

JOB SPECIAL PROVISIONS TABLE OF CONTENTS (ROADWAY)

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

A.	General - Federal JSP-09-02L	1
B.	Contract Liquidated Damages JSP- 13-01D  REVISED	1
C.	Work Zone Traffic Management JSP-02-06N	2
D.	DBE Prompt Payment Reporting JSP-24-05B	5
E.	Emergency Provisions and Incident Management JSP-90-11A	7
F.	Project Contact for Contractor/Bidder Questