint Offset.** The longitudinal joint in any layer shall offset that in the layer immediately below by a minimum of 6 inches; except, the joints in the completed surfacing shall be at the lane lines of the traveled way or other required placement width outside the travel lane. The placement width shall be adjusted such that pavement marking shall not fall on a longitudinal joint.

#### **403.17 Quality Control.**

**403.17.1 Quality Control Operations.** The contractor shall maintain equipment and qualified personnel to perform all QC field inspection, sampling and testing as required by this specification. All contractor personnel included in the QC operation shall be qualified by the MoDOT Technician Certification Program. Under no circumstances will unqualified personnel be allowed to perform QC sampling or testing. Personnel will be disqualified if acceptable methods and procedures are not followed.

**403.17.1.1 Asphalt Test Results.** The contractor shall record all test results and furnish a copy, including all raw data, to the engineer no later than the beginning of the day following the test. The contractor shall maintain all test results in an organized format and shall be available to the QA inspector at all times. Scale readings and other measurements not directly recorded by electronic media shall be recorded in an organized format. Printouts from gyratory compactors and asphalt content devices shall be retained as part of the testing records.

**403.17.2 Bituminous Quality Control Plan.** Prior to approval of the trial mix design by the engineer, the contractor shall submit a QC Plan to Construction and Materials for approval. The QC Plan shall include:

- (a) The contractor representative in charge of QC and the project level representative if different from the contractor representative. Contact information should be recorded for these individuals.
- (b) Lot and subplot sizes and how they will be designated.
- (c) Performance testing, volumetrics, and asphalt content sampling, fabrication, and testing plan.
- (d) The test method for determining asphalt content and density determination. If cores are to be cut, the number of cores shall be specified.
- (e) Intelligent Compaction (if included in contract) and Paver Mounted Thermal Profiler base station and cellular reception plan.
- (f) A proposed independent third party name, contact, address, and phone number for dispute resolution.

**403.17.2.1 Third Party.** The third party shall be independent of the contractor, MoDOT consultants and all project subcontractors or suppliers on each specific project. All testing of material for dispute resolution shall be performed by an approved laboratory. Approved laboratories shall be AASHTO Accreditation Program certified in the areas of the material being tested.

**403.17.2.2 Plant Calibration.** Plant calibration shall be performed by the contractor in accordance with [Sec 404](#), and records shall be made available to the engineer.

**403.17.2.3 Retained Samples.** All samples taken by the contractor, including but not limited to tested aggregate, volumetric and density samples, shall be retained for the engineer until the contractor's and engineer's tests are complete and accepted unless otherwise instructed. This includes  $CT_{Index}$  and  $RT_{Index}$  results. These samples shall be maintained in clean covered containers, without contamination, readily accessible to the engineer. The retained sample's identification shall consist of, but is not limited to:

- (a) Time and date sampled.
- (b) Product specification number.
- (c) Type of sample, i.e. belt, bin, stockpile.
- (d) Lot and subplot designation.
- (e) Sampler/Tester.
- (f) Project Job Number.

**403.17.2.3.1 Retained Loose Mix Material.** All loose mix samples for determination of volumetrics, performance tests, asphalt binder content and TSR shall be taken from the plant at random as designated by the engineer. Loose mix material shall be taken, identified, and retained for the engineer.

**403.17.2.4 Performance Test Specimens and Loose Mix Sample.** All loose mix samples for determination of performance tests, volumetrics, asphalt binder content and TSR shall be taken at the plant at random intervals as designated by the engineer. All QC/QA loose mix samples shall be taken by the contractor. Non-TSR performance test specimens shall be fabricated by the contractor. The engineer shall be present when taking loose mix samples and fabricating specimens for QA testing. Companion samples shall be identified and retained for the engineer.

**403.17.3 Quality Control Laboratory.** All QC mixture testing shall be performed in an approved laboratory.

**403.17.3.1 Calibration Schedule.** The contractor shall calibrate or verify all significant test equipment associated with tests covered in this specification. Intervals as set by the contractor shall not exceed the following limits:

Equipment - Test Method (AASHTO)	Requirement	Interval (Month)
Performance Testing Load Frames – R 18	Calibrate	12
Hamburg Wheel Track Test - R 18	Calibrate	12
Gyratory Compactor - T 312	Calibrate – 1.16 ± .02° internal angle	12 <sup>a</sup>
Gyratory Compactor - T 312	Verify	1 <sup>c</sup>
Gyratory Molds - T 312	Check Critical Dimensions	12
Thermometers - T 209, T 166, T 312	Calibrate	12
Vacuum System - T 209	Check Pressure	12
Pycnometer (Flask) - T 209	Calibrate	Daily
Binder Ignition Oven - T 308	Verify	12 <sup>b</sup>
Nuclear Content Gauge – T 287 or MoDOT TM 54	Drift & Stability – Manuf. Recommendation	1
Mechanical Shakers - T 27	Check Sieving Thoroughness	12
Sieves	Check Physical Condition	6
Weighted Foot Assembly - T 176	Check Weight	12
Mechanical Shaker - T 176	Check Rate & Length of Throw	12
Liquid Limit Device - T 89	Check Wear & Critical Dimensions	12
Grooving Tool - T 89	Check Critical Dimensions	12
Ovens	Verify Temp. Settings	12
Balances	Verify	12 <sup>b</sup>
Timers	Check Accuracy	12

<sup>a</sup>Calibrate and/or verify after each move.

<sup>b</sup>Verify after each move.

<sup>c</sup>Includes ram pressure, LVDT, frequency of gyration, and external angle.

**403.17.3.1.1 Inventory.** An inventory of all major sampling, testing, calibration, and verification equipment, including the serial number or other identifying number shall be maintained.

**403.17.3.1.2 Calibration Records.** Calibration and verification records shall include but are not limited to:

- (a) Detailed results of the work performed (dimensions, mass, force, temperature, etc.)
- (b) Description of the equipment calibrated including identifying number.
- (c) Date the work was performed.

- (d) Identification of the individual performing the work.
- (e) Identification of the calibration or verification procedure used.
- (f) The previous calibration or verification date and next due date.
- (g) Identification of any in-house calibration or verification device used (including identification to establish traceability of items such as standard masses, proving rings, standard thermometers, balances, etc.).

**403.17.3.2 Record Retention.** Test records shall be maintained to permit verification of any test report. Records pertaining to testing, equipment calibration and verification, test reports, internal quality systems review, proficiency sample testing, test technician training and evaluation and personnel shall be retained in a secure location for a minimum of three years.

**403.17.3.3 Test Method Availability.** A current copy of all test methods and procedures shall be maintained in the QC laboratory at all times for reference by the technicians. Examples of report formats and procedures may be found in AASHTO R 18.

**403.18 Quality Assurance.** All QA field inspection, sampling and testing will be performed by a qualified MoDOT technician. The QA inspector shall have free access to any and all testing equipment used by the mixture producer and any workbooks, records or control charts maintained by the mixture producer for the QC process. The QA inspector shall also have sufficient access to the plant grounds to assure compliance with the approved QC Plan.

**403.18.1 Assurance Testing.** The engineer will independently test the specimens and/or mixture from the roadway or plant at the frequency listed in Sec 403.19.3. The independent samples shall be of sufficient size to retain half for possible disputes. Further testing of this sample will be under the direction of the engineer. The retained portion of the QC samples for mixture properties, gradation, and deleterious content will be tested as directed by the engineer. The engineer's test results, including all raw data, will be made available to the contractor when completed and no later than the next working day.

**403.18.2 Chain of Custody.** QA density cores shall be sealed in approved tamper-evident containers immediately after extraction in the presence of the engineer. At the plant, the contractor shall provide loose mix material and test specimens at the frequency listed in Sec 403.19.3 for all QA testing at the provided random tonnage in the presence of the engineer.

**403.18.3 Aggregate Comparison.** Comparison for aggregate will be considered favorable when the contractor's QC results and engineer's QA test results of a retained sample compare within the following limits.

**403.18.3.1 Gradation.**

Sieve Size	Percentage Points
¾ inch and larger	5.0
½ inch	5.0
3/8 inch	4.0
No. 4	4.0
No. 8	3.0
No. 10	3.0
No. 16	3.0
No. 20	3.0
No. 30	3.0
No. 40	2.0
No. 50	2.0
No. 100	2.0
No. 200	1.0

**403.18.3.2 Deleterious.** The total and individual deleterious content shall not exceed the specification limits.

**403.18.4 Federal Highway Administration Requirements.** Performance and acceptance of QC/QA testing under these specifications shall not eliminate any FHWA requirements for acceptance of the material.

**403.19 Acceptance of Material.** Acceptance of bituminous mixture will be based on lots. With the exception of density, asphalt material will be sampled at the asphalt plant in lots or sublots on a random basis through the use of a random number system and evaluated using a Quality Level Analysis (QLA). A QLA will determine payment based on a combination of the total PWL (PWL<sub>t</sub>) determined for each pay factor item for each lot of material produced.

**403.19.1 Random Numbers.** The engineer will generate random numbers. Random numbers will be based upon tonnage.

**403.19.2** A lot shall consist of a maximum of 6,000 tons. The maximum subplot size shall be 1500 tons and each lot shall contain no less than 4 sublots. Sublots from incomplete lots shall be combined with the previous complete lot for determination of pay factors. When no previous lot exists, the mixture shall be treated in accordance with Sec 403.23.8.1. A new lot shall begin when the asphalt content of a mixture is adjusted in accordance with Sec 403.11 or if there is an asphalt binder grade change or an additive source change.

**403.19.3 Test and Pay Factor Items.** As a minimum, the contractor and engineer shall test in accordance with the following table. The number of random tests per subplot may be increased per the contractor's QC plan. The QC plan shall state the test and testing frequency. All random tests shall be used in the pay factor determination. Where multiple test methods are allowed, the contractor shall designate the test method to be used in the QC Plan. Final payment will be based on the indicated pay factor items.

Tested Property	Test Method	Contractor Frequency	Engineer Frequency
<b>Pay Factors</b>			
Mat Density (% of theoretical maximum density) <sup>(a)</sup>	MoDOT TM 41, AASHTO T 166 or AASHTO T 331	1 Sample / Sublot	1 Sample / Lot
Asphalt content	AASHTO T 164, or MoDOT Test Method TM-54, or AASHTO T 287, or AASHTO T 308	1 / Sublot	1 / Lot
V <sub>a</sub> , N <sub>des</sub>	AASHTO T 312 and R 35	1 / Sublot	1 / Lot
CT <sub>Index</sub>	ASTM D 8225	1 / 3000 tons	1 / 12000 tons
<b>Pay Factor Adjustments</b>			
Unconfined Longitudinal Joint Density <sup>(a)</sup>	MoDOT TM 41, AASHTO T 166 or AASHTO T 331	1 Sample / Sublot	1 Sample / Lot
Intelligent Compaction	Sec 405	Continuous	10% of travelway of one roller
RT <sub>Index</sub>	ASTM D 8360	1 / 3000 tons	1 / 12000 tons
Tensile Strength and TSR	AASHTO T 283	1 / 12000 tons (maximum)	1 / Project
<b>Other Testing</b>			
Cold feed or hot bin gradation and deleterious content	AASHTO T 27 and AASHTO T 11	As Needed	As Needed
Mix Temperature at Plant	----	1 / Sublot	1 / Day
Temperature of Base and Air	----	As Needed	As Needed

(a) Core samples shall consist of one core. Up to two additional cores, as stated in the QC Plan, may be obtained at the same offset within one foot of the randomly selected location. If more than one core is obtained, all cores shall be combined into one sample.

#### 403.19.3.1 Test Method Modification.

**403.19.3.1.1 Binder Ignition Modification.** Asphalt content determination in accordance with AASHTO T 308, Section 6.9.1 shall be modified by adding the following: If the calibration factor exceeds 1.0 percent, lower the test temperature to 800 ± 8 F and repeat test. Use the calibration factor obtained at 800 F even if it exceeds 1.0 percent. If RAP is used, the binder ignition oven shall be calibrated in accordance with MoDOT Test Method TM 77. At the engineer's discretion, testing may be waived when production does not exceed 200 tons per day. The contractor shall certify the proper proportions of a previously proven mixture were used.

**403.19.3.1.2 Rice Test.** When the water absorption of any aggregate fraction is greater than 2.0 percent, the test method for determining theoretical maximum specific gravity, AASHTO T 209, shall be modified as follows: After completing the procedure in accordance with Section 9.5.1 or 9.5.2, drain water from the sample. To prevent loss of fine particles, decant the water through a paper towel held over the top of the container. Spread the sample before an electric fan to remove surface moisture. Weigh at 15-minute intervals, and when the loss in mass is less than 0.05 percent for this interval, the sample may be considered to be surface dry. This procedure requires about 2 hours and shall be accompanied by intermittent stirring of the sample. Break

conglomerations of mixture by hand. Take care to prevent loss of particles of mixture. Calculate the specific gravity of the sample by substituting the final surface-dry mass for A in denominator of Equations 2 or 3.

**403.19.3.1.3 Mixture Bulk Specific Gravity.** Determining bulk specific gravity using paraffin-coated specimens, AASHTO T 275, shall not be used when required by AASHTO T 166. Alternate methods are AASHTO T 331 and ASTM D1188. The surface of specimens prepared for testing by these methods may have the surface texture removed by sawing a minimal amount. Specimens shall be securely held in a jig or other clamping device to eliminate distortion and retain a face parallel to the original surface. Measurements for lift thickness shall be made prior to sawing.

**403.19.3.1.4 QC and QA Mix Sampling and Preparation.** All loose mix shall be sampled at the plant by the contractor during production in accordance with AASHTO R 97 and split to the appropriate size in accordance with AASHTO R 47. After QC has been notified of the random sample, the first truck shall be sampled as directed by the engineer. If the random number for multiple tests overlap, the contractor shall complete the first testing requirements and then immediately proceed with the second testing requirements. The contractor shall wait 30 minutes after sampling loose mix before fabricating specimens for  $CT_{Index}$  and  $RT_{Index}$  testing. Loose mix temperatures shall not drop below the molding temperature. The 30 minutes shall start when all the material for the loose mix sample has been obtained and the time this occurs shall be recorded. All specimens shall be fabricated as soon as possible after the 30-minute delay. QC and QA samples shall be taken and fabricated by the contractor at separate random times.

The following table details the minimum number of specimens required for QC or QA testing:

Test Method	Minimum Number of Specimens	Molded Specimen Height (mm)
<b>Required Fabrication for <math>CT_{Index}</math> and <math>RT_{Index}</math></b> <b>QC Frequency: 1 Set per 3000 tons</b> <b>QA Frequency 1 Set per 12000 tons</b>		
Cracking Tolerance Index ( $CT_{Index}$ )	5 Compacted Specimens	62 ( $\pm 1$ mm) <sup>(b)</sup>
Rutting Tolerance Index ( $RT_{Index}$ )	3 Compacted Specimens	62 ( $\pm 1$ mm) <sup>(b)</sup>
Retained Loose Mix <sup>(a)</sup> (QA sample only)	125 lbs	N/A
<b>Required Fabrication for Volumetrics and % Asphalt Content</b> <b>QC Frequency: 1 Set per subplot</b> <b>QA Frequency 1 Set per Lot</b>		
% Asphalt Content	1 Sample	N/A
Theo. Max SG of mixture, Gmm	1 Sample	N/A
% Air Voids	2 Compacted Specimens	$N_{Design}$
Retained Loose Mix <sup>(c)</sup>	30 lbs	N/A

<b>Required Sampling for TSR</b> <b>QC Frequency: 1 Sample per 12,000 tons</b> <b>QA Frequency: 1 Sample per Project</b>		
Tensile Strength Ratio (TSR)	250 lbs	N/A

- (a) Retained loose mix for Hamburg verification of mixture not meeting minimum  $RT_{index}$  thresholds
- (b) 95 mm specimen height for SP250 mixes
- (c) Retain at least 30 pounds of loose mix material for dispute resolution.

The  $CT_{index}$  test shall be based upon five compacted specimens tested, discard the single highest and lowest values, and average the three remaining values.

The  $RT_{index}$  test shall be based upon the average of three compacted specimens.

Volumetric testing shall be based upon the average of two compacted specimens.

**403.19.3.1.5 Molding Performance Samples.** The specimens shall be compacted to an air void content of  $7.0 \pm 0.5$  percent or  $6.0 \pm 0.5$  percent for SMA mixtures. The compacted test specimens shall be allowed to cool to  $77 \pm 5$  F prior to determining the air void content.

**403.19.3.1.6 Records.** Compaction temperature, times in and out of the oven, gyratory specimen weights and times, and sample identification shall be recorded.

**403.20 Miscellaneous Applications.**

**403.20.1 Small Quantities.** Small quantities are less than 6000 tons for the pay item quantities of each separate mixture and the following shall apply:

- (a) A field laboratory will not be required for monitoring mixtures. All required QC and QA testing shall be performed in an approved laboratory.
- (b) No Performance Testing is required and acceptance shall be in accordance with Sec 403.23.8.1. Density, % AC, and % Air Voids shall be performed at a frequency of no less than one per day if production does not exceed 1000 tons and at a frequency of no less than two per day if production exceeds 1000 tons. Independent or retained sample QA tests shall be performed at least once per project, as indicated.

**403.20.2 Base Widening and Entrances.** For base widening mixture and entrance work, the following will apply:

- (a) All base widening shall be constructed in accordance with [Sec 401.7](#) and subsections.
- (b) The minimum density of these mixtures shall be attained as specified herein, except, compaction may be performed in accordance with [Sec 403.15.3](#).

**403.20.3 Dispute Resolution.** When there are significant discrepancies between the engineer's and the contractor's test results, dispute resolution procedures will be used.

**403.20.3.1 Cease Work.** The contractor's operations may be required to cease until the dispute is resolved if the test results indicate the mixture is subject to failure.

**403.20.3.2 Third Party Resolution.** The first step in dispute resolution will be to identify differences in procedures and correcting inappropriate procedures before moving to third party resolution. If that does not resolve the dispute, either the contractor or the engineer may request the approved QC Plan third party involvement. The recommendations of the approved third party shall be binding on both the engineer and contractor.

**403.20.3.3 Third Party Payment.** The contractor shall be responsible for the cost associated with the third party testing and resolution if the final result indicates the engineer's test results were correct. Likewise the Commission will be responsible for the cost associated with the third party testing and resolution when the final result indicates the contractor's results were correct.

**403.20.3.4 Other Adjustments.** The contractor shall not be entitled to any additional payment for costs incurred due to use of the dispute resolution procedures such as, but not limited to, those for delay, cessation of operations, costs to subcontractors, etc. The engineer may give consideration to adjustment of working days if warranted.

**403.20.3.5 Dispute with  $CT_{Index}$  and  $RT_{Index}$  Results.** If QA and QC results for  $CT_{Index}$  or  $RT_{Index}$  do not compare favorably, the first step will be to identify differences in procedures, including specimen aging. If that does not resolve the dispute, the QA  $CT_{Index}$  result shall be averaged with the QC  $CT_{Index}$  result to determine pay. If  $RT_{Index}$  results are in dispute, QC shall fabricate specimens for Hamburg testing in the presence of the Engineer using the retained loose mix material. Retained loose mix material from the QC sample shall be used to fabricate specimens unless otherwise directed by the Engineer. Specimens shall be sent to the Engineer for Hamburg testing to determine specification compliance.

#### **403.21 General Requirements.**

**403.21.1 Sequence of Operations.** To reduce inconvenience to the traveling public during widening or surfacing, the contractor will not be permitted to place any final surface course until the base widening, the leveling course and the binder course have been completed throughout the entire combination of sections, unless otherwise authorized by the engineer. The proper condition of the base widening, the leveling course, and the binder course, at the time of placing the surface course, shall be the contractor's responsibility.

**403.21.2 Pavement Marking.** If the contractor's work has obliterated the existing pavement marking on resurfacing projects open to through traffic, the pavement marking shall be replaced in accordance with [Sec 620](#).

**403.21.3 Surfaced Approaches.** At locations designated in the contract or as specified by the engineer, approaches shall be primed in accordance with [Sec 408](#) and surfaced with Type SP125 asphaltic concrete. The asphaltic concrete surface shall be placed in accordance with the details shown on the plans or as specified by the engineer. Approaches shall not be surfaced until after the surface course adjacent to the entrance is completed. Any work required to condition and prepare the subgrade on the approaches will be at the contractor's expense.

**403.21.4 Filling Drain Basins.** If shown on the plans, existing drain basins shall be filled to the top of the lip with plant mix bituminous base course or asphaltic concrete from the pavement edge to the edge of the shoulder. Any difficulty or delay created by this requirement will be at the contractor's expense.

**403.21.5 Pavement Repairs (Blow-Ups).** A blow-up will be considered that area where excessive expansion has resulted in distress to the existing pavement. Blow-ups occurring prior to the application of the tack coat on the existing surface will normally be repaired by the Commission. Blow-ups occurring after the application of the tack coat shall be repaired by the contractor by removing the distressed concrete and replacing the pavement in accordance with [Sec 613](#).

#### **403.22 Method of Measurement.**

**403.22.1 Weight Determination.** The weight of the mixture will be determined from the batch weights if a batch-type plant is used, and will be determined by weighing each truck load on scales in accordance with [Sec 310](#) if other types of plants are used. Measurement will be made to the nearest 0.1 ton for the total tonnage of material accepted.

#### **403.22.2 Full Depth.**

**403.22.2.1** The final driving surface area, for the full depth of the pavement, will be used as the area for all underlying bituminous lifts and will not include the additional quantity needed to construct the 1:1 slope.

**403.22.2.2** Final measurement of the completed pavement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of the pavement complete in place will be made to the nearest 0.1 square yard. The revision or correction will be computed and added to or deducted from the contract quantity.

#### **403.22.3 Alternate Overlay.**

**403.22.3.1 Field Established Quantity.** When bid as an alternate to a Portland cement concrete overlay, the contractor shall establish the existing roadway profile and set the final overlay profile. The engineer may adjust the final profile as needed. The tons of hot mix asphalt required will be determined by the engineer from the set or adjusted profile. This quantity will be the field established plan quantity.

**403.22.3.2 Overlay Measurement.** Final measurement of the completed pavement will be based on the field established plan quantity except for authorized changes during construction. The revision or correction will be computed and added to or deducted from the contract quantity. Measurement of the pavement complete in place will be made to the nearest 0.1 ton.

**403.22.4 Pavement Testing.** The finished courses shall have the nominal thickness shown on the plans. Tests will be conducted to ensure that each course is being constructed to proper thickness, composition, and density. The contractor shall cut samples from any layer of the compacted mixture at locations designated by the engineer. QA samples shall be cut and delivered to the engineer no later than the end of the next day following the laydown operation. If the samples are not cut and delivered as stated, the asphaltic laydown operation may be suspended and a deduction of 5 percent per day of the contract unit price of the representative material may be applied, until samples are cut and delivered to the engineer. Samples may be obtained by either sawing or drilling 4-inch minimum diameter cores. Each sawed sample shall consist of a single piece of the pavement of the size designated by the engineer, but no larger than 12 inches square.

**403.22.4.1 Pavement Thickness.** Lift thickness may be determined by the average thickness of cores taken for density measurements for each lot. Total thickness samples for new full depth asphalt pavements shall be obtained after all bituminous construction is completed on the project and shall be taken at locations specified by the engineer. For the purpose of determining the constructed thickness of full depth pavement, cores shall be taken at random intervals in each traffic lane at the rate of one core per 1000 feet or increment thereof, or at any other locations as may be determined by the engineer and measured in accordance with AASHTO T 148. Sections of any asphaltic concrete determined to be 0.5 inches or more, less than the thickness shown on the plans, shall be corrected by the contractor. No payment will be made for any costs incurred by the contractor in correcting pavement deficient in thickness. Each core is representative of the pavement thickness for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement.

**403.22.4.2 Surface Restoration.** The surface from which samples have been taken, including those for density measurements, shall be restored by the contractor with the mixture then being produced no later than the next day of plant operation, if construction is still active. If bituminous construction has been completed, the surface from which samples have been taken shall be restored within 48 hours with an approved commercial mixture or with cold patch mixtures acceptable to the engineer.

#### **403.23 Basis of Payment.**

**403.23.1 Percent Within Limits.** PWL will be based on the mean, standard deviation and quality index of each lot's test results. The upper PWL ( $PWL_u$ ) and lower PWL ( $PWL_l$ ) is determined from the table in [Sec 502.15.8](#). For Upper or Lower Quality Index values less than zero, the value in the Table shall be subtracted from 100. Total percent within limits,  $PWL_t$ , is:  $PWL_t = (PWL_u + PWL_l) - 100$ . For Density of SMA mixes the  $PWL_u$  shall be 100.

The mean is:  $x_a = (\sum x_j)/n$

Where:  $x_a$  = Average of the individual values being considered

$\sum x_j$  = The summation of all the individual values being considered

$n$  = The number of individual values under consideration

The Standard Deviation is:  $s = (\sum(x_i - x_a)^2/(n - 1))^{1/2}$

The Upper Quality Index is:  $Q_u = (USL - x_a)/s$

The Lower Quality Index is:  $Q_l = (x_a - LSL)/s$

Where:  $Q_u$  = Upper Quality Index

$Q_l$  = Lower Quality Index

USL = Pay Factor Item Upper Spec Limit

LSL = Pay Factor Item Lower Spec Limit

**403.23.1.1 Quality Level Analysis.** The engineer will make the QLA no more than 24 hours after receipt of the contractor's test results, by determining the  $PWL_t$  for each designated pay factor item.

**403.23.1.1.1 Acceptance.** The contractor's test results will be used when applicable to determine the PWL, provided the contractor's QC tests and the engineer's QA tests compare favorably, and provided the engineer's inspection and monitoring activities indicate the contractor is following the approved QC Plan.

**403.23.1.1.2 Comparison.** Favorable comparison will be obtained when the engineer's QA test results on a production sample are within two standard deviations or the comparison limit, whichever is greater, of the mean of the contractor's test results for that particular lot. Comparison limits for QC average results are as follows: air voids within  $\pm 0.5$  percent, asphalt content within  $\pm 0.2$  percent, and density within  $\pm 1.3$  percent. QA  $CT_{\text{Index}}$  results shall be within  $\pm 30$  of the QC testing that falls nearest result for SuperPave and  $\pm 60$  for SMA. For the  $CT_{\text{Index}}$  test, if all QC and QA are greater than 80 for SuperPave mixes and greater than 190 for SMA mixes, then results are considered comparable. QA  $RT_{\text{Index}}$  results shall be within  $\pm 15$  percent of the QC testing that falls nearest. Further comparisons may be made by using F & t testing at a significance level of 1 percent as directed by the engineer.

**403.23.1.1.3 Outliers.** No test result shall be discarded, except individual test results on a lot basis may be checked for an outlier in accordance with the statistic T in ASTM E 178, at a significance level of 5 percent. If an outlier is found, material from the retained QA sample may be tested, in the presence of the engineer, to determine a replacement test value. The replacement test value shall be used in the PWL determination.

**403.23.1.1.4 Roadway/Shoulder Lots.** For the purpose of QLA, mixture placed on the traveled way and placed on the traveled way and shoulders integrally, shall be accounted for in a regular lot/sublot routine. Mixture placed on shoulders only shall be accounted for in a shoulder lot/sublot routine.

**403.23.1.1.5 Random Sampling.** For the purpose of QLA, all mixture produced at the plant and placed on the roadway shall be subject to random testing. Mainline density measurements at the roadway shall not be taken within 6 inches of an unconfined longitudinal joint. Random samples taken in the same day may be separated by 200 tons.

**403.23.2 Pay Factors.** The total pay factor ( $PF_T$ ) for each lot will be equal to the weighted sum of the pay factors (PF) for each pay factor item for each lot, and is determined as follows:

$$PF_T = + (0.5) PF_{\text{Density}} + (0.25) PF_{\text{Va}} + (0.25) PF_{\text{AC}}$$

The  $PF_T$  for each lot, on the shoulder or otherwise when the density pay factor is not directly included, will be equal to the weighted sum of the PF for each pay factor item for each lot, and will be determined as follows:

$$PF_T = (0.5) PF_{\text{Va}} + (0.5) PF_{\text{AC}}$$

The PF for each pay factor item for each lot will be based on the  $PWL_t$  of each pay factor item of each lot and will be determined as follows:

When  $PWL_t$  is greater than or equal to 90:  $PF = 0.3 PWL_t + 73$ ;

When  $PWL_t$  is greater than or equal to 70 and  $PWL_t$  is less than 90:  $PF = 0.5 PWL_t + 55$ ;

When  $PWL_t$  is less than 70:  $PF = 2 PWL_t - 50$ ;

**403.23.2.1 Density Pay Factor.** The theoretical maximum specific gravity of the mixture, as determined for each subplot and the bulk specific gravity of no less than one core from each subplot, will be used to perform the QLA for the percent of theoretical maximum density. Thick cores

required to be cut in half in accordance with [Sec 403.15.4](#) shall effectively double the number of sublots for cores. When density is not used as a pay factor, additional adjustment of the contract unit price will be based on the table in [Sec 403.23.8.1](#).

**403.23.2.2 Asphalt Content Pay Factor.** The QLA will be performed using the asphalt content test results from each lot.

**403.23.2.3 Air Voids Pay Factor.** Two gyratory specimens shall be compacted for each subplot and the average of the two specimens will be used to calculate the volumetrics of the subplot. The air voids shall be determined from the gyratory compacted specimens. The air voids for the QLA shall be those calculated using the average bulk specific gravity of the gyratory compacted specimens and the theoretical maximum specific gravity of the mixture determined for the subplot of material.

**403.23.2.4 CT<sub>Index</sub> and TSR Pay Factor.** The contract unit price for each 3,000 tons or fraction thereof for all mixtures shall be adjusted based on the average CT<sub>Index</sub> results for the tonnage according to the following table provided that acceptable RT<sub>Index</sub> or Hamburg and TSR results are obtained. The lower adjusted contract unit price from the CT<sub>Index</sub> and TSR results shall apply.

SuperPave Mixtures		
Cracking Tolerance Index (CT <sub>Index</sub> )	Tensile Strength Ratio (TSR) <sup>(a)</sup>	Percent of Contract Price
40 – 49	70 – 74 %	97%
50 – 99	75 – 84 %	100%
100 or Greater	85 % or Greater	103%
SMA Mixtures		
Cracking Tolerance Index (CT <sub>Index</sub> )	Tensile Strength Ratio (TSR) <sup>(a)</sup>	Percent of Contract Price
80 – 134	70 – 74 %	97%
135 – 239	75 – 84 %	100%
240 or Greater	85 % or Greater	103%

(a) If an approved liquid anti-strip is used, the TSR limit to receive full incentive is 80 percent.

The QLA shall be performed using each Density, % Air Void, and % Asphalt Content result within the lot.

**403.23.3 Removal of Material.** All lots of material with a PF<sub>T</sub> less than 50.0 shall be removed and replaced with acceptable material by the contractor.

Any subplot of material with a percent of theoretical maximum density of less than 90.5 percent or greater than 98.5 percent shall be removed and replaced with acceptable material by the contractor. For SMA mixtures, any subplot of material with a percent of theoretical maximum density of less than 92.0 percent shall be removed and replaced with acceptable material by the contractor.

Any material with a CT<sub>Index</sub> less than 40 shall be considered unacceptable material. For SMA mixtures, any material with a CT<sub>Index</sub> less than 80 shall be considered unacceptable material.

Any subplot of material with air voids in the compacted specimens less than 1.5 percent or tonnage of material not meeting the minimum RT<sub>Index</sub> shall be evaluated with Hamburg testing and removed

and replaced with acceptable material by the contractor if the rut depth is greater than 1/2 inch at the designated number of wheel passes.

Any material with TSR results below 70 percent or minimum conditioned tensile strength below 60 psi are considered unacceptable and will be subject to removal, production shall cease, the mixture reverified, and other payfactors incentives shall not be applied.

No additional payment will be made for such removal and replacement. The replaced material will be tested at the frequencies listed in [Sec 403.19](#). Pay for the material will be determined in accordance with the applicable portions of [Sec 403.23](#) based on the replacement material.

**403.23.4 Pay Factor Adjustments.** Pay factor adjustments are as follows:

**403.23.4.1 Unconfined Longitudinal Joint Density Adjustment.** The minimum density of all traveled way pavement within 6 inches of a longitudinal joint, including the pavement on the traveled way side of the shoulder joint, shall not be less than 90.5 percent of the theoretical maximum specific gravity for SuperPave mixtures and above 92.0 percent of the theoretical maximum specific gravity for SMA mixtures. The density of the longitudinal joint when confined will be included in the evaluation of the remainder of the mat. Pay adjustments will be in accordance with the following table and will be applied to the corresponding tonnage represented by the core(s).

Pay adjustments due to longitudinal joint density will apply to the full width of the lane paved. The average of joint cores from each subplot will determine specification compliance. If payment reductions are necessary, the lowest PF<sub>Total</sub> shall apply. Adjustments due to joint density will apply to the subplot from which the cores are obtained.

<b>Longitudinal Joint Density</b>	
Field Density (Percent of Laboratory Max. Theoretical Specific Gravity)	Percent of Contract Unit Price
<b>SuperPave Mixtures</b>	
≥ 90.5	PF <sub>Total</sub> not changed by longitudinal joint density
89.5 – 90.4	Maximum PF <sub>Total</sub> = 100%; Correction Required <sup>(a)</sup>
< 89.5	Remove and Replace
<b>SMA Mixtures</b>	
≥ 92.0	PF <sub>Total</sub> not changed by longitudinal joint density
90.0 – 91.9	Maximum PF <sub>Total</sub> = 100%; Correction Required <sup>(a)</sup>
< 90.0	Remove and Replace

(a) Correction requires spraying rapid penetrating emulsion on deficient density areas in accordance with JSP2303. All costs associated with correction shall be at the contractor's expense with no additional payment.

**403.23.4.2 Smoothness Adjustment.** The contract unit price for all mixes, except wedge or level course, will be adjusted in accordance with [Sec 610.5](#). The contract unit prices for asphaltic concrete pavement will be considered full compensation for all materials entering into the construction of the pavement and for the cost of the smoothness testing and correction.

**403.23.4.3 Paver Mounted Thermal Profiler.** The contract unit price for all mixes, except wedge or level course, will be adjusted in accordance with Sec 406. The contract unit prices for asphaltic concrete pavement will be considered full compensation for all materials entering into the construction of the pavement and for the cost of the PMTP testing and correction.

**403.23.4.4 Intelligent Compaction.** If Intelligent compaction is not included as a pay item in the contract, then all specification requirements and pay adjustments pertaining to Intelligent Compaction will not apply. If pay items for Intelligent Compaction are included in the contract, then all specification requirements and pay adjustments pertaining to Intelligent Compaction shall apply.

**403.23.5 Aggregate Variation.** Due to possible variations in the specific gravity of the aggregates, the tonnage of mixture used may vary from the proposal quantities. No adjustment in contract unit price will be made because of such variation.

**403.23.6 Compacted Samples.** Payment for obtaining and delivering samples of compacted mixture from the pavement and replacing the surface will be made per sample at the fixed price specified in [Sec 109](#). No direct payment will be made for samples taken for QC and QA testing.

**403.23.7 Payment for Pavement Repairs (Blow-ups).** Payment for repairing blow-ups will be made in accordance with [Sec 104](#).

**403.23.8 Miscellaneous Applications.**

**403.23.8.1 Small Quantities.** Small quantities are defined in [Sec 403.20.1](#). Unless the contractor has elected to use the normal evaluation in the Bituminous QC Plan for small quantities, the following shall apply for each separate mixture qualifying as a small quantity

(a) QLA and PWL shall not apply.

(b) Mixtures shall be within the specified limits for % Air Voids, % AC, and density. In addition to any adjustments in pay due to profile, the contract unit price for the mixture represented by each set of cores will be adjusted based on actual field density above or below the specified density using the following schedule:

Field Density (Percent of Laboratory Max. Theoretical Density)	Pay Factor (Percent of Contract Unit Price)
<b>For all SP mixtures other than SMA:</b>	
92.5 to 98.0 inclusive	100
90.5 to 92.4 inclusive	Correction <sup>(a)</sup>
Above 98.0 or Below 90.5	Remove and Replace
<b>For SMA mixtures:</b>	
>94.0	100
92.0 to 93.9 inclusive	Correction <sup>(a)</sup>
Above 98.0 or Below 92.0	Remove and Replace

(a) Correction requires spraying rapid penetrating emulsion on deficient density areas in accordance with JSP2303. All costs associated with correction shall be at the contractor's expense with no additional payment.

**403.23.8.2 Base Widening and Entrances.** For base widening mixtures and entrance work, QLA and PWL will not be required. Payment for these mixtures will be made at 100 percent of contract unit price for material that otherwise meets the specifications.

**403.23.8.3 Single Lift on Unmilled Surface or Leveling Course Work.** For resurfacing projects specifying a single lift on an unmilled surface, surface mixture of 3,000 tons or more, or for leveling course work, the following shall apply to the traveled way mixture. All bituminous mixture QC/QA requirements shall apply, except the density pay factor designated in [Sec 403.23.2](#) will not be directly included in the total pay factor. In lieu of that, one density sample shall be taken per subplot and the pay adjustment for density will be made using the table in [Sec 403.23.8.1](#).

**3.0 Insert Sec 406 Paver-Mounted Thermal Profiles:**

**406 Paver-Mounted Thermal Profiles**

**406.1 Description.** This work shall consist of continuous thermal profiling of the asphalt mat temperature behind the trailing edge of the paver screed plate during placement operations using a Paver-Mounted Thermal Profile System (PMTPS). This work shall be completed in accordance with the general principles set forth in AASHTO R 110 "Standard Practice for Continuous Thermal Profile of Asphalt Mixture Construction", and specifically as stated in the following sections.

**406.2 Required Measurements.** PMTPS measurements are required on the full width of paving of each asphalt lift. Collection of data shall include shoulder pavement when placed simultaneously with the mainline. The shoulder paving data will be filtered out using Veta during data processing. PMTPS data collection is not required in the following exceptions:

- (1) PMTPS measurements are not required on auxiliary lane tapers, ramps, shoulders (not paved simultaneously with mainline), cross-overs, non-continuous turn lanes, loops, bypass lanes, acceleration/deceleration lanes, intersecting streets, roundabouts, and partial lane width widenings.
- (2) PMTPS measurements are not required for a total net paving length less than 2 lane miles.
- (3) PMTPS measurements are not required on asphalt lift thicknesses less than 1 inch.

**406.3 Equipment Requirements.** The PMTPS shall consist of the following components listed.

- (1) Temperature sensor to continuously monitor surface temperature of mat.
  - a. Longitudinal and lateral surface temperature readings shall be collected at 12-inch or less intervals at all paving speeds with an X-Y accuracy of plus or minus 1 inch.
  - b. Surface temperatures shall be collected for the full width paved in one pass (including any shoulders paved simultaneously with mainline).
  - c. Surface temperature sensors(s) shall have a temperature range of at least 140 F to 480 F. Sensory accuracy shall be plus or minus 3.6 F, or plus or minus 2.0 percent of sensor reading, whichever is greater.

(2) Global Navigation Satellite System (GNSS) receiver to capture coordinates of the surface temperature readings. GNSS accuracy shall be plus or minus 2 inches or less in X and Y directions when intelligent compaction is being used. A base station shall be required at any locations having poor cellular reception to obtain required accuracy. When intelligent compaction is not being used GNSS accuracy shall be plus or minus 4 feet or less in the X and Y directions and ground distance sensor shall be within plus or minus 1/1000 feet.

(3) Onboard data acquisition with a minimum of the following capabilities:

- a. Displays (in real-time) map of the surface temperature readings.
- b. Displays total distance, paver speed and location.
- c. Reports surface temperature readings and GNSS status.
- d. Provides real-time statistical summaries of surface temperature readings.
- e. Allows operator to define data lot currently being placed per AASHTO PP 114.
- f. Stores data internally until data transfer.
- g. Automatically transfers data to cloud storage or other approved methods.

**406.3.1 System Setup on Pavers.** Pavers shall be instrumented with the PMTP system for the full paving width and shall collect measurements no less than 3 feet and no greater than 12 feet from the trailing edge of the screed plate. Other objects shall not obstruct surface temperature measurements and GNSS accuracy.

#### **406.4 Construction Requirements.**

**406.4.1 Temperature Verification.** Temperature verification shall follow AASHTO R110-22, Section 6 Calibration. A record of each verification shall be submitted to the SharePoint prior to the start of the project.

**406.4.2 Data Management.** PMTP data files shall be compatible with the Veta software. The contractor shall supply the engineer with the manufacturer's PMTPS Computer Software 14 days prior to beginning work and until ninety days after completion of all work. If Cloud Storage or Cloud Computing is used, the engineer shall be supplied one user ID with full access for the same time-period specified. If cloud storage is not used Raw PMTP data files shall be downloaded once per day and uploaded to the appropriate MoDOT IC-PMTP SharePoint site before the start of the next day's production. The following data management requirements shall apply:

- (1) The PMTP data files should be directly transferred from cloud storage to Veta. Other methods shall be approved by the engineer.
- (2) The PMTP Veta files shall be appropriately formatted and filtered in accordance with MoDOT IC-PMTP protocol.
- (3) Date and time stamp of PMTP shall be checked and verified to reflect the local time zone for both mapped and exported data.

**406.4.3 Quality Control.** The following shall apply to the Contractor's Quality Control for PMTP.

- (1) The contractor shall have a properly trained person listed in the QC Plan that has completed a Veta training course within the last 2 years to perform the PMTP data collection and file management for the project.
- (2) The PMTP system shall have a documented annual calibration before beginning construction.
- (3) For each run, the thermal profile shall be divided into 150-foot sublots at the full paving width and partial data sublots as follows:
  - (a) Combine partial data sublots less than 75 feet with the previous data subplot.
  - (b) Treat partial sublots greater than 75 feet as one data subplot.
  - (c) Sublots shall not extend over multiple days, different lifts, or paving directions.
- (4) Veta files shall be completed and uploaded with the appropriate naming convention in accordance with MoDOT IC-PMTPS Protocol. Appropriate naming convention can be found in the IC-PMTP Document Helper. The completed Veta files shall have the appropriate filters applied with the summary data transferred to the Summary Report. An up-to-date Summary Report shall be provided to the engineer two days prior to the 1<sup>st</sup> and 15<sup>th</sup> of each month.
- (5) **PMTP Quality Control Plan.** A pre-activity meeting shall be required prior to mainline paving. The PMTP Quality Control Plan shall be submitted to the engineer at least 2 weeks prior to the mainline paving pre-activity meeting. The plan at minimum shall include the following:
  - (a) A list of personnel previously trained
  - (b) Detailed daily verification procedure for checking the RTK-GNSS of PMTP
  - (c) Procedure for downloading PMTP data from the instrument
  - (c) The procedure for training operators or other project staff
  - (e) Detailed daily verification procedure for checking the temperature sensor on the PMTP
  - (f) The name of the designated PMTP Quality Control Technician
  - (g) Procedure for submitting data
  - (h) Contact information for technical support staff
  - (i) Anticipated cellular service and GNSS coverage throughout entire project
  - (j) A list of the control points with either UTM or State Plane Coordinates established by the contractor if a base station is required.

**406.4.4 Quality Assurance (QA) Testing.** The Engineer will use a Forward Looking InfraRed (FLIR) camera to verify the contractor's PMTP system. QA tests shall be taken at random locations twice per day. The contractor shall assist the engineer with the placement of the event marker.

The QA tests using the FLIR data QA tool shall compare favorably, according to the instructions found in the IC-PMTP Document Helper. If results do not compare favorably, the contractor's PMTPS shall be verified by the manufacturer. In the case that the PMTPS is required to be sent off to the manufacturer and the contractor is not able to provide a

replacement, the contractor will be allowed to continue paving with the verification by the engineer using a FLIR camera for acceptance only.

**406.4.5 Thermal Segregation.** Thermal segregation will be calculated by using the Differential Range Statistics (DRS) under the parameters of AASHTO R110 in each 150-foot subplot.

The Veta analysis with the appropriate filters applied shall exclude the following surface temperature readings from each subplot:

- (1) Surface temperature readings less than 180 F.
- (2) Surface temperature readings within 2 feet. prior to and 8 feet. after paver stops that are greater than 1 minute in length.

The thermal segregation categories are based on the Differential Range Statistics (DRS), as shown in the table below.

Differential Range Statistics (DRS)	Thermal Segregation Category
DRS ≤ 25.0°F	Low
25°F < DRS ≤ 35°F	Moderate
35°F < DRS ≤ 50°F	Moderate-High
DRS ≥ 50°F	Severe

**406.4.6.1 Incentive/Disincentive.** Incentive/disincentive adjustments shall be made for each subplot in accordance with the following:

Thermal Segregation Category	Adjustment per 150 ft. Sublot
Low	\$40 Incentive
Moderate	\$40 to \$0 Incentive (Linear)
Moderate-High	\$0 to -\$40 Disincentive (Linear)
Severe	-\$40 Disincentive and Reviewed by Engineer

**406.5 Loss of Data.** If data collection ceases as a result of circumstances reasonably beyond the control of the contractor, the contractor will be allowed to continue the days paving, but the paved sublots will not be eligible for 406 PMTP Incentive. The engineer must be notified immediately of the issue and shall determine if the contractor has made a reasonable effort to resolve the issue. A meeting with the engineer shall be held to determine how to proceed if the issue is expected to extend into the next day’s paving. Failure to notify the engineer of the issue at hand will result in the paved sublots to receive a minus \$40 deduct.

**406.5.1 GNSS Obstructions.** Isolated areas of GNSS obstruction may be filtered out of Veta at the contractor’s choice. These areas shall be identified in Veta and brought to the attention of the Engineer. Areas excluded from GPS obstruction shall not exceed approximately 5 percent of the total day’s production. It is at the discretion of the engineer to determine if the area exceeds an approximate 5 percent.

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

YY. Additional Research JSP-25-06

**1.0 Description.** This contract requires additional research work that shall be completed in accordance with this special provision. The additional research work along with the associated fixed cost bid item is described herein. The contractor shall be responsible for performing all tasks identified in Section 2.0.

**2.0 Research Workplan.** This research workplan includes the contractor sampling, fabricating, handling, and shipping asphalt specimens at the asphalt plant during production to be used for the Asphalt Mixture Performance Tester (AMPT) research. It is imperative that the contractor follows all protocols since AMPT test data will be used to determine future design thicknesses and performance of asphalt pavements. In addition, the asphalt plant shall be operating at the production capacity to minimize silo storage time and obtain a representative asphalt sample. The AASHTO specifications and protocols used for this research are listed as follows:

**2.1 AASHTO PP 99** – Preparation of Small Cylindrical Performance Test Specimens Using the SuperPave Gyrotory Compactor (SCG) or Field Cores

**2.2 AASTHO T 312** – Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the SuperPave Gyrotory Compactor

**2.3 AASTHO T 166** – Bulk Specific Gravity (Gmb) of Compacted Asphalt Mixtures Using Saturated Surface Dry Specimens

**2.4 AASHTO T 331** – Bulk Specific Gravity (Gmb) and Density of Compacted Asphalt Mixtures using Automatic Vacuum Sealing Method

**2.5 AASHTO T 209** – Theoretical Maximum Specific Gravity (Gmm) and Density of Asphalt Mixtures

**2.6 AASHTO T 269** – Percent Air Voids in Compacted Dense and Open Asphalt Mixtures

**2.7 AASHTO R 97** – Sampling Asphalt Mixtures

**2.8 AASHTO R 47** – Reducing Samples of Asphalt Mixtures to Testing Size

**3.0 Fabricating** - The contractor is responsible for fabricating four (4) 150-mm diameter by 180-mm tall SGC AMPT specimens, verifying and recording the air voids of these specimens, and shipping the specimens to the location provided by the engineer. Additional SGC specimens will be fabricated to establish acceptable air void parameters. Acceptable air voids shall be determined by coring out smaller (100-mm diameter by 150-mm diameter) specimens out of the SGC specimens that meets the target air void content for AMPT testing. Once the smaller sized specimens meet the required air voids then the specimen heights of the larger SGC specimens can be fabricated accordingly.

**3.1** The contractor shall follow AASHTO PP 99-3, Sections 9.1 – 9.3 of Procedure A (Fabrication from SGC Specimens), for making the SGC specimens. These tasks are summarized as follows:

**3.1.1** Prepare asphalt mixture for the 150-mm diameter by 180-mm tall SGC specimens in accordance with AASHTO 312 and prepare a companion mixture sample for determining the Theoretical Maximum Specific Gravity (Gmm) in accordance with AASHTO T 209.

**3.1.2** The mass of the asphalt mixture needed for each SGC specimen will be determined by Appendix X2 in AASTTO PP 99-3 where a 100-mm diameter by 150-mm diameter specimen is cored and sawn from the center of the larger SGC specimen. The air voids of the smaller specimen shall be  $7.0 \pm 0.5$  percent for dense graded asphalt,  $6.0 \pm 0.5$  percent for SMA mixtures, or  $3.0 \pm 0.5$  percent for HiMod asphalt mixtures. Once the air voids of the small test specimens are within the correct tolerance, the mass of the SGC specimens shall be recorded so that the SGC test specimens can then be replicated.

**3.1.3** After sampling of all loose mix material, splitting and breakdown, condition the material at the molding temperature for a minimum of 30 minutes before fabricating SGC specimens. The loose mix shall be at molding/compaction temperature prior to specimen fabrication.

**3.1.4** Compact the SGC specimens to a height of 180 mm (minimum) in accordance with AASHTO T 312, carefully following Sections 9.2.2 through 9.2.4 of AASHTO PP 99-3 as summarized below. Once the target mass of the SGC specimens has been established in Step 2, the SGC heights shall not vary by more than +1 mm (must be 180 mm or greater) of the target height without reevaluating the air voids within the smaller test specimens.

- a. A mixture transfer funnel centered over the specimen mold shall be required for pouring the mixture into the specimen mold. (See AASHTP PP-99, Note 5, for acceptable transfer funnels).
- b. Pour the mixture into the center of the mixture transfer funnel to minimize air void variation between test specimens.
- c. Charge the mold in two equal lifts. After each lift, use the spatula to scrape the walls of the mold, inserting the spatula 8-10 times around the circumference of the mold. Insert the spatula into the center of the mixture 10-12 times in an evenly distributed pattern. Insert the spatula as far as possible into the mixture without damaging aggregates.
- d. Allow the compacted SGC specimen to cool before extracting out of the mold to minimize any deformation of the specimen.
- e. Compaction temperature, times in and out of the oven, gyratory specimen weight and sample identification shall be recorded.

**3.1.5** Determine and record the Gmb of the SGC specimen in accordance with AASHTO T 166.

**3.1.6** Determine and record the Gmm of the asphalt mixture in accordance with AASHTO T 209.

**3.1.7** Compute the air void content of SGC specimen in accordance with AASHTO T 269 and record percent air void content for each specimen. This percent air void content should be higher compared to the acceptable air void content of the smaller specimens established in Step 2.

**3.1.8** Research tasks are complete when four (4) 150 mm x 180 mm (minimum) SGC specimens are fabricated with acceptable air voids established in Step 2.

**3.1.9** Specimen Storage Instructions – After fabrication, the SGC specimen shall be stored in a refrigerator between 34 F and 40 F, until shipping. The samples shall be shipped within 3 days of fabrication.

**3.1.10** Specimen Shipping Instructions - The SGC specimens shall be packaged in 6" x 12" cylinder molds with wrapping/filler as needed. The cylinder molds shall be shipped in a cooler

with dry ice or other cooling agents to the address provided by the engineer. Expedited shipping methods shall be used.

**3.1.11** The template attached to this JSP shall be completely filled out along with all raw data and calculations.

**4.0 Basis of Payment.** The accepted lump sum quantity of SGC specimens will be paid for at the fixed unit price for the pay item number found below. Failure to produce the research work items in the workplan or an invalid AMPT sample will result in a contract deduction equal to that of the fixed unit cost.

Pay Item	Unit	Fixed Unit Cost
401-99.01, Asphalt Research – SP125C	Lump Sum	\$ 10,000
401-99.01, Asphalt Research – SP125CLP	Lump Sum	\$ 10,000

Data Template for Additional Research			
Date of Fabrication		Asphalt Plant	
Contract ID		Contractor	
Job Number		Contact Name	
Mix ID		Phone Number	
Plant Mixing Temp.		Email Address	
Target Compaction Temp.			
<b>Sampling and Splitting of Asphalt Loose Mix</b>			
Ensure plant is running at production rate to minimize silo storage time			
Proper sampling protocols in accordance with AASHTO R 97 and R 47 to minimize segregation			
Mix Temperature		<b>Air Voids for Specific Mix Types</b>	
Gmm (AASHTO T 209)		SuperPave	7.0 +/- 0.5 %
Mix Type		SMA	6.0 +/- 0.5 %
		Hi-Mod	3.0 +/- 0.5 %
<b>Air Void Validation (Repeat as necessary - Cored/Sawn Specimen meets air voids per mix type)</b>			
Trial Specimens	SGC Specimens	Cored/Sawn Specimen	(Shall meet air void range)
Dimensions	150-mm x 180-mm	100-mm x 150-mm	
Trial Weights			
Gmb (AASHTO T 166)			
Air Void %			
Absorption % check*			
* Note: Absorptions greater than 2.0% shall be tested in accordance with AASHTO T 331)			
<b>(Repeat Trials as necessary until air voids meet criteria per mix type)</b>			

Final Specimen Fabrication	(3 - 150-mm x 180 mm SCG specimens)			
Final Specimens	SCG 1	SCG 2	SCG 3	SCG 4
Oven Set Temperature				
Time In Oven				
Time Out of Oven				
Total Oven Time (minutes)				
Mix Temp prior to Compaction				
# of Gyration				
Final Weight				
Final Height (=>180 mm)				
Gmb (AASHTO T 166/T331)				
Air Voids %				
Absorption % check				

ZZ. 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

AAA. Additional Aggregate Base for Sidewalks Around Curb Inlets

**1.0 Description.** The contractor shall install a thicker rock base material adjacent to all utility structures within the width of the sidewalk and curb ramps to limit differential settlement of the pedestrian path over the structure. Structures include but are not limited to stormwater inlets, manholes, and valves.

**1.1** An additional two-inch depth of rock base shall be placed for 12 feet either side of each structure totaling six inches over the 4 inch pay quantity

**2.0 Method of Measurement.** Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

**3.0 Basis of Payment.** The accepted quantity of Additional Aggregate Base for Sidewalks Around Curb Inlets will be paid at the contract unit price for the pay items in the plan. No additional payment will be made to fulfil the requirements above.

Item Number	Unit	Description
608-99.02	EACH	ADA Concrete Curb Ramp
304-05.04	SQ YD	Type 5 Aggregate for Base (4 In. Thick)

BBB. Adjusting Manholes, Valves and Pullboxes

**1.0 Description.** This work shall consist of adjusting water valves, water meters, basins/inlets, manholes, lighting pull boxes, and signal pull boxes that are within areas where either new sidewalks, curb ramps, approaches or pavements are to be constructed as shown on the plans. The contractor shall verify the type of frame and cover in the field before performing the work. The adjustments shall be made to match the final proposed grade. Various pull boxes are called out to be relocated and adjusted to grade. The relocation of these pull boxes is included in the adjust to grade pay item. Adjusting rings shall not exceed 12 inches in height.

**2.0 Construction Requirements.** Adjusting manholes and adjusting basins or inlets shall be done in accordance with Sec 604 except as modified herein.

**2.1** Adjustments, extensions, and/or lowering of utility and any related excavation and backfill shall be constructed as approved by the Engineer. For MoDOT owned facilities, adjustments shall conform to current Missouri Standard Specifications for Highway Construction. For MSD owned facilities, adjustments shall conform to the 2018 MSD Construction Specifications for Sewer and Drainage Facilities and the 2009 MSD Standard Detail Sheets. Adjustments for inlets require the top lid slopes to be adjusted to less than 2% slope in all directions and some of these inlets need to be raised to the final sidewalk grade. These are called out in the plans as “adjust inlet top”. Adjustments shall be completed so that the finished sidewalk, ramp, approach, or pavement meets current ADA standards.

**2.1 Concrete Aprons.** Damaged concrete aprons on manholes shall be replaced as directed by the engineer. The replacement concrete collars shall be 4 inches deep and 18 inches wide around the manhole.

**3.0** The contractor is advised that Metropolitan St. Louis Sewer District, MoDOT, MAWC, and Spire Gas have manholes and valves, located within the islands/roadway/sidewalk that will require adjustments. The Contractor shall adjust these facilities to grade as necessary. The Contractor shall contact the respective utility regarding any questions regarding the adjustment of these facilities.

**3.1** The contractor shall notify the engineer if manholes or pull boxes belonging to utilities other than Metropolitan St. Louis Sewer District or MoDOT, are encountered that will require adjustment. The contractor shall coordinate work with the affected utility to ensure that the completed facilities meet ADA requirements.

**3.2** No direct payment will be made for any required hauling, cutting, joining, backfilling, or adjusting rings, or any other requirements necessary to fulfill this provision. No direct payment will be made to recover the cost of equipment, labor, materials, or time required to fulfill the above provision.

**3.3 Basis of Payment.** All costs associated with compliance with this special provision for all material, equipment, and labor shall be completely covered by the contract unit price for:

Item Number	Type	Description
604-99.02	Each	Adjust Manhole
604-99.02	Each	Adjust Pull Box to Grade
604-99.02	Each	Adjust MSD Sanitary or Storm Manhole
604-99.02	Each	Adjust Water Valve
604-99.02	Each	Adjust Gas Valve

**4.0** Pull boxes, valves or manholes not owned by MoDOT or specified as required work by the Contractor may require adjustment due to work in the contract. The Contractor shall contact the respective utility owners regarding any questions about the adjustment of these facilities. The Contractor shall contact the respective utility owner, at least 3 weeks prior to adjustment of these facilities to allow the utility owner to make necessary adjustments. The Contractor shall coordinate with the respective utility owners for scheduling and providing the necessary grade requirements for each adjustment. Payment for all necessary work required for the coordination for the scheduling, grade requirements and adjustments of these utility facilities shall be at no direct pay.

Contractor shall directly contact Utility companies to verify location of facilities and status of relocation/adjustment work. The contractor shall coordinate construction activities with Utility Companies and take measures to ensure the integrity of the existing facilities are not disturbed until such time as the Utility Companies have completed the adjustment work.

**CCC. 2.5" PSST Posts**

**1.0 Description.** The contractor shall not request a VE (Value Engineering) in order to change the sign posts from 2.5" PSST to 2" PSST. The contractor shall install what is shown in the plans. MoDOT will not consider a VE in this case

**DDD. Coordination with MoDOT Signal Shop for Cabinet Entry**

**1.0 Description.** Commission-furnished color-coded pad locks have been placed on all of MoDOT's signal cabinets in addition to the key used to unlock the door handle. To gain access to the appropriate cabinets during the project all contractors shall coordinate with MoDOT's signal shop to obtain the proper keys and locks..

**1.0.1 Keys & Locks.** Red locks & keys are provided when a contractor has modified the signal cabinet and MoDOT staff shall not have access to the cabinet until it is accepted for maintenance. The blue keys are provided for entry into the cabinet where MoDOT's Signal Shop group deems the access to be minor in nature (entry to the cabinet to make a simple network switch connection, for example).

**1.0.2 Completion of Project.** At the completion of the project all keys and pad locks distributed to contractor during the project shall be returned to the Signal Shop supervisor or their representative and keys shall not be reproduced.

**2.0 Contact.** Initial contact must be made at least seven calendar days before work begins, preferably when the project has the notice to proceed or during the pre-construction meeting, if applicable. MoDOT's Signal Shop supervisors shall be notified prior to work beginning. Contact the signal shop via email at [sltrs@modot.mo.gov](mailto:sltrs@modot.mo.gov) to coordinate which padlocks are to be used.

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

### EEE. Disposition of Existing Signal/Lighting and Network Equipment

**1.0 Description.** All controllers, cabinets, cabinet equipment, network equipment, DMS equipment, antennas, radios, modems, and other equipment noted in the plans shall be removed by the contractor.

**2.0 Signal Equipment.** All equipment other than network communication devices noted in 3.0 are to be transported to the Commission's maintenance lot located at 2309a Barrett Station Road, Ballwin, Missouri 63021. The contractor shall notify the Commission's representative 24 hours prior to each delivery by calling:

- Mr. Dennis Hixson, Traffic Supervisor, Preventive Maintenance/ITS
  - Cell: (314) 565-6726
- Mr. Brian Ducote, Traffic Supervisor, Emergency Signal Maintenance
  - Cell: (314) 681-8395
- Mr. Todd Burgess, Lighting and Locate Supervisor
  - Cell: (314) 348-9470

**3.0 Network Communication Devices.** Devices such as CCTV cameras and domes, video encoders, device servers, Ethernet switches, media converters, and radio assemblies are to be transported to the Commission's TMC in Chesterfield. The contractor shall notify the Commission's representative 24 hours prior to each delivery by calling 314-275-1526 and providing details for the delivery.

**4.0** The contractor shall exercise reasonable care in the handling of the equipment during removal and transportation. Should any of the equipment be damaged by the contractor's negligence, it shall be replaced at the contractor's expense. The contractor shall dispose of any other equipment. Delivery shall be within 2 working days of removal. All items returned shall be tagged with the date removed, project number and location/intersection.

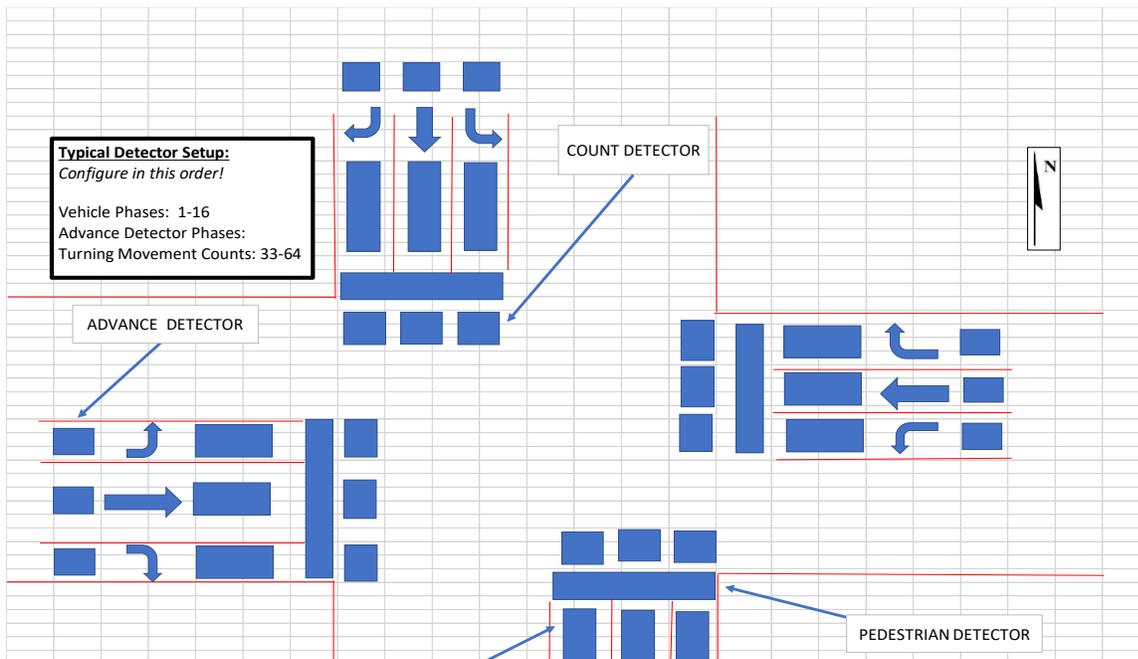
**5.0 Basis of Payment.** Payment for removal, handling and transportation of all equipment specified shall be considered completely covered by the contract unit price for “Removal of Improvements” per lump sum.

FFF. SL District Traffic Signal Detection System

**1.0 Description.** This work shall consist of providing detectors for signalized installations that will support advance traffic signal performance measures (ATSPM) on the Commission’s St. Louis District roadways. Detectors shall be in accordance with the Missouri Standard Specifications for Highway Construction (latest version) and installed to provide detection at locations as shown on the plans or as directed by the Engineer in accordance with Section 902. If any information conflicts between Section 902 and this JSP, the JSP shall supersede.

**2.0 Detector Zones.** The following detector zones shall be placed as shown in the plans:

- Stop Bar Detection
- Advance Upstream (Performance Measures)
- Dilemma Zone
- Turn Counts
- Advance Video Zones (if applicable)
- Radar Zones (if applicable)
- Advance Data Collector (if applicable)
- Bicycle/Pedestrian (see Section 2.2)



**[INSTRUCTIONS: Configure detector setup per project and/or intersection. Double click to edit Excel file base.]**

**2.1 Dilemma Zones.** Dilemma zone detection shall be required for the following approaches for high-speed dilemma zone detection:45

***[INSTRUCTIONS: Insert any approaches 45 MPH + or where engineering judgment dictates the need for dilemma zone detection.]***

Dilemma zone detectors shall be placed at 5 secs and 8 seconds travel time before stop bar per below Table unless directed otherwise in the plans or by the Engineer.

Approach Speed (MPH)	Advance Detector Placement secs Travel time 5	Advance Detector Placement seconds travel time 8
35 mph	260	415
40 mph	295	470
45 mph	330	530
50 mph	370	590
55 mph	405	645
60 mph	440	705

**2.2 Bicycle/Pedestrian Zones.** Bicycle and/or pedestrian zones (if applicable) shall be provided as directed by the Engineer. Specific zone placement and description as required by vendor shall be reviewed and approved by the Engineer.

**3.0 Performance Measures.** In addition to presence detection, the detection system shall be capable of providing data to an advanced traffic signal controller that can perform at a minimum the following calculations in real time for each detection zone without the addition of another device:

- Speed
- Volume
- Lane Occupancy
- Vehicle Classification
- Other available performance measures

For speed calculations through movements are required for all detection installations. Turning movement measurements are required for all detection installations. For volume measurements/calculations both mainline through and all turning movements are required. All values are to be assigned to detector channels within the controller. Other performance measures must be clearly defined. In all cases all performances measures must be ultimately available in an easily usable, exportable format. Turning movement counts shall be installed per the detector setup diagram(s) above to include all lanes. The Contractor shall provide documentation to the Engineer to confirm the volumes are configured and operational through the detection system. The Contractor shall also provide a final schedule of detector assignments in the .pdf format to the Engineer and the Commission’s signal maintenance supervisor. Performance measurement data must be configured and fed into the Commission’s ATSPM platform with data storage confirmed, see Section 5.0. If utilized on the project, the Contractor’s Traffic Engineer shall assist in this task.

**4.0 Material.** The Contractor can choose from the following list of detector types according to the exceptions noted below:

- Video Image

- Radar

Reference each detection type's subsection for specific allowable models. Unless otherwise specified on the plans, the Contractor may supply more than one type of detector and customize the installation based on field conditions, as approved by the Engineer.

**4.1 Video Detection.** If video detection is selected, the following provisions shall also apply.

**4.1.1 Description.** The Contractor shall furnish and install all equipment, materials, software and other miscellaneous items that are required to provide a fully functional Video Detection System for the control of vehicular and pedestrian traffic signals.

**4.1.2 Material.** The video detection system shall consist of power supply, hard-wired video cameras, all necessary video and power cabling with end connectors, mounting brackets, surge protection as recommended by the manufacturer, video detection processors/extension modules capable of processing the number of camera and phase combination video sources shown on the project plans. The video detection system will be defined as the complete assembly of all required equipment and components for detection of vehicles. Each video detection system shall consist of the video camera(s), lightning arrester for video cabling, processor unit(s), control device (track ball or keypad; no mouse allowed), software and license for system control via a computer (if applicable), communication components, and a color monitor. The video detection system shall have the most current available firmware installed. All camera views shall be obtainable without requiring the disconnection and reconnection of cables within the system. The video detection systems in the list below are the only systems that are tested, fully functional, and approved for use in the St. Louis District.

- Autoscope Vision
- Iteris Vantage Next
- Aldis Gridsmart Smart mount Camera (Performance Module to be included)

**4.1.3 Installation Requirements.** The video detection system shall be installed per the manufacturer's recommendations. The installer shall be certified by the video detection system's manufacturer to install the system. All CAT5 cable runs (if used) shall be continuous without splice from the cabinet to the camera. If requested by the engineer, a factory certified representative from the supplier shall be available for on-site assistance for a minimum of one day during installation. The bottom of the video camera shall be mounted per the manufacturer's recommendations, unless otherwise indicated on the plans or approved by the Engineer. The video detection system shall not be installed on pedestal signal unless otherwise directed by the Engineer. The video detection system shall not be installed on a 15' luminaire arm unless otherwise directed by the Engineer.

A separate grounded 120 VAC service outlet shall be provided in the controller cabinet for supplying power to the parts of the video detection system requiring AC power. Use of the grounded service outlet located on the cabinet door will not be permitted. The video detection system must integrate/be compatible with an Advanced Transportation Signal Controller (ATC).

**4.1.4 Detection Zones.** The detection zones shall be created by drawing the detection zones on the video image. A graphical user interface shall be built into the video detection system and displayed on a video monitor or computer. It shall be possible to edit previously defined detector configurations to fine-tune detection zone placement. When a vehicle is detected by crossing a

detection zone, there shall be a visual change on the video display, such as a flashing symbol or a change in color or intensity to verify proper operation of the video detection system.

**4.1.5 Performance.** Overall performance of the video detection system shall be comparable to inductive loops. Using camera optics and in the absence of occlusion, the video detection system shall be able to detect vehicle presence with 98% accuracy under normal day and night conditions with only slight deterioration in performance under adverse weather conditions, including fog, snow and rain. When visibility exceeds the capabilities of the camera, the video detection system shall default to placing a call on all detectors. Supportive documentation is required to meet this specification and shall be provided to the Engineer before installation.

**4.1.6 Monitor.** The monitor shall be an LCD active matrix with a minimum 7" diagonal screen color monitor, an NTSC-M system and BNC video in-out connections built into the housing. The unit shall be compact and lightweight, securely mounted to the cabinet shelving, have low power consumption, constructed to operate under extreme temperature conditions, and run on AC power. AC adaptor shall be included. The monitor shall be installed to automatically power on when the cabinet door is opened and automatically power off when the cabinet door is closed. A manual on/off switch shall be provided.

**4.1.7 Video Camera and Housing.** The camera shall produce a color video image of vehicles during daylight hours, with an optional production of black and white images during nighttime hours. The video shall produce a clear image for scenes with a luminance from a minimum range of 0.18 to 929 foot-candles (2.0 to 10,000 lux). The camera shall provide a minimum resolution of 430 lines horizontal (TVL) and 350 lines vertical under NTSC operation. The camera shall include an electronic shutter or auto iris control based on average scene luminance and shall be equipped with an auto iris lens. sun shield that prevents sunlight from directly entering the lens. The sun shield shall include a provision for water diversion to prevent water from flowing in the camera field of view and shall be able to slide forward and back.

**4.1.8 Video Detection System Connections.** All bus connections in the video detection system shall be corrosion resistant. Serial communications to a computer shall be through an RS-232/RS-422 serial port through a subminiature "D" connector with a computer running supplied system software. The port shall have the capability to access detection system data as well as the real-time imagery needed to show detector actuations. The processor shall have a RJ-45 plug using Ethernet 10/100 protocols. The equipment shall be provided with either a NEMA TS1 or NEMA TS2 interface as shown on the plans.

***[INSTRUCTIONS: Only use this paragraph when retrofitting a signalized intersection].*** For TS1 systems, the video detection system shall be equipped with a TS1 detector interface for a minimum of 32 detector outputs. Logic output levels shall be compatible with the TS1. A subminiature "D" connector on the video detection system shall be used for interfacing to these outputs.

For TS2 systems, the video detection system shall be equipped with a TS2 Type 1 detector interface, where detector information is transmitted serially via an RS-485 data path. A 15-pin subminiature "D" connector, meeting the requirements of the TS2 standard, shall be used for the serial detector output. A minimum of 32 detector outputs is required, with the capability of expansion to 64 outputs if required based on the design plans.

The contractor shall be responsible for any changes or additions to either an existing or new cabinet in order to provide a properly functional video detection system and monitor display. This

may include, but is not limited to, additional SDLC connectors, an MMU (malfunction management unit), shelf relocation and component reorganization. No direct pay for any changes or additions. All required connections will be considered part of the video detection system installation.

**4.1.9 Documentation.** The contractor shall provide one bound copy and one electronic version (.pdf format) of the user's manual.

**4.2 Radar Detection.** If radar detection is selected, the following provisions shall also apply.

**4.2.1 Description.** Provide, install and test continuous tracking advance detector (CTAD) units and cabinet interface to detect range, speed, and vehicle estimated time of arrival (ETA) to the stop bar for vehicles or clusters of vehicles moving in the user selected direction of travel. The CTAD shall also detect instantaneous roadway efficiency. This specification sets forth the provisions for a radar detection system that detects vehicles, pedestrians, bicycles, and motorcycles on roadways and provides vehicle presence and full-motion tracking.

#### **4.2.2 Material**

**4.2.2.1 Stop Bar Detector.** The radar detection systems in the list below are the only systems approved for use in the St. Louis District. Installation of radar detection systems shall follow both the below specifications and the manufacturer's instructions.

- WAVETRONIX SmartSensor
  - Matrix

Provide a radar detection system with the following features.

- Shall be able to track/detect a minimum of 64 objects
- Shall be able to operate in a temperature range between -30 degrees and 165 degrees F
- The detection zones shall be configurable based off several factors' such as classification, ETA, speed, presence, and delay.
- The radar sensor shall be forward fire
- The sensor shall operate in the 25 GHz band
- The sensor shall be housed in a sealed IP-67 enclosure

**4.2.2.2 Advance Detector.** The radar detection systems in the list below are the only systems approved for use in the St. Louis District. Installation of radar detection systems shall follow both the below specifications and the manufacturer's instructions.

- WAVETRONIX SmartSensor
  - Advance
  - Advance Extended
- Iteris Vector
- In addition to the specifications listed in Section 4.3.2.1, the detection range shall also cover the dilemma zone distances prescribed in section 2.1.

#### **4.2.2.3 Power and Communications.**

- Power and communications cabling shall be installed per manufacturer specifications
- The radar sensor shall operate at 24 VDC
- Power consumption shall be no more than 38 watts
- If required, the advance detection System shall include all equipment to communicate wirelessly.

**4.2.2.4 Contact Closure Card.** Any contact closure card shall be compatible with a NEMA detector rack and shall be installed per manufacturer specifications.

**4.2.2.5 Lightning Surge Protection.** The CTAD shall include surge protection hardware installed per manufacturer specifications. The hardware shall be accepted by the engineer before installation in the cabinet.

#### **4.2.3 Construction Requirements.**

**4.2.3.1 Mounting Location.** All mounting hardware shall be installed per manufacturers specifications. The CTAD shall be mounted as follows:

- at a height that is within the manufacturer's recommended mounting heights.
- The radar shall be positioned so that all detection zones needed for an approach can be captured.
- in a forward-fire position, looking towards either approaching or departing traffic.

***{NOTE: Adjust 4.3.3.2 depending on the availability of an induction card rack in cabinets}***

**4.2.3.2 Induction Card Rack Interface.** {Install the contact closure card in the existing induction card rack} **or** {Install a 4-position induction card rack with power supply} and configure based on manufacturer's instructions to provide all needed detection outputs. Any power supply cards for the induction card rack needed for proper operation of the CTAD shall be provided and installed by the contractor.

**4.2.3.3 Support.** A factory certified representative from the supplier shall be available for on-site assistance for a minimum of one day during installation and shall provide two (2) days of local training after the CTAD has been installed and are operational.

**4.2.3.4 Acceptance Testing.** The contractor shall develop a proposed test procedure for the CTAD and submit it to the Engineer for approval. It must include visual verification of vehicle detections being received. Each detector shall be tested separately. Revise the proposed test procedure until it is acceptable to the Engineer. Provide all equipment and personnel needed to safely conduct the tests. Arrange for the Engineer's representative to witness the tests. Give the Engineer a report documenting the result of the tests.

#### **4.2.4 Documentation and Software.**

**4.2.4.1** Prior to purchasing the CTAD system, the contractor shall submit five copies of catalog cut sheets and the environmental testing results to the Engineer for approval.

**4.2.4.2** The contractor shall provide five copies of the operation and maintenance manuals for the CTAD system.

**4.2.4.3** Contractor shall provide one copy of the software and any cables needed to interface with the system.

**4.2.4.4** Contractor shall provide the CTAD installation kit, if applicable, to the Commission upon completion and acceptance of the project.

**5.0 Communication with Advanced Transportation Management System (ATMS).** The detection systems and all performance measure data should be fed directly into the Commission’s current ATSPM platform (currently through TransSuite). All data must be online and verified by contractor to be fully operational and available for data output reporting via the Commission’s ATSPM platform. In addition, the data storage for long-term storage use should be configured properly on the Commission’s ATSPM platform. The Contractor shall be responsible for ensuring the firmware of all detection works with the Commission’s ATSPM platform. If utilized on the project, the Contractor’s Traffic Engineer shall assist in this task.

**6.0 Technical Support for Detection System.** The detection system(s) chosen for installation shall be free of defects in material and workmanship. For five (5) years, technical support from factory certified personnel or factory certified installers shall be available from the supplier. Ongoing software support by the supplier shall include updates for the processor unit and computer software and shall be provided at no cost during this two-year period. The update of the processor unit software to be NTCIP compliant shall be included. Detection system(s) must not be within 5 years of end of support or sale by manufacturer.

**7.0 Construction Requirements.** Construction requirements shall conform to Sec 902.

**8.0 Method of Measurement.** Method of measurement shall conform to Sec 902.

**9.0 Basis of Payment.** Measurement and payment for work covered by this specification shall include all equipment, materials, tools, labor, programming, testing, and documentation necessary to provide a detection system **per intersection** and shall be paid at the contract unit price as follows:

Item No.	Type	Description
902-99.02	Each	SL District Traffic Signal Detection System

GGG. ATC Traffic Signal Controller

**1.0 Description.** The Commission’s St. Louis District is utilizing TransCore’s TransSuite software as their Advanced Traffic Management System (ATMS), therefore all signal controllers must be able to interface with their TCS program.

**2.0 Material.** All traffic signal controllers purchased and installed on this project shall be selected from the list below and match the cabinet type and connections indicated on the D-37C sheet for each intersection(s). The controllers on the list below are the only controllers that are tested, fully functional, and approved with the version of TransSuite that the St. Louis District is currently operating (TransSuite version 20.4):

Controller/Firmware Type	Firmware Supported	Cabinet Type (Match in field)
Econolite Cobalt	EOS 3.2.24	NEMA TS2 Type 1 or 2

McCain Omni eX, eX2	3.4	NEMA TS2 Type 1 or 2
Intelight X3	MaxTime 2.1.1	NEMA TS2 Type 1 or 2

**3.0 Construction Requirements.** Contractor shall ensure that the signal controller as noted above is programmed to be compatible with the previously mentioned version of TransSuite TCS system.

**4.0 Acceptance Testing.** All controllers shall be tested per the Commission’s specifications. Programming and testing should be done prior to any installation and approved by the Commission’s engineer or representative. The contractor shall provide a copy of the signal programming to the engineer via an USB Flash drive.

**5.0 Documentation.** Contractor shall provide the engineer with an electronic copy of the manufacturer’s signal controller manual or link to the website where the manual can be downloaded in .pdf format.

**6.0 Basis of Payment.** Measurement and payment for work covered by this specification shall include all equipment, tools and materials necessary and shall be paid at the contract unit price as follows:

Item No.	Type	Description
902-99.02	Each	ATC Traffic Signal Controller

HHH. Network Connected Signal Monitor

**1.0 Description.** The Commission’s signal cabinet shall have a flashing yellow arrow compatible monitor installed with an internal RJ-45 plug for 10/100 Ethernet communication that is connected to the Commission’s computer network through Commission furnished Ethernet switch and allow a remote user running the monitor’s software to interface with any specific monitor.

**2.0 Performance.**

**2.1 Inputs.** If video detection is used, inputs into controller shall be via SDLC port. Signal cabinet to be TS2 Type 2 setup with 3 ea. SDLC connectors and the monitor to be a Malfunction Management Unit (MMU).

**2.2 Status and Event Logging.** Monitor shall be able to remotely communicate, at a minimum, active status, current faults, and event logs for at least the previous 7 days.

**2.3 Flashing Yellow Arrow.** Monitor shall be capable of operating a flashing yellow arrow for left turns by utilizing unused yellow channels on the pedestrian load switches.

**2.4 Software and Configuration.** Software needed to communicate to any network-enabled monitor shall be provided to the Commission for an unlimited number of users.

**3.0 Construction Requirements.** Construction requirements shall conform to Sections 902 and 1092.

**3.1 Setup and Training.** A minimum of one day of training shall be provided in the operation, setup communication and maintenance of the monitors.

**3.2 Contractor shall demonstrate that all network-connected monitors are remotely communicating and individually addressable via supplied software and Commission furnished devices from the Commission’s St. Louis Traffic Management Center in order to satisfy the requirements of this provision. No direct payment will be made for this testing.**

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

**5.0 Basis of Payment.** No direct payment will be made for the software. Payment will be considered full compensation for all labor, equipment, and material to complete the described work other than Commission furnished devices needed to complete the network connections. Payment will be made as follows:

Item No.	Type	Description
902-99.02	Each	Network Connected Signal Monitor

III. MoDOT TS2 Type 1 Cabinet Assembly

**1.0 Description.** The cabinet assembly shall meet, as a minimum, all applicable sections of the latest revisions as found in the NEMA TS2 Standard Publication and sections 902 and 1092 of the Missouri Standard Specifications for Highway Construction Manual. Where differences occur, this specification shall govern.

**2.0 Materials.**

**2.1 Cabinet.** The cabinet shall be constructed from aluminum with a minimum thickness of 0.125 inches. The cabinet shall be designed and manufactured with materials that will allow rigid mounting, whether intended for pole, base or pedestal mounting. All mounting points where the cabinet is bolted to the foundation shall be reinforced at the factory by welding in an additional layer of material equal to the thickness of the material that the cabinet is constructed from. Triangular gussets are also required when the base plate and cabinet walls are welded together vs. continuous rolled material. A rain channel shall be incorporated into the design of the main door opening to prevent liquids from entering the enclosure. All external hardware shall be stainless steel. Unless otherwise specified, the cabinet exterior shall be supplied with a natural aluminum finish. Sufficient care shall be taken in handling to ensure that scratches are minimized. All surfaces shall be free from weld flash. Welds shall be smooth, neatly formed, free from cracks, blowholes and other irregularities. All sharp edges shall be ground smooth. The cabinet shall be equipped with (2) lifting brackets for installation and removal purposes.

**2.2 Cabinet Doors.** The cabinet shall include front and rear doors of NEMA type 3R construction with rain tight gaskets. A stiffener plate shall be welded across the inside of the main door to prevent flexing. Doors shall include a mechanism capable of holding the door open at approximately 90 and 165 degrees under windy conditions. Manual placement of the mechanism shall not be required by field personnel. Only the main door shall have ventilation louvers. A plaque designation “Traffic Control” shall be affix to each main cabinet door.

**2.3 Door Alarm.** The front and rear doors shall be equipped with switches wired to the traffic signal controller alarm **with** 1 input for logging and reporting of a door open condition. This should

indicate a Special Status 1 alarm in the signal controller alarm screen.

**2.4 Shelves.** No less than (2) shelves shall be provided and each shall have the ability to be independently removed, relocated, and adjusted. The front edge of each shelf shall have holes predrilled at a spacing of no greater than 8 inches to accommodate tie-wrapping to secure cables/harnesses.

**2.5 Mounting Rails.** A minimum of one set of vertical "C" channels shall be mounted on each interior wall of the cabinet for the purpose of mounting the cabinet components. The channels shall accommodate spring mounted nuts or studs. All mounting rails shall extend to within 7 inches of the top and bottom of the cabinet.

**2.6 Pull-out Drawer.** The cabinet shall be equipped with a pull-out drawer/shelf assembly. A 1½ inch deep drawer shall be provided in the cabinet, mounted directly beneath the controller support shelf. The drawer shall have a hinged top cover and shall be capable of accommodating one complete set of cabinet prints and manuals. This drawer shall support 50 pounds in weight when fully extended. The drawer shall open and close smoothly. The drawer dimensions shall make maximum use of available depth offered by the controller shelf and be a minimum of 18 inches wide.

**2.7 Police Door.** The police door shall contain only (1) switch used for flash/auto operations. The ability to turn field indications off from the police panel will not be permitted.

**2.8 Lighting.** The cabinet shall include no less than (3) field replaceable LED light assemblies along the top and sides of the cabinet. The LED panels shall be controlled by a manually activated toggle switch on the tech panel.

**2.9 Fans/Ventilation.** The components of the system as well as the CFM requirements shall be in compliance with the MoDOT 902 & 1092 specifications.

**2.10 Heater.** The cabinet shall be supplied with a 200 Watt fan heater with thermostat control that is designed to protect electronics from the effects of low temperatures such as corrosion, freezing or condensation, which can damage critical components within a control enclosure. Housing shall be constructed of aluminum. Overall dimensions including mounting areas shall be approximately: 4inch depth, 4inch width, 5.50inch height.

**2.11 Switch Guards.** All switches shall include switch guards. All switches shall be clearly labeled.

**2.12 Receptacles and power strip(s).** One 8-outlet IP-addressable power strip shall be provided and Commission-furnished. The installation of the power strip shall be included in the cost of the cabinet assembly. The main door tech panel shall contain a 15 amp duplex GFI receptacle. A separate grounded service outlet shall be provided in the controller cabinet for supplying power to the video detection monitor. The monitor shall be installed to automatically power on when the cabinet door is opened and automatically power off when the cabinet door is closed. The use of the grounded service outlet located on the cabinet door will not be permitted for this function. A manual on/off switch shall also be provided and mounted to the main door tech panel.

**2.13 16-Position Back Panel Wiring.** All new signal cabinets shall have a 16-position load switch back panel and conform to the following specifications. Regardless of the number of phases specified on the plans, all load switch positions shall be completely wired for use. The load switch

back panel shall be configured for NEMA Configuration “A” or “G” as designated on the signal plans. Vehicle phases, overlaps (including FYA configurations), and pedestrian phases shall be wired such that it must work with a Type 16 MMU. The cabinet shall include both a DT panel and a CTB (SDLC) panel with 6 harnesses.

## **2.14 Detection Configuration.**

**2.14.1 For all Detector Types.** Detection configuration shall be in accordance with the configuration prescribed in the SL District Detection JSP.

**2.14.2 Intersections with Video Detection.** For intersections with video detection, the cabinet shall be wired to automatically power on the video monitor when the cabinet door is open.

**2.15 Load Switch.** The front of the load switch shall be provided with (3) indicators to show the input signal from the controller to the load switch and (3) indicators to show the output to the field devices. The full complement of load switches shall be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

**2.16 SDLC.** All connection points shall be protected by a BIU 15 pin surge suppressor used for the protection of any devices on Port 1 Synchronous Data Link Control (SDLC). Each cabinet shall be provided with a SDLC hub assembly and (6) SDLC cables unless otherwise noted on the order form. All mechanical connections shall be soldered.

**2.17 Surge Protection.** Surge protection shall be a modular plug in type product as listed in the MoDOT Traffic APL.

**2.18 AC line filter.** The AC line filter shall protect equipment from malfunctions due to conducted interference coming into the equipment from line, especially line to ground (common mode) noise and transients. Overall dimensions including mounting areas shall be approximately: 4.17inch width and 3.53inch height.

**2.19 Signal Buss Relay.** The relay shall be a direct “drop-in” replacement for existing mercury displacement relays. The relay shall be a single pole solid state or hybrid relay. Overall dimensions including mounting areas shall be approximately: 2.5inch depth, 2inch width, 5 inch height.

**2.20 Field Wiring termination.** All field wires shall be attached to the back panel terminal strips via a mechanical copper lug, which can accommodate wire sizes from 14AWG - 6AWG. Lugs shall be provided for all field outputs to maximize the cabinet design.

**2.21 Flash Transfer Relays.** The full complement of relays shall be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

**2.22 Cabinet Wiring Prints.** Paper cabinet prints as well as electronic media shall be provided with each cabinet. (4) paper copies shall be provided (22” X 34”) and (1) electronic copy in pdf and dgn format. All flash program wiring configurations shall be represented on the cabinet print (Red, Amber, No Flash, FYA, Ped, FYA & Ped).

**2.23 Generator Attachment.** A generator plug shall be installed on each cabinet unless otherwise noted. The access door shall be hinged, lockable and watertight. The plug shall conform to the (NEMA L5-30 configuration). An automatic transfer switch shall be provided which will

switch power to/from “line”, “UPS” or “generator” when power from one of the sources has been lost or gained. The unit shall be rated for 30 amps and shall contain either a LCD display or indicator lights that validate the following: Line in, Line out, UPS in, UPS out and “from” generator. The unit shall contain a main breaker (on/off switch), a UPS bypass breaker (switch) and a Generator breaker (switch). To minimize the impact of the presence of the auto transfer switch, the dimensions shall be no greater than 12” wide X 6” deep X 4” high. The unit shall be constructed of either aluminum or stainless steel.

### 3.0 Testing.

**3.1** Each controller and cabinet assembly shall be tested as a complete entity under signal load in accordance with Missouri Standard Specifications Section 902 for a minimum of 30 days after installation.

**3.2** Each assembly shall be delivered with a signed document detailing the cabinet final tests performed.

The cabinet shall be assembled and tested by the controller manufacturer or authorized local distributor to ensure proper component integration and operation.

### 4.0 Warranty and Training.

**4.1** If a Controller and/or Malfunction Management Unit are ordered with a cabinet assembly, the Controller and Malfunction Management Unit shall be warranted by the manufacturer against mechanical and electrical defects for a period of 2 years from date of shipment. The manufacturer's warranty shall be supplied in writing with each cabinet and controller. Second party extended warranties are not acceptable.

**4.2** The cabinet assembly and all other components shall be warranted for a period of one year from date of shipment. Any defects shall be corrected by the manufacturer or supplier at no cost to the owner.

**4.3** MoDOT may require training on the maintenance and operation of NEMA TS2 cabinet assemblies. Maintenance and operation personnel shall be trained on troubleshooting, maintenance and repair of cabinets and all serviceable equipment. Training shall include field level troubleshooting and bench repair. This training shall be for a minimum of sixteen hours over two days. Training shall be conducted at a time and location mutually agreeable by the contractor and the signal shop traffic supervisor or as directed by MoDOT.

**5.0 Method of Measurement.** Method of measurement shall conform to Sections 902 and 1092 of the Standard Specifications.

**6.0 Basis of Payment.** Payment included with cost of item number 902-42.83, “Controller Assembly Housing, NEMA TS2 Controller”, per each. Payment will be considered full compensation for all labor, equipment, and material to complete the described work as shown on the plans. No additional payment will be made to provide conformance. Payment also includes connection of NEMA TS2 Controller to existing power source. **Modifications required for connection to the existing power source shall be at no direct pay.**

Item Number	Type	Description
902-42.83	Each	Controller Assembly Housing, NEMA TS2 Controller

JJJ. Combination Pad Mounted 120V/240V Power Supply and Lighting Controller with Uninterruptible Power Supply (UPS) – TS2 Traffic Signal Cabinet

**1.0 Description.** This work shall consist of furnishing and installing combination 120/240-volt signal and lighting power supply and uninterruptible power supply (UPS) at signalized intersections utilizing a TS2 traffic signal control cabinet.

**2.0 UPS Requirements.** The traffic signals being constructed on the intersections listed below shall include an “Uninterruptible Power Supply” specifically constructed and NEMA approved for traffic signal operations.

**2.1 UPS Location and Cabling.** The UPS shall be installed separately from the signal cabinet and shall be installed in the same cabinet as the power supply and lighting controller station. In addition to the power cables from the UPS to the signal cabinet, the contractor will route but not connect an outdoor rated CAT-6 cable between the UPS RJ-45 port and the Ethernet switch in the signal cabinet. The contractor shall also install a 7-conductor serial cable and make the appropriate connections from the UPS to the traffic signal cabinet. The **On battery** contact (C-1) on the inverter should be programmed to energize when the UPS provides battery backup. The normally open contact should be wired to provide logic ground to Alarm 2 when the UPS is in battery backup mode. This should indicate a Special Status 2 alarm in the signal controller alarm screen. The **Low Battery** contact (C-2) on the inverter should be programmed to energize when the UPS drops below a preset voltage level, typically set at 40%. The normally open contact should be wired to provide logic ground to Test Point A when the UPS is in Low Battery mode. This should indicate a Special Status 3 alarm in the signal controller alarm screen. The **Arrestor** contact should be wired to provide logic ground to Test Point B and generate a Special Status 4 alarm in the signal controller alarm screen. The **Timer #1** contact (C-4) on the inverter should be programmed to energize after the UPS is in inverter mode for **three (3)** hours. The normally closed contract should be wired in series with the remote flash output to allow for the circuit to open after **three (3)** hours and bring the signal to flash after the side streets service. The remote flash parameters shall be programmed to red/red flash, unless directed otherwise by the Engineer. The CAT-6 cable and serial cable will be run in a separate conduit from the power cables into the cabinet. All conduits will be internal and not visible from the exterior of either the UPS or signal cabinet. The contractor shall verify all control wiring with the manufacture of the traffic signal cabinet assembly for accuracy and compatibility and perform test to ensure proper operation. The contractor shall be responsible for all controller programming to mask the TS2 features to this setup. Upon completion of all controller programming, contractor shall notify contractor’s or Commission’s traffic engineer (depending on assignment) for uploading into Commission’s central signal control system.

**2.2 UPS Input Specifications.** Each UPS system shall have the following input requirements:

- (a) A nominal input voltage of 120 VAC.
- (b) An input voltage range of 85 to 175 VAC.
- (c) Two (2) input voltage boost modes.
- (d) Boost-1 shall increase the input voltage from 94 to 115 VAC.
- (e) Boost-2 shall increase the input voltage from 85 to 101 VAC.
- (f) Two (2) input voltages buck modes.
- (g) Buck-1 shall decrease the input voltage from 154 to 124 VAC.
- (h) Buck-2 shall decrease the input voltage from 175 to 142 VAC.

A user configurable power quality (PQ) option with default values of:

- (a) High line disqualify shall be 130 VAC.
- (b) High line qualify shall be 128 VAC.
- (c) Low line qualify shall be 105 VAC.
- (d) Low line disqualify shall be 100 VAC.
- (e) Input current shall be less than 16A with nominal voltage, full load on the output and charger set at 10A.
- (f) 50/60Hz automatic frequency detection with built-in class A EMI filter and transient suppression.

**2.3 UPS Output Specifications.** Each UPS system shall have the following output requirements:

- (a) The output voltage of the UPS shall be 120 VAC  $\pm$ 10% in line mode.
- (b) The output voltage of the UPS shall be 120 VAC  $\pm$ 6% in backup mode.
- (c) The output frequency of the UPS shall be 60Hz  $\pm$ 5% in line mode.
- (d) The output frequency of the UPS shall be 60Hz  $\pm$ 5% in backup mode.
- (e) The output waveform of the UPS shall be sinusoidal.
- (f) The output voltage total harmonic distortion (THD) shall be less than 3% with a resistive load.
- (g) The efficiency of the UPS at nominal line voltage shall be greater than 98%.
- (h) The efficiency of the UPS in backup mode shall be greater than 84%.
- (i) The step-load response of the UPS shall be full recovery in ½-cycle @ 50% change with a resistive load.
- (j) The transfer time of the UPS line to back up and backup to line shall be 5ms typical.
- (k) The line qualification time of the UPS shall be user selectable at 3, 10, 20, 30, 40 and 50 seconds.
- (l) The line qualification time of the UPS default shall be three (3) seconds.

**2.4 UPS Battery and Charger Specifications.** Each UPS system shall have the following specifications for the battery and charger:

- (a) The nominal battery voltage of the UPS shall be 48 VDC.
- (b) The battery charger current of the UPS shall be user programmable for 3, 6, and 10 A.
- (c) The battery charger current default setting for the UPS shall be 6A.
- (d) The battery charger in the UPS shall turn OFF when the battery temperature is 50°C.
- (e) The UPS shall have a user programmable temperature compensated battery charger with setting for -2.5, -4, -5 and -6 mV/°C/Cell.
- (f) The UPS shall have a temperature compensated battery charger with a default setting of -5 mV/°C/Cell.
- (g) The UPS shall have a battery charge with a float voltage of 56VDC maximum.
- (h) The UPS shall have a user configurable low battery warning.
- (i) The UPS shall have a default low battery warning set at 47VDC to indication 40% remaining battery capacity.
- (j) The UPS shall have a low battery shutdown set for 42VDC (10.5VDC per battery).

**2.5 UPS Protection Specifications.** Each UPS system shall have the following specifications for protection:

- (a) The UPS shall have a 250VAC @ 20A input circuit breaker.
- (b) The UPS shall have a 50A battery circuit breaker.
- (c) The UPS shall have electronic short circuit protection when operating in backup mode.
- (d) The UPS shall indicate an overload warning with a flashing alarm LED when the load is between 95% and 105% of the rated output for the UPS.

- (e) The UPS shall shutdown in two (2) minutes when operating in backup mode when the load is between 106% and 115% of the rated output for the UPS, and the fault LED shall turn ON. The fault LED shall clear when the overload is removed and the utility line power returns.
- (f) The UPS shall shutdown in one (1) minute when operating in backup mode when the load is greater than 115% and the fault LED shall turn ON. The fault LED shall clear when the overload is removed and the utility line power returns.
- (g) The UPS shall disable the backup mode function when operating in line mode if the load exceeds 115% of the rated output for the UPS. The alarm shall be reset when the overload condition is removed.
- (h) The UPS shall display an alarm LED if the battery ambient temperature is greater than 75°C and disable the backup mode function. The alarm shall clear when the battery ambient temperature is less than 70°C.
- (i) The UPS shall display a fault LED when operating in backup mode and shutdown the inverter if the internal temperature is greater than 110°C. The fault shall clear when the utility power returns and the internal temperature is less than 90°C.
- (j) The UPS shall have output over-voltage protection to electronically shutdown the UPS if the output voltage exceeds 132VAC.
- (k) The UPS shall disable the battery charger in two (2) seconds and display an alarm LED if the battery voltage exceeds 59VDC. The alarm shall be cleared and charge enabled when the battery voltage drops to less than 57VDC.
- (l) The UPS shall limit the charger voltage to 52VDC in the event the battery probe is not installed.
- (m) The UPS shall have a battery circuit breaker with reverse polarity protection. The battery circuit breaker shall trip in the event the battery polarity is wired incorrectly.
- (n) The UPS shall have protection for electrical backfeed to the utility that meets UL 1778 and CSA C22.2 No. 107.1.3 requirements.
- (o) The UPS shall have user-selectable settings that are password protected.
- (p) The UPS shall be cooled by a variable speed fan that is microprocessor and PWM controlled.
- (q) The fan shall be OFF when the ambient temperature is less than 40°C.
- (r) The UPS shall display an alarm LED to indicate the fan is enabled but not turning.
- (s) The UPS shall have a fan that is field replaceable.

**2.6 UPS Displays, Controls and Diagnostics Specifications.** Each UPS system shall have the following specifications for the noted features:

- (a) The UPS shall have a two (2) line/20-character LCD display and control panel that can be rotated for easy user interface.
- (b) The UPS shall have event and alarm logging with time/date stamping for up to 100 historical events.
- (c) The UPS shall have six (6) independently programmable control relays for control and report functions.
- (d) The UPS shall have two (2) independently programmable timers 0 to 8hr with two (2) time-of-day restrictions on each timer.
- (e) The UPS shall be equipped with a RS-232 port, which can be connected to a laptop.
- (f) The UPS shall be equipped with a SNMP Ethernet card.

**2.7 Programmable Dry Contacts.** Each UPS system shall have the following requirements for the noted features relating to dry contacts:

- (a) The UPS shall have six (6) sets of normally open (NO) and normally closed (NC) single pole double-throw (SPDT) dry contact relays rated for 250VAC @1A.

- (b) The UPS shall have five (5) sets of dry contact relays that are user programmable, C1 through C5, and one relay contact that is factory configured, C6.
- (c) The UPS shall have dry contact relays that are user programmable via either the RS-232 or (optional) Ethernet communication ports to activate under the following conditions:
- (d) ON BATTERY. The relay is energized whenever the UPS switches to battery power.
- (e) LOW BATTERY. The relay is energized when the battery has reached a user defined low battery level of remaining useful capacity. This alarm is latched when a qualified line returns or the inverter shuts down. The default setting is 47VDC (~40%) of remaining useful battery capacity.
- (f) TIMER 1. The relay is energized after being in backup mode for a given amount of time. This timer is adjustable from 0 to 8hr. The default setting is two (2) hours.
- (g) ALARM. The relay is activated after a specific or general alarm is detected. The alarm conditions include: line frequency, low output voltage, no temperature probe, overload,
- (h) unconnected batteries, high temperature (>55°C) and low temperature (<-20°C).
- (i) FAULT. The relay is activated after a specific or general fault is detected. These faults include: short circuit, low battery voltage (<41VDC), high battery voltage (> 59VDC), overload and over temperature (>75°C).
- (j) OFF. The relay is disabled and will not activate under any condition.
- (k) TIMER 2. Same as TIMER 1.
- (l) TIMER 3. Same as TIMER 1.
- (m) AC/DC FAN CONTROL. The relay is activated when the battery ambient temperature is greater than 35°C or at a user programmable threshold from 25 to 55°C @ 5°C increments.
- (n) The UPS shall have a default dry contact relay configuration of:

C1	ON BATT
C2	LOW BATT
C3	LOW BATT
C4	TIMER
C5	ALARM
C6	48VDC

**2.8 Mechanical.** Each UPS system shall have the following mechanical requirements:

- (a) The UPS shall have AC input and AC output terminal blocks mounted on the front panel. The terminal blocks shall be a 3 pole, 35 amp, 300 volt Eurostyle socket terminal strip (22-8 AWG).
- (b) The UPS shall have six (6) user programmable dry contact relay terminal blocks on the front panel. The terminal blocks shall be 3 pole, 35 amp, 300 volt PLUGGABLE TERMINAL BLOCK (12-26 AWG)
- (c) The UPS shall have one (1) user input and one (1) Automatic Transfer Switch (ATS) terminal block on the front panel. The terminal blocks shall be 3 pole, 35 amp, 300 volt PLUGGABLE TERMINAL BLOCK (12-26 AWG).
- (d) The UPS shall have a DE-9 RS-232 connector on the front panel.
- (e) The UPS shall have an RJ45 Ethernet connector on the front panel.
- (f) The UPS shall have a battery connector on the front panel. The battery connector shall be a 50 amp SB® series type battery connector (16-6 AWG).
- (g) The UPS shall have a RJ14 battery temperature probe connector on the front panel.

**2.9 Environmental.** Each UPS system shall have the following environmental requirements:

- (a) The operating temperature range of the UPS shall be -40° to 55°C with the capability of operating @ 800W for up to 2hr at 74°C ambient.
- (b) The storage temperature range of the UPS shall be -40° to 75°C.
- (c) The operating and storage humidity (non-condensing) range of the UPS is up to 95% RH.

- (d) The altitude operating range of the UPS is up to 12,000ft with a de-rating of 2°C per 1000ft above 4500ft.
- (e) The UPS shall be shipped in materials designed to meet requirements for ISTA program.
- (f) The UPS shall pass electrical safety standards UL1778, CSA 22.2 No. 107.3, EN50091-1-1-2 and EN60950.
- (g) The UPS shall pass emission standards FCC Subpart J Level A for conducted and radiated EMI CISPR22, EN55022 Level A for conducted and radiated EMI.
- (h) The UPS shall pass Immunity standards:
  - EN61000-4-2: ESD (Electrostatic discharge).
  - EN61000-4-3: Radiated immunity.
  - EN61000-4-4: EFT (Electrical fast transient).
  - EN61000-4-5: Surge.
  - EN61000-4-6: Conducted (Power and signal lines).
  - EN61000-4-8: Power frequency magnetic.
  - EN61000-3-2: Harmonic distortion.
- (i) The UPS shall display agency approval mark “cCSAus” on the manufacturer’s nameplate label.

**2.10 Manual Bypass Switch.** Each UPS system shall include a manual bypass switch (MPS). UATS assemblies that include items referenced individually need not be duplicated. The MPS shall have the following specifications:

- (a) The MPS shall be a self-contained module separate from the UPS
- (b) The MPS shall be shelf or rack mountable.
- (c) The MPS shall have terminal blocks labeled “AC Input”, “AC Output”, “To UPS” and “From UPS”.
- (d) The MPS shall be a Break-Before-Make rotary switch.
- (e) The MPS shall be rated at 120VAC @ 20A.
- (f) The MPS shall have a 5-15R duplex receptacle connected to utility line.
- (g) The MPS shall have a 5-15R receptacle labeled “Optional LA-P” to facilitate a plug-in surge suppressor.
- (h) The MPS shall have a 5-15R receptacle labeled “Optional Battery Heater Mat” to provide non-standby power to a battery heater mat.
- (i) The MPS shall have two (2) positions: one labeled “UPS” to connect the utility line to the UPS, and one labeled “Bypass” to connect the utility line to the load.
- (j) The MPS shall have a 15A circuit breaker labeled “AC Input”.
- (k) The MPS shall have a 15A circuit breaker labeled “AC Output”.

**2.11 Automatic Transfer Switch.** Each UPS system shall include an automatic transfer switch (ATS) with the following requirements:

- (a) The ATS shall be rated for 120VAC @ 40A.
- (b) The ATS shall be shelf or rack mountable.
- (c) The ATS shall transfer the load to UPS when the utility line fails or is unqualified.
- (d) The ATS shall transfer the load to utility line when the utility line is available and qualified.
- (e) The ATS shall be activated by a 48VDC input from the UPS.
- (f) The ATS shall have a terminal block labeled “L IN”, “NEUT”, “GRD” and “L OUT”.
- (g) The ATS shall have a six (6) foot line cord labeled “UPS IN”.
- (h) The ATS shall have a six (6) foot line cord labeled “UPS OUT”.
- (i) The ATS shall have a 5-15R duplex receptacle connected to utility line.
- (j) The ATS shall have a 5-15R receptacle labeled “Optional LA-P” to facilitate a plug-in surge suppressor.

(k) The ATS shall have a 5-15R receptacle labeled "Optional Battery Heater Mat" to provide non-standby power to a battery heater mat.

**2.12 Automatic Bypass Switch.** Each UPS system shall include an automatic bypass switch (ABS) with the following requirements:

- (a) The ABS shall be rated for 120VAC @ 20 amps.
- (b) The ABS shall be shelf or rack mountable.
- (c) The ABS shall connect the UPS to the load to allow the UPS to continuously power the load.
- (d) The ABS shall transfer the load to utility line when there is no UPS output voltage.
- (e) The ABS shall be activated by the 120VAC from the UPS.
- (f) The ABS shall have a terminal block labeled "L IN", "NEUT", "GRD" and "L OUT".
- (g) The ABS shall have a six (6) foot line cord labeled "UPS IN".
- (h) The ABS shall have a six (6) foot line cord labeled "UPS OUT".
- (i) The ABS shall have a 5-15R duplex receptacle connected to utility line.
- (j) The ABS shall have a 5-15R receptacle labeled "Optional LA-P" to facilitate a plug-in surge suppressor.
- (k) The ABS shall have a 5-15R receptacle labeled "Optional Battery Heater Mat" to provide non-standby power to a battery heater mat.
- (l) The ABS dimensions shall be 4.6"H x 4.75"W x 6.5"D.
- (m) The ABS weight shall be 4lbs.

**2.13 Generator Transfer Switch.** Each UPS system shall include a generator transfer switch (GTS) with the following requirements:

- (a) The GTS shall sense when a portable generator is connected and transfer the load to the generator after a 30s delay.
- (b) The GTS shall be rated for 120VAC @ 20A.
- (c) The GTS shall be shelf or rack mountable.
- (d) The GTS shall have a terminal block labeled "AC INPUT", "AC OUTPUT" and "GENERATOR INPUT".

**2.14 UPS Batteries.** The batteries for the UPS system shall meet the following requirements:

- (a) The batteries shall be Gel Cell Valve Regulated Lead Acid (VRLA) type specifically designed for outdoor use.
- (b) The batteries shall be designed for "Float Service" to provide 100% out-of-box runtime capacity.
- (c) The batteries shall have Silver Alloy positive plates.
- (d) The batteries shall have a five (5) year full replacement, non-prorated warranty.
- (e) The battery capacity rating at 20hr shall be 94Ah.
- (f) The battery shall be 12VDC.
- (g) The number of batteries in the system shall be four (4) or eight (8).
- (h) The batteries shall be connected to provide 48VDC.
- (i) Batteries for each location shall provide full power for all devices shown on the plans that are powered through the signal cabinet for three (3) hours and then send the signal into all red flash and power that state for an additional three (3) hours.

**2.15 Battery Heater Mat.**

- (a) The battery heater mats shall be available in four (4) battery and single (1) battery sizes.
- (b) The single battery heater mat shall allow for a Master-Slave configuration so two (2) or more mats can be ganged together.
- (c) The battery heater mats shall plug into a 120VAC/5-15 receptacle.

- (d) The battery mats shall be thermally controlled, turning ON at 5°C and turning OFF at 15°C.
- (e) The battery mats shall be thermally fused for 82°C to prevent thermal runaway.

**2.16 Battery Charge Management System.** Each UPS system shall have a battery charge management system with the following requirements:

- (a) The battery charge management system shall spread the charge voltage equally across all batteries.
- (b) The battery charge management system shall compensate for batteries with different internal resistances.
- (c) The battery charge management system shall have a quality of final balance of ±100mV maximum between any two (2) batteries in the string.
- (d) The battery charge management system shall have reversed polarity protection.
- (e) The battery charge management system shall be designed to CSA C22.2 No. 107.1 and UL 1778 Standards for safe unattended operation.

**2.17 Surge Suppression.** Each UPS system shall have the following requirements for surge suppression:

- (a) The surge suppression shall provide protection from voltage transients appearing on the utility line.
- (b) The surge suppression shall be a plug-in module that is field replaceable.
- (c) The surge suppression shall have a LED indicator that turns OFF when the module is no longer providing protection.
- (d) The surge suppression shall have a clamping voltage of 150VAC.
- (e) The surge suppression shall have a response time of less than one (1) nanosecond.

**2.18 Construction Requirements.** Construction requirements shall conform to Sec 902. Any exceptions to these requirements will be approved by the engineer before system installation.

**3.0 Method of Measurement.** Method of measurement shall conform to Sec 902.

**4.0 Basis of Payment.** Payment for furnishing and installing pad mounted combination units shall include all excavation, materials, equipment, tools, labor, CAT-5 cable and work incidental thereto, and shall be considered to be completely covered by the contract unit price for:

Item Number	Type	Description
902-99.02	Each	Combination Pad Mounted 120V/240V Power Supply and Lighting Controller with UPS

**KKK. Traffic Signal Maintenance and Programming**

**1.0 Description.** Traffic signal maintenance and programming for this project shall be in accordance with Section 902 of the Standard Specifications, and specifically as follows.

**2.0 Contractor Maintenance Responsibilities.**

**2.1 Traffic Signal Maintenance.** Once any part of an existing traffic signal within the limits of this project has otherwise been modified and/or adjusted by the contractor or the contractor begins work at an intersection with traffic signals already in operation, then the contractor shall be solely responsible for that traffic signal's maintenance. All traffic signal maintenance shall be

the responsibility of the contractor as specified in 902.2 and 902.3, until the Commission accepts the traffic signal for maintenance or as directed by the Engineer. Traffic signals to be accepted for maintenance by the contractor are listed in the below schedule:

Commission Traffic Signals to be Maintained by the Contractor:

Route AC and Old Pershall Road

Route AC and Old Halls Ferry Road

Route AC and Hudson Drive

Route AC and Chambers Road

Route AC and Lucas-Hunt

**2.2 Traffic Signal Controller Programming.** If the contractor modifies and/or adjusts an existing traffic signal controller's programming or makes any roadway changes to reduce the traffic capacity through a signalized intersection within the limits of a project or utilizes a project defined detour that utilizes the traffic signals within the below schedule, the contractor shall be solely responsible for those traffic signal controller programs. All controller programming shall be the responsibility of the contractor as specified in 902.2 or until final acceptance of the project or until released from the responsibility by the Engineer. Traffic signal controller programs to be administered by the contractor are listed in the below schedule:

MoDOT Traffic Signal Controller Programs to be Administered by the Contractor:

Route AC and Old Pershall Road

Route AC and Old Halls Ferry Road

Route AC and Hudson Drive

Route AC and Chambers Road

Route AC and Lucas-Hunt

**2.3 Contractor's Traffic Engineer.** If traffic signals are listed in the schedule outlined in section 2.2, the contractor shall have an experienced traffic Engineer with a Professional Engineer's (PE) license in Missouri as well as a Professional Traffic Operations Engineer (PTOE) certification (hereafter referred to as "contractor's traffic Engineer") with the noted experience outlined to section 3.0. MoDOT shall approve the traffic Engineer prior to them being hired.

**2.4 Traffic Signal Complaints** The contractor shall respond to malfunction complaints or traffic signal timing complaints for those locations detailed in section 2.1 and/or section 2.2 of this provision and as specified in Section 902.21.1. Response time shall be 1 hour for complaints received by the contractor between 6 AM and 6 PM on non-holiday weekdays, and 2 hours for all other times. For cases due to travel times or other extenuating circumstances additional time may be acceptable within reason but must be approved by a Commission Traffic Operations Engineers. These timeframes will replace the '24 hour' response time in Section 105.14 for any traffic signal-related incidents, where the entire cost of the work, if performed by MoDOT

personnel or a third party, will be computed as described in Section 108.9 and deducted from the payments due the contractor.

**2.5 Traffic Signal Contacts.** The contractor must supply to the Engineer and to the Commission's Transportation Management Center (TMC) a contact name and phone number who will be responsible for receiving traffic signal timing complaints for the Engineer. These complaints may be forwarded directly to the contractor by someone other than the Engineer's representative and will not relieve the contractor from properly responding based on the response times of this provision. The contractor shall respond to the Engineer and its representative within 12 hours of the complaint and its remedy. The contractor shall submit to the Engineer's representative a weekly report of complaints received, and remedies performed throughout the duration of the project.

**2.6 Existing Traffic Signal Controller Programming.** The contractor shall request an electronic report from the Engineer on the existing phasing and timing of each traffic signal, which may be the contractor's responsibility to program. The contractor shall give the Engineer 2 weeks' notice to supply the electronic report. The Engineer's representative shall be available to the contractor before any changes are made to a traffic signal or controller to answer any questions about the report. In lieu of the report, the contractor's traffic Engineer may obtain this information from the appropriate agency's central traffic signal control system.

**2.7 Traffic Mitigation Plan.** The contractor shall notify the Engineer 2 weeks prior to the date of any work impacting the Commission's traffic signals as described in Section 2.1 and/or 2.2. The contractor shall meet with the Engineer's representatives to discuss their traffic mitigation plan at least 1 week before the date of the first impacts and as needed between construction stages. The traffic mitigation plan should at a minimum include:

- (a) Proposed Timing Plan changes and any models
- (b) Anticipated locations of concern
- (c) A map in electronic format displaying the locations and names of the traffic signals and owning agency as detailed in sections 2.1 and/or section 2.2.
- (d) Other traffic mitigation efforts

**2.8 Notification of Changes to Traffic Signal System.** The contractor shall notify the Engineer or representative of the changes no later than 1 working day after changes are programmed if unable to provide advance notice as specified in 902.2.

### **3.0 Contractor's Traffic Engineer Qualifications.**

**3.1 Credentials.** The contractor shall have an experienced traffic Engineer with a Professional Engineer's (PE) license in Missouri as well as a Professional Traffic Operations Engineer (PTOE) certification.

**3.2 Experience.** Any proposed contractor traffic Engineer shall be able to demonstrate personal successful previous experience in the following tasks:

**3.2.1 Response.** The contractor's traffic Engineer shall have the ability to be on site within 1 hour of being requested.

**3.2.2 Corridor Management.** Time/space diagram manipulation to successfully adjust offsets and splits for rapidly changing traffic demands.

**3.2.3 Controller Programming.** Ability to program by hand and by software NTCIP-compatible controllers.

**3.2.4 Intersection Programming.** Implementation of adjusted and/or new timing plans because of changing traffic demand.

**3.2.5 Traffic Signal Software.** Use and understanding of all traffic signal controllers and central traffic signal control systems utilized by the Commission.

**3.3 Proposed Traffic Engineers.** The contractor shall submit the names(s) of proposed traffic engineer(s) and the name(s) of all other personnel on their proposed staff along with detailed experience in all tasks outlined in Paragraph 3.2 above. The Engineer reserves the right to reject any contractor traffic engineer, before the start of work, who does not have sufficient experience or, at any point during the project, which does not satisfy the requirements set forth within this Job Special Provision. A list of potential traffic engineers shall be submitted for review to the Project Manager and the Commission's Traffic Engineers prior to beginning work.

#### **4.0 Contractor's Traffic Engineer Responsibilities.**

**4.1 VPN Access.** The approved contractor's traffic Engineer and any staff assigned to manage the traffic signals during the project are encouraged to apply for VPN (Virtual Private Network) access with the Engineer once the project is awarded. If approved, the Engineer will assign a unique IP address to the contractor's traffic Engineer, which will allow for remote access to the Commission's central traffic signal control systems as appropriate and the ability to interface with the noted traffic signals on this project.

**4.2 Traffic Signal Timing Complaints.** The contractor's traffic Engineer shall respond to any traffic signal timing complaints regarding signals outlined in section 2.2 of this provision.

**4.3 Traffic Signal Coordination.** The contractor's traffic Engineer shall be solely responsible for maintaining the coordination at any affected traffic signal to the satisfaction of the Commission's Traffic Operations Engineers or representative until completion of work as set forth in section 2.2 of this provision. Maintenance of coordination may include the synchronization of the affected controller's internal time clocks to the second using an atomic clock, or other means approved by the Commission's Traffic Operations Engineers. If time clock synchronization is used, the contractor shall verify all affected controllers are synchronized at least 1 time per week with a report to the Engineer or representative. This report will be in the form of a documentation record as spelled out in the Work Zone Traffic Management Plan.

**4.4 Traffic Signal Controller Programming.** The contractor's traffic Engineer shall be responsible for implementing traffic signal controller programming at each intersection listed in section 2.2 for any of the following scenarios:

- a. Intersection Impact
- b. Construction Stage Traffic Switch
- c. Response to Customer Concern
- d. New Intersection Turn-On (along with any subsequent revisions)
- e. Final completion of improvements
- f. As otherwise directed by the Engineer or the Commission's Traffic Operations Engineers

Proposed timing plans should be submitted to the Commission's Traffic Operations Engineers for review prior to field implementation.

**4.5 Central Traffic Signal Control System Setup.** If a traffic signal cabinet is reconfigured, the contractor's traffic Engineer shall archive the existing controller programming in the Commission's central traffic signal control system. If the signal controller type is changed, the contractor's traffic Engineer shall archive the existing controller programming and convert any new controllers to the proper controller interface type in the Commission's central traffic signal control system. If only signal timing adjustments are made, all database versions shall be clearly labeled and saved separately from the default version, and the final timing program shall be uploaded into the Commission's central traffic signal control system and set as the default database. In addition, the contractor's traffic Engineer shall update any intersection diagrams (i.e., XPL) whose intersection controls were modified during construction.

**4.6 Controller Program Test Period.** The intersection program shall operate properly with no faults or malfunctions for a period of 15 consecutive days as a condition of being accepted for maintenance by the Commission. Any programming faults shall be corrected by the contractor's traffic Engineer per the response protocols of this provision and the 15 days will start over.

**4.7 Cabinet Photos.** The contractor's traffic Engineer shall obtain cabinet photos of any new or modified traffic signal cabinet affected by the project. The photos shall be captured of the following perspectives and delivered in the .jpg format electronically and via thumb drive to the Commission's Traffic Operations Engineers.

- (a) Power Meter 1 – Away from power meter with meter centered
- (b) Power Meter 2 – Close up with power meter number
- (c) Cabinet 1 – Away with cabinet centered and door closed
- (d) Cabinet 2 – Close up of entire cabinet with door opened
- (e) Cabinet 3 – Close up of center cabinet interior
- (f) Cabinet 4 – Close up of left cabinet interior
- (g) Cabinet 5 – Close up of right cabinet interior
- (h) Cabinet 6 – Close up of back panel
- (i) Cabinet 7 – Close up of switch
- (j) Cabinet 8 - Close up of wall interconnect center

**4.8 RRFB/PHB Timing.** The contractor's traffic Engineer shall calculate the duration of flash time for any new or modified RRFB's (rectangular rapid flashing beacons) affected by the project. The contractor's traffic engineer shall be responsible for calculating phase intervals and programming traffic signal controllers for new/modified PHB's (pedestrian hybrid beacons) affected by the project.

**4.9 Detection.** The contractor's traffic Engineer shall assist the contractor in setting up detection as per plan and/or SL District Traffic Signal Detection System JSP. The contractor's traffic Engineer shall verify that all detectors work properly and that each detector input into the traffic signal controller is programmed regarding its intended use. The contractor's traffic Engineer is responsible for optimizing the detector operation by utilizing various detector settings in the traffic signal controller.

**4.10 Signal Performance Measures.** The contractor's traffic Engineer shall setup traffic signal controllers on the Commission's advanced traffic signal performance measures module unless directed otherwise by the Commission's Traffic Operations Engineers. This includes any work on the Commission's advanced traffic signal performance measures module, traffic signal controller(s), and video detection processor(s). The contractor's traffic Engineer shall provide proof of each traffic signal setup in the module to the Commission's Traffic Operations

Engineers. The contractor's traffic Engineer shall setup any traffic signal detectors as system detectors in the Commission's central traffic signal control system.

**4.11 Preemption Controller Programming.** If preemption is to be provided at a traffic signal, the contractor's traffic Engineer shall program the preemption settings in the traffic signal controller per MoDOT EPG guidelines and at the direction of the Commission's Traffic Operations Engineers. The contractor's traffic Engineer shall test the preempt settings at the traffic signal cabinet to verify proper operation.

**4.12 Leading Pedestrian Interval (LPI) for Pedestrians at Signals.** The Contractor shall program the signal controller at the following intersections to allow for additional time, typically 3 to 7 seconds, for a pedestrian to cross an approach of the intersection. LPI will be used at locations that do not have an island separating the right turn from mainline traffic.

<b>Intersection</b>	<b>Approach</b>	<b>Roadway Pedestrian is Crossing</b>
Rte. AC/Old Pershall	NB (Rte. AC)	Home Depot Entrance
Rte. AC/Old Pershall	EB (Old Pershall)	Rte. AC
Rte. AC/Old Pershall	SB (Rte. AC)	Old Pershall
Rte. AC/Hudson	NB (Rte. AC)	Hudson
Rte. AC/Hudson	WB (Hudson)	Rte. AC
Rte. AC/Chambers	NB (Rte. AC)	Chambers
Rte. AC/Chambers	SB (Rte. AC)	Chambers
Rte. AC/Chambers	WB (Chambers)	Rte. AC
Rte. AC/Chambers	EB (Chambers)	Rte. AC

**4.12.1 LPI Notification.** The Engineer and the District Traffic Engineer or his/her designee must approve the site for using LPI at each signalized intersection as noted in the plans. The Engineer, Contractor and the District Traffic Engineer or designee shall field check the location together at least 7 days in advance before the planned date when the signal's controller has been programmed (reprogrammed) to allow for LPI. The contractor should coordinate with them in advance and follow their instructions and recommendations. Contact Information is below:

Lisa Kuntz  
(314)-453-1879

**4.12.2 LPI Testing.** The Contractor shall test the additional time to cross each approach noted above by programming 3 additional seconds of time for a pedestrian to cross. MoDOT personnel shall be made aware 48 hours prior to this test. If additional timing is needed as determined by the Engineer and the Contractor, the contractor shall increase the additional time by 1 second until both the Engineer and the Contractor are satisfied with the results. Any modifications needed after testing shall be completed by the Contractor at no additional pay. Once modifications are made, the Contractor shall retest per requirements within this section. The Engineer shall give approval to the Contractor once each location has been successfully tested.

**4.13 Left-Turn Protection for Pedestrians at Signals.** The Contractor shall program the signal controller at the following intersections with Flashing Yellow Arrow (FYA) left turns to not provide

for the flashing yellow phase and instead keep the red left arrow phase when the push-button is activated until the pedestrian has crossed that leg of the intersection.

<b>Intersection</b>	<b>Approach</b>	<b>Roadway Pedestrian is Crossing*</b>
Rte. AC/Old Pershall	EB (Old Pershall)	Rte. AC (Signal Head 80)
Rte. AC/Old Pershall	SB (Rte. AC)	Home Depot Entrance (Signal Head 50)
Rte. AC/Old Pershall	NB (Rte. AC)	Old Pershall (Signal Head 10)
Rte. AC/Hudson	SB (Rte. AC)	Hudson (Signal Head 10)
Rte. AC/Lucas-Hunt	NB (Rte. AC)	Lucas-Hunt (Signal Head To Be Determined)

Note: \* Indicates Signal Head Associated with Left Turn Movement that will be Left-Turn Protect

**4.13.1 Left-Protect Notification.** The Engineer and the District Traffic Engineer or his/her designee must approve the site for using Left-Protect at each signalized intersection as noted in the plans. The Engineer, Contractor and the District Traffic Engineer or designee shall field check the location together at least 7 days in advance before the planned date when the signal's controller has been programmed (reprogrammed) to allow for Left-Protect. The contractor should coordinate with them in advance and follow their instructions and recommendations. Contact Information is below:

Lisa Kuntz  
(314)-453-1879

**4.13.2 Left-Protect Testing.** The Contractor shall test that the Left-Protect setup for each approach noted above is functioning as designed. MoDOT personnel shall be made aware 48 hours prior to this test. The actual test will require the Contractor to activate the push button for a particular crossing and to monitor that the left turn signal that turns into that particular crossing being tested does not allow for the FYA to function until after the pedestrian has crossed. All Left-Protect crossings shall be tested by the Contractor. Any modifications needed after testing shall be completed by the Contractor at no additional pay. Once modifications are made, the Contractor shall retest per requirements within this section. The Engineer shall give approval to the Contractor once each location has been successfully tested.

**5.0 Post Project Report.** The contractor shall submit to the Engineer a post project report, four to six weeks after the final traffic signal adjustments have been completed. The report shall include at a minimum an observation report, summary of timing changes and locations, summary of complaints, and any other pertinent information regarding the contractor's efforts for managing these traffic signal corridors in one electronic document.

**6.0 Deliverables.** All deliverables mentioned in this provision shall be submitted to the Engineer in a timely manner to the satisfaction of the Engineer prior to receiving full compensation for this work. All deliverables must be submitted to the Engineer via USB.

- Experience submittal
- Preliminary Traffic Mitigation Plan
- Notification of Detour Implementation
- Time Base Reports, As Needed
- Complaint Resolutions
- Audible pedestrian signal voice message files
- Traffic Signal Database versions (in PDF format)
- Traffic signal photos

- Notification of Restoration to Normal Operations
- Post Project Report

**7.0 Construction Requirements.** Construction requirements shall conform to Sections 902, 1061 and 1092.

**8.0 Method of Measurement.** Method of measurement shall conform to Section 902.

**9.0 Basis of Payment.** Payment will be considered full compensation for all contractor services, installation, and labor to complete the described work:

Item No.	Type	Description
902-99.01	Lump Sum	Traffic Signal Maintenance & Programming

LLL. Accessible Pedestrian Pushbutton and Signing

**1.0 Description.** This work shall consist of furnishing, installing and placing into operation an Accessible Pedestrian Signal (APS) that assists the pedestrian who has visual or physical disabilities in activating the pedestrian phase. The APS shall be installed per the manufacturer's recommendations and specifications. Cable runs shall be continuous and unspliced. Audible pedestrian pushbuttons and signing will be required for all pedestrian indications at all intersections.

**2.0 Installation.** The APS shall be installed as part of a pushbutton assembly and shall have both audible and vibrotactile walk indications.

**2.1 Material.** The following systems in the list below are the only systems that are tested, fully functional, and approved for use in the St. Louis District. All necessary equipment for use of the systems below, shall be provided to the Commission for adequate maintenance of the system.

- PedSafety Guardian Mini
- Polara iDS/iNS Accessible Pedestrian Signal (2 wire System)
- Guardian with Bluetooth and Wayfinding Sign

**3.0 Equipment.**

**3.1 Vibrotactile.** Vibrotactile walk indications shall be provided by a tactile arrow on the pushbutton that vibrates during the walk interval have high visual contrast (light on dark or dark on light), and shall be aligned parallel to the direction of travel on the associated crosswalk.

**3.2 Audible.** The APS shall have an audible walk indication during the walk interval only. The audible walk indication shall be audible from the beginning of the associated crosswalk.

**3.3 Pushbutton Signage.** In addition to standard pedestrian sign requirements, all pushbuttons shall have additional signage to indicate crosswalk direction by use of a tactile arrow and the name of the street containing the crosswalk served by the audible pedestrian

signal. The sign shall be located immediately above the push button mechanism and parallel to the crosswalk controlled by the button. The street name shall be the name of the street or reasonable abbreviation whose crosswalk is controlled by the push button. Signage shall comply with ADA Accessibility Guidelines (ADAAG) 703.2 specifications for Braille and raised print.

**3.4.1 Arrow.** Signs shall include a tactile arrow aligned parallel to the crosswalk direction. The arrow shall be raised 0.8 mm (.03 inch) minimum and shall be 4 mm (1.5 in) minimum in length. The arrowhead shall be open at 45 degrees to the shaft and shall be 33 percent of the length of the shaft. Stroke width shall be 10 percent minimum and 15 percent maximum of arrow length. The arrow shall contrast with the background.

**3.4.2 Street Name.** The APS shall include street name information aligned parallel to the crosswalk direction and shall comply with Guidelines for Accessible Public Rights-of-Way R308.3.2 or shall provide street name information in audible format.

#### **4.0 Performance.**

**4.1 Audible Locator Tone.** Locator tone tells the pedestrian that the intersection is equipped with APS and where it is. Pushbutton locator tones shall have duration of 0.15 seconds or less, and shall repeat at 1-second intervals. Pushbutton locator tones shall be intensity responsive to ambient sound, and be audible 6 to 12 feet from the pushbutton, or to the building line, whichever is less. The locator tone shall operate during the DON'T WALK and flashing DON'T WALK intervals only and shall be deactivated when the pedestrian signal is not operative.

**4.2 Verbal Wait Message.** If available, the acknowledge tone feature shall not be used. A verbal wait message shall provide a clear message to the pedestrian they have placed a call. The verbal information informational message "Wait to cross" street name at intersecting street name shall be used..

**4.3 Verbal Walk Message.** If available, the audio tone feature shall not be used. The verbal messages shall provide a clear message that the walk interval is in effect, as well as to which crossing it applies. The verbal message shall be provided at regular intervals throughout the timing of the walk interval and shall be the term "walk sign," which will be followed by the name of the street to be crossed.

**4.4 Volume.** Automatic volume adjustment in response to ambient traffic sound level shall be provided up to a maximum volume of 100 dB. The units shall be responsive to ambient noise level changes up to no more than 5 dB louder than ambient sound. Tone or voice volume measured at 36 inches from the unit shall be 2dB minimum and 5dB maximum above ambient noise level. At installation, signal system is to be adjusted to be audible at no more than 5 to 12 feet from the system.

#### **5.0 Documentation and Support.**

**5.1 Operation and Maintenance Manuals.** Two copies of the operation and maintenance manuals for each location shall be provided to the Commission.

**5.2 USB with Audible Messages.** The Contractor shall provide two copies of USB data cards, to the Engineer, that contains files for the manufacturer's audible messages for complete operation of all APS at all locations.

**6.0 Construction Requirements.** Construction requirements shall conform to Sec 902, 1061, and 1092.

**7.0 Method of Measurement.** Method of measurement shall conform to Sec 902.

**8.0 Basis of Payment.** Accepted "Accessible Pedestrian Pushbuttons and Signing" will be paid for at the contract unit price. Payment will be considered full compensation for all labor, equipment and material to complete the described work. Payment for signing will be included in the contract unit price for Accessible Pedestrian Signals.

Item Number	Type	Description
902-99.02	EA	Accessible Pedestrian Pushbutton and Signing

MMM. Countdown Pedestrian Signal Heads

**1.0 Description.** This work shall consist of furnishing, installing and placing into operation any countdown, pedestrian signal heads.

**2.0 System Requirements.** Delete Sec. 1092.1.9 in its entirety and substitute the following:

**1092.1.9 Pedestrian Signal Heads.** Pedestrian signal heads shall be in accordance with ITE specifications and standards for pedestrian traffic control signal indications and the following:

(a) Pedestrian signal head housings shall be constructed of a one-piece, 0.250-inch (6 mm) thick, polycarbonate material as shown on the plans. The housing shall include an integral mounting bracket designed for side-of-pole mounting on all makes of signal poles with a terminal compartment and minimum 5-position, double-row terminal block.

(b) The door, lens and any openings in the housing shall have gaskets or seals to exclude dust and moisture from the inside of the compartment.

(c) Lenses shall be constructed of polycarbonate material.

(d) Pedestrian signal head units shall be provided with a manufactured preformed rectangular visor or screen-type louver.

(e) All plastic material shall be ultraviolet stabilized.

(f) Indications shall be ITE Class 3 symbol messages. The "Upraised Hand" symbol shall be illuminated with a filled, Portland orange LED module. The "Walking Person" symbol shall be illuminated with a filled, white LED module. The "Countdown" display numbers shall be illuminated with a Portland orange LED module. The LED modules shall be in accordance with applicable portions of Sec 1092.1.

(g) Pedestrian traffic control signal faces shall be constructed such that all messages are displayed from the same message-bearing surface having a black opaque background. The "Countdown" display shall be located to the right of the "Upraised Hand" and "Walking Person" symbols, which will be overlaid.

(h) Pedestrian signal heads require "Countdown" displays and shall have the following features:

- (1) Display numbers must be two digits at least 9 inches in height.
- (2) Shall only display the "Countdown" time during the pedestrian change interval. Time displayed shall be in seconds, and begin only at the beginning of the pedestrian change interval. The flashing "Upraised Hand" symbol shall be concurrently displayed during the pedestrian change interval. The total time displayed at the start of the pedestrian change interval shall be automatically adjusted by the pedestrian signal head and not require any manual settings or additional wiring to the signal cabinet.
- (3) Once the "Countdown" display reaches "0", the "Countdown" display shall blank-out until the next pedestrian change interval begins.
- (4) If the pedestrian change interval is interrupted or shortened as part of a transition into a preemption sequence, the "Countdown" display shall go dark immediately upon activation of the preemption transition.
- (5) A test switch shall be provided in order to test the "Countdown" display.

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

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

**5.0 Basis of Payment.** Payment for pedestrian signal heads, including all materials, equipment, labor and tools shall be made and considered completely covered by the contract unit price bid for:

Item Number	Type	Description
902-99.02	Each	Countdown Pedestrian Signal Head, Type 1S

NNN. Partial Acceptance of Signalized Intersections

**1.0 Description.** This work shall consist of maintaining operational signals and detection (both stopbar and advanced) throughout the construction staging, in accordance with Sec 902 and except as approved by the engineer. At the engineer's option, MoDOT may accept intersections for maintenance prior to final acceptance.

**1.1** Once an intersection is complete, including but not limited to completion of construction, acceptance of all ADA facilities, and successful testing and operation of signal equipment, the

engineer may partially accept that intersection for MoDOT's maintenance prior to Final Acceptance of the entire project.

**2.0 Basis of Payment.** No direct payment will be made for the cost of equipment, labor, materials or time required to fulfill this provision.

OOO. 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** at least 2 days before any work that may impact the existing network communications. The contractor shall include the Job#, 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.

PPP. 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 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)

**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, node 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

QQQ. MoDOT ITS Assets 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 and other above and underground

ITS (Intelligent Transportation System) facilities 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 \$100.00 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. Contractor's reimbursement for MoDOT expense for this option shall be in addition to the liquidated damages.

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

#### RRR. Relocate Existing Communication Equipment

**1.0 Description.** The contractor shall relocate all existing network equipment from existing signal cabinet onto 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](mailto:SLITS@modot.mo.gov).

#### **2.0 Materials.**

**2.1** Existing Ethernet switches, video encoders, fiber optic data modems, cell modems and device servers will be re-used by the Contractor. These will include power cables except for the CCTV cameras (see Remove and Install CCTV Camera Assembly JSP for details).

**2.2** The Contractor shall provide any other cables such as Category 5E patch cords, coax patch cords, and short serial cables, etc. as required.

2.3 The Contractor shall provide any miscellaneous mounting hardware required to install the equipment in the new sign cabinet.

### 3.0 Construction Requirements.

3.1 Provide to the engineer a detailed schedule for relocation of existing 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 power strips as required. Connect the communication cables as shown on the connection diagrams in the plans. The equipment was 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 Cell Modem.** If the network connection at a cabinet is via cell modem, the contractor shall provide before relocation and after relocation documentation on cell modem signal strength. The relocated cell modem signal strength shall be equivalent or better than existing.

**4.0 Basis of Payment.** Measurement and payment for relocation of communication equipment will be on a per cabinet basis. The unit price shall include relocation of equipment, 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	Relocate Communication Equipment

SSS. Install Commission Furnished and Programmed IP Addressable Power Strip

**1.0 Description.** The contractor shall install a Commission Furnished and Programmed IP-Addressable Power Strip(s) in the ITS and/or Signal Cabinets as shown on 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 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.

**4.0 Acceptance Testing.** The Contractor shall contact MoDOT St. Louis ITS staff 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.

**5.0 Basis of Payment.** Measurement and payment for 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 Number	Unit	Description
910.99-02	Each	Install Commission Furnished and Programmed IP Addressable Power Strip

TTT. Contractor-Furnished and Install Closed Circuit Television (CCTV) Assembly

**1.0 Description.** The contractor shall furnish and install a CCTV Camera Assembly (this includes the camera unit, power supply, surge protection and Cat-6 cable) to the signal CL up-right pole as shown on the plans, ground the cable inside the signal cabinet and ground and test it for proper operation.

**1.1 Compatibility.** The St. Louis District is utilizing TransSuite as their Advanced Traffic Management System (ATMS) and all CCTV cameras must be able to integrate with the software and its related interfaces.

**2.0 Materials.**

**2.1** Camera assembly, mounting bracket, power supply, and surge suppressors will be provided by the Contractor. The cable connecting the camera to the cabinet will also be provided by the contractor.

**2.2 CCTV Camera.** All CCTV cameras purchased and installed on this project shall be selected from the list below. These are the only CCTV cameras that are tested and fully functional with the current MoDOT ATMS (Advanced Traffic Management System):

<b>CCTV Manufacturer</b>	<b>Model</b>	<b>Connection Type</b>
CostarHD (formerly known as Cohu)	4220HD RISE 3 Dome	Outdoor cat5e
Axis	Q6355-LE Dome	Outdoor cat5e
Bosch	Autodome 7000i	Outdoor cat5e

**2.3 POE Injector.** The Power Over Ethernet (POE) injector shall be of a make and model produced by the manufacturer of the camera. The POE injector shall operate on standard 120 VAC at 60 Hz electrical service and shall not be affected by transient voltages, surges, and sags normally experienced on commercial power lines. The POE injector shall have an operating temperature range of -40 degrees F (-40 degrees C) to 158 degrees F (70 degrees C).

**2.4 Surge Protection.** The cable between the POE injector and the camera assembly shall be protected by a surge protection device in the cabinet that meets the following requirements:

- a) UL listed and labeled to current editions of UL 497B and UL 497C
- b) Operating Temperature: -20 degrees F (- 28 degrees C) to 122 degrees F (50 degrees C)
- c) Operating Humidity: 95% RH non-condensing
- d) Wall, DIN rail or 19" rack mountable
- e) Three stage protection
- f) Maximum Continuous Operating Voltage: 44-52 V
- g) Data Rate: >100 Mbps
- h) Frequency: 125 MHz
- i) Surge Capacity: 10kA per mode (8x20 μs)
- j) Maximum Let-Through Voltage <90Vpk

**2.5 Cables.** Provide CAT 5e outdoor rated cable to carry power, video, and camera control between the camera and POE injector. Between the POE injector and the Ethernet switch an outdoor rated CAT 5e patch cable with factory terminated connectors shall be used. These cables shall meet requirements of applicable manufacturers listed in Section 2.2 above.

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

**3.0 Construction Requirements.**

**3.1** The contractor shall coordinate this work as well as any ITS (Intelligent Transportation System) network changes with MoDOT St Louis District ITS Group in advance via an email to [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov).

**3.2** The contractor shall use the latest manufacture camera firmware.

**3.3** Install the dome so that the pole does not block the camera's view of traffic. Unless directed differently by the engineer, install the camera in the same position as the existing camera.

**3.4** To confirm the existing camera pole is properly grounded, use a device that measures resistance to ground using the three-point fall-of-potential method to ensure that the resistance from the pole to ground does not exceed 8 ohms. If resistance exceeds the 8 ohms threshold report to the engineer.

**3.5** Terminate all the cables on surge protectors, install the Contractor furnished power supply in the cabinet, and connect the camera power circuit to the power supply. Connect POE injector port to the existing Ethernet switch in the cabinet.

**3.6** Restrict the camera's field of view, if necessary, so that a user cannot use the cameras to look in the windows of dwellings. To the extent that it does not interfere with the use of the camera for traffic management purposes, ensure that a camera cannot be used to view residential property. The camera should have clear view of all approaching traffic lanes. Prior to creating these restrictions, submit to the engineer a written description of the proposed restrictions to be installed at each camera, and the proposed method of achieving them. It shall not be possible for an operator to override these restrictions without intervention by his or her supervisor. Affixing a mask to the inside of the clear dome shall be an acceptable method to achieve this. Highlight situations in which there is a conflict between the need to protect privacy and the need to know about traffic situations. Revise the field of view restrictions as directed by the engineer.

**3.7** Apply a rain repellent coating to the outside of the lower dome, following the coating manufacturer's instructions. The coating must be recommended by the CCTV manufacturer for use on their equipment.

#### **4.0 Acceptance Testing.**

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

**4.2** After installing the camera assembly, test it using the same procedures used when the camera assemblies were delivered. In addition, demonstrate that the agreed upon viewing restrictions have been implemented. If the installed camera assembly fails to operate properly, and the problem cannot be fixed by changing the wiring or setup parameters, the camera assembly will be deemed defective and the contractor shall return it to the manufacturer for replacement at Contractor's expense. Except for costs borne by the manufacturer under their warranty agreement, the cost of replacement shall be borne entirely by the contractor.

**4.3** SLITS Group shall inspect this CCTV assembly installation as well as the related network devices for proper operations prior to acceptance.

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

<b>Item No.</b>	<b>Type</b>	<b>Description</b>
910-99.02	Each	CCTV Camera Assembly
910-99.02	Each	TV Camera Assembly

## UUU. 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.** Connectors shall be the LC type with ceramic ferrules, unless a different connector is required to mate with the equipment or an existing panel. They shall be suitable for use in traffic cabinets and shall be designed for single mode fibers.

**2.4 Pigtail.** Pigtails shall be factory-made, buffered, and strengthened with aramid yarn to reduce the possibility that accidental mishandling will damage the fiber or connection. Pigtails shall be yellow. 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.

**2.2.2** 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.

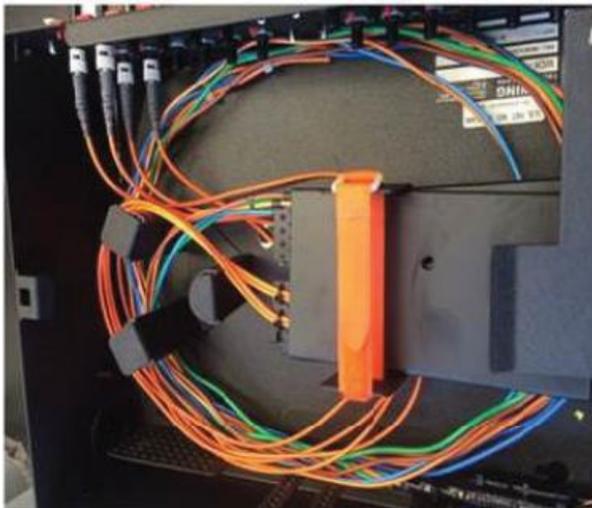
**3.3.4** Use a different splice tray for each buffer tube color. If an enclosure contains multiple buffer tubes of the same color, but none of the fibers in one of the tubes are spliced to fibers in other tubes of the same color, use a separate splice tray for that tube.

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

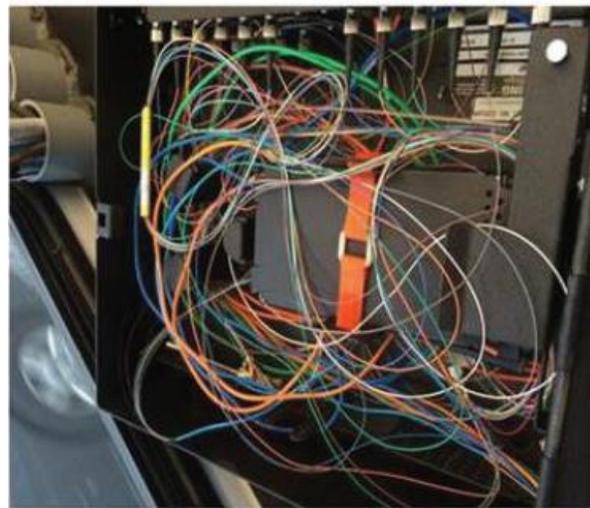
**3.5 Tracer Wire.** The contractor shall install a jacketed #14 AWG XHHW-2 standard blue tracer wire (also known as the locator wire) in conduit with new or replaced fiber optic cable(s). In the pull box nearest to the ITS or signal cabinet connect the tracer wire to a ground rod with a ground rod clamp 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](mailto: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	Wall-Mounted Interconnect Center

#### VVV. Relocate Existing Wireless Radio System

**1.0 Description.** The contractor shall relocate the existing radio system kit from existing signal facilities onto the new facilities (the exact signal pole or arm location shall be determined by the contractor during testing process based on line of sight and acceptable radio signal quality for all signal and ITS devices within the wireless network segment), install a new Cat-5/6E cables, program and test those per manufacture's specifications and MoDOT instruction guide (this instruction will be provided to the contractor at the pre-construction meeting or via an email to the [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov)) at the locations shown on this project's plans.

**2.0 Requirements.** The contractor shall keep the existing radio system online and in-use and relocate them all onto new signal facilities, program and test the entire radio system, including existing mid-block radio repeaters (in case of re-aiming) for proper operations within one business day. An outdoor rated Cat-5/6E Cable shall be furnished and install for each radio system between the radio unit and the new signal cabinet. Any additional radios needed to keep the existing system online during construction shall be the responsibility of the contractor to furnish and install. The radio must be tested in combination with other radios prior to acceptance.

**3.0 Construction Requirements.** Construction requirements shall conform to Sec 902 and 1092. The radios shall be mounted directly to the signal mast arm using an approved bracket and have the best signal strength to the downstream radio.

**4.0 Testing.** The items of work described in this provision are not complete until network communications testing has been completed to the satisfaction of the Engineer. The proposed radio(s) relocations may require a proper network communication with the downstream radio or ITS cabinet. The contractor shall coordinate and verify the radio operation with the MoDOT ITS group in advance via an email to the [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov).

**5.0 Method of Measurement.** Method of measurement shall conform to Sec 902.

**6.0 Basis of Payment.** Payment for the installing/relocating of radios system at signalized intersections will be made by Item No. 910-99.02 per each intersection and shall be considered full compensation for all contractor-provided equipment, connection cables, installation of non-contractual items, labor, and material to complete the described work.

Item No.	Type	Description
910-99.02	Each	Relocate Existing Wireless Radio System

WWW. CCTV Extension Pole Installation

**1.0 Description.** Furnish and install a 20' x 4" extension pole to the existing signal upright pole as shown on the plans. CCTV Camera assembly installation is paid separately.

**2.0 Material.** See details in the plans. A metallic finish means a natural aluminum finish. Free from blemishes.

The contractor shall demonstrate to the Engineer that the brackets are installed properly, and bandings are tight to the signal and extension poles.

**3.0 Basis of Payment.** Measurement and payment for CCTV extension pole includes materials, installation and all miscellaneous hardware required for a fully operational system.

Item No.	Type	Description
910-99.02	Each	CCTV Extension Pole Installation

XXX. Relocate Existing CCTV Camera Assembly

**1.0 Description.** The contractor shall remove the existing CCTV camera assembly (camera, cable, PoE (Power over Ethernet) power injector, surge arresters, power pack, encoder, device server, extension pipe, etc.) from existing signal facility and re-install it on new signal facility as shown on the plans and test it for proper operation.

**2.0 Construction Requirements.**

**2.1** Before removing the existing CCTV camera assembly, the contractor shall inspect all related CCTV camera parts and report to the SLITS Group via an email to [SLITS@modot.mo.gov](mailto:SLITS@modot.mo.gov) any damage or concern items. Also verify with the SLITS Group that the camera has a quality images and the pan-tilt-zoom works properly.

**2.2** The contractor shall replace the CCTV cable from the switch to the new mounting location. Either an outdoor rated Cat-5 cable or manufacturer provided composite cable (power plus network), depending on the type of camera in place, shall be used with no substitution of cable types allowed. Contractor will provide documentation for either type of cable. In cases where a composite cable is used and the PoE, surge arrester or power pack is damaged, the contractor shall replace them with the MoDOT furnished parts respectively.

**2.3** The contractor shall exercise reasonable care in the handling of the equipment during removal, temporary storage, and installation. Should any of the equipment be damaged by the contractor's negligence, it shall be replaced at the contractor's expense.

**2.4** The contractor shall install the existing CCTV camera assembly or those parts required in Section 2.2 on new signal facilities as shown on the plans, make all necessary connections, program the CCTV camera per manufacturer specifications, and work with the SLITS Group to test the relocated camera for proper operation.

#### **4.0 Acceptance Testing.**

**4.1** After installing the camera assembly, test it using manufacturer recommended procedures to demonstrate that high quality video is be transmitted and that the pan, tilt and zoom functions are operating properly. Also, use a device that measures resistance to ground using the three-point fall-of-potential method to demonstrate that the resistance from the air terminal to ground does not exceed 8 ohms. If the installed camera assembly fails to operate properly, and the problem cannot be fixed by changing the wiring or setup parameters, the camera assembly will be deemed defective and the contractor shall return it to the manufacturer for replacement. Except for costs borne by the manufacturer under his warranty agreement, the cost of replacement shall be borne entirely by the contractor.

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

<b>Item No.</b>	<b>Type</b>	<b>Description</b>
910-99.02	Each	Relocate Existing CCTV Camera Assembly

#### YYY. Ground Rod With Exothermic Welds

**1.0 Description.** This work shall consist of furnishing and installing ground rods with exothermic welds at locations shown on the plans or as directed by the engineer. All work and materials shall be in accordance with the Missouri Standard Specifications for Highway Construction, latest edition, applicable Missouri Standard Plans, and as specified herein.

#### **2.0 Materials**

##### **1. Ground Rods**

- Ground rods shall be **copper-clad steel**, minimum **5/8 inch diameter** and **8 feet long**, conforming to **ASTM F2321** and **UL 467**.
- Copper cladding shall be bonded via an **exothermic weld**, with a minimum thickness of **10 mils**.

**2. Exothermic Welds**

- Connections between ground rods and grounding conductors shall be made using **exothermic welding**.
- Exothermic weld materials shall be suitable for copper-to-copper and copper-to-steel connections as required by the ground rod manufacturer.

**3. Grounding Conductors**

- Bare stranded copper wire, minimum size **#6 AWG**, unless otherwise shown on the plans.
- Conductor shall conform to **ASTM B8** and shall be soft-drawn.

**3.0 Construction Requirements**

**A. Installation**

- Drive ground rods vertically into the earth to a minimum depth of 8 feet.
- Where rock prevents full depth installation, the rod shall be installed at an angle not to exceed 45°, or horizontally in a trench at a minimum depth of 30 inches, as approved by the engineer.
- All connections between the conductor and ground rod shall be made using exothermic welds in accordance with the manufacturer's instructions.
- Weld molds shall be properly sized and cleaned before each use.
- After welding, all slag shall be removed and the weld visually inspected for completeness and integrity.

**B. Testing**

- After installation, the contractor shall test each ground rod for continuity and grounding resistance if required by the engineer.
- Ground resistance shall not exceed **25 ohms** unless otherwise specified.

**4.0 Method of Measurement**

Measurement will be made per each **ground rod with exothermic welds** installed and accepted.

**5.0 Basis of Payment**

Payment for accepted quantities of ground rods with exothermic welds will be made at the contract unit price per each. Such payment shall be full compensation for furnishing and installing ground rods, conductors, exothermic welds, and all related materials, equipment, labor, and incidentals necessary to complete the work.

<b>Item Number</b>	<b>Item Name</b>	<b>Units</b>
901-99.01	Ground Rod W/Exothermic Welds	Each

ZZZ. NEMA 4 X-Rated 8 Inch X 8 Inch X 6 Inch Junction Box

**1.0 Description.** This work shall consist of furnishing and installing **NEMA 4X-rated junction boxes (8" x 8" x 6")** at locations shown on the plans or as directed by the engineer. Work shall be performed in accordance with the plans and manufacturer's recommendations.

## 2.0 Materials.

### 1. Junction Box Requirements

- Dimensions: Nominal size shall be **8 inches x 8 inches x 6 inches** (H x W x D).
- Enclosure Rating: **NEMA 4X**, suitable for **outdoor and corrosive environments**, offering protection against water, dust, and corrosion.
- Material:
  - **304 or 316 stainless steel** with brushed finish, or
- Cover: **Hinged or screw-on** with **weatherproof gasket** to maintain the NEMA 4X rating.
- All enclosures shall include an internal **grounding stud or bar**.
- Knockouts or holes shall not be factory pre-punched unless shown on the plans.
- All penetrations shall maintain the NEMA 4X rating with proper strain reliefs or fittings.

### 2. Mounting Hardware

- Mounting brackets or backplates shall be stainless steel or corrosion-resistant alloy.
- All fasteners, hinges, latches, and exterior hardware shall be **corrosion-resistant**, stainless steel, or approved equivalent.

### 3. Conduit Fittings

- All conduit entries shall use **watertight hubs** (e.g., Myers hubs or equivalent).
- Conduit shall enter the box in a manner that maintains the NEMA 4X enclosure rating.

### 4. Submittals

- The contractor shall submit **manufacturer datasheets**, installation instructions, and cut sheets for all junction boxes and fittings to the engineer for approval prior to installation.

## 3.0 Construction Requirements.

### 1. Installation

- Junction boxes shall be securely mounted to the structure (e.g., wall, pole, or cabinet) as shown on the plans.
- Install at a height and orientation that provides safe and convenient access for maintenance.
- Ensure box is level, plumb, and all conduit connections are watertight and properly aligned.
- All wire entries shall be sealed and strain-relieved as necessary.
- Unused knockouts or holes shall be sealed with plugs rated for NEMA 4X use.
- All wiring within the box shall be neat and labeled as per MoDOT specifications.

### 2. Grounding

- A ground conductor shall be connected to the internal ground lug or bar in accordance with the **National Electrical Code (NEC)** and MoDOT electrical standards.

### 3. Inspection and Testing

- All boxes shall be inspected after installation for water-tightness, secure mounting, correct labeling, and overall workmanship.
- The engineer may require a visual inspection of interior terminations and connections.

## 4.0 Method of Measurement.

Measurement will be made per each NEMA 4X 8 INCH X 8 INCH X 6 INCH Junction Box installed and accepted.

**5.0 Basis of Payment.** Payment for furnishing and installing NEMA 4X 8 INCH X 8 INCH X 6 INCH Junction Box shall include all materials, equipment, tools, labor, and work incidental thereto, and shall be considered completely covered by the contract unit price for:

Item Number	Item Name	Units
901-99.02	NEMA 4X 8 INCH X 8 INCH X 6 INCH Junction Box	Each

AAAA. Top Mount Luminaire

**1.0 Description.** This work shall consist of furnishing and installing LED Top Mounted Luminaires as indicated in the plans.

**2.0 Construction Requirements.** Luminaires shall be vertical top mount type (pole top mount) with a slip-fitter that accommodates a standard 2" top mount. Available types are listed on the MoDOT approved products list and must meet all MoDOT Specifications along with additional requirements noted in the additional sections below. The contractor shall coordinate the pole top mount size with the luminaire mount to ensure compatibility. All luminaires for this project shall allow for a tilt angle to be adjusted in the field dependent upon the placement of the pole. All necessary mounting brackets and hardware shall be included in the payment for the luminaire.

**2.1** LED luminaires shall not be equipped with a Photo Control Receptacle.

**2.2** LED Luminaires shall have a terminal block for easy installation of a two wire Line/neutral circuit (no wire nuts for termination of field/luminaire circuit).

**2.3** LED luminaires shall have an easy access point for future repairs to the driver.

**2.4** LED luminaires shall have pole adaptors which are capable of feeding wires through without disassembling the knuckle.

**3.0 Basis of Payment.** Payment for furnishing and installing top mounted luminaries shall include all materials, equipment, tools, labor, and work incidental thereto, and shall be considered completely covered by the contract unit price for:

Item Number	Item Name	Units
901.99.02	170W Top Mounted LED-A Luminaire	Each
901-99.02	170W Top Mounted LED-B Luminaire	Each

BBBB. Top Mount Light Pole

**1.0 Description.** This work shall consist of furnishing and installing top mount poles as indicated in the plans.

**2.0 Construction Requirements.** Top mount poles shall conform to the Type AT lighting poles and shall be fabricated with a circumferentially welded top mount and top plate to accept top

mounted luminaries. The top mount shall extend 4” above the top of the pole and meet AASHTO loading requirements for the luminaires provided. The top mount shall be made of the same material as the pole shaft, be constructed as a one-piece pole and top mount unit by the manufacturer and have an outside diameter that accepts the appropriate luminaire slip-fitter. Pole and top mount shall conform to all MoDOT specifications and material requirements. Bridge mounted poles shall be constructed to match the existing bolt pattern.

**3.0 Basis of Payment.** Payment for furnishing and installing top mount poles shall include all excavation, materials, equipment, tools, labor, and work incidental thereto, and shall be considered completely covered by the contract unit price for:

Item Number	Item Name	Units
901-99.02	30 Ft. Top Mount Light Pole	Each
901-99.02	45 Ft. Top Mount Light Pole	Each

**CCCC. 18 Inch Island Tubular Marker**

**1.0 Description.** Tubular markers shall be mounted on raised islands at the locations indicated in the plans.

**2.0 Requirements.** Island tubular markers shall have a height 18-inches as noted on plans, 2 reflective bands with super high intensity prismatic sheeting in accordance to Sec 1042 and be constructed from thermoplastic polyurethane. Color of the island tubular marker and reflective bands shall match the pavement marking in which it is placed. Post shall be in the shape of a “T” with a width of 3 inches and depth of 2 inches. Post shall be capable of recovering from repeated vehicle impacts. Post shall insert and be secured into the plastic base with horizontal locking pins. When the post is no longer serviceable, it shall be able to be removed and a new post can be manually inserted and locked into the existing base.

**3.0 Construction Requirements.** Shall be surface mounted on the radius points of the island noses. The roadway shall be cleaned of dirt and gravel before installation. Island tubular markers shall be mounted using proper sized anchor bolts according to the manufacturer’s instructions.

**4.0 Method of Measurement.** Measurement for installation of tubular marker with base will be made per each.

**5.0 Basis of Payment.** All labor, equipment and materials necessary to install these markers will be paid for under:

Item Number	Item Name	Units
620-99.02	18 inch Tubular Marker	Each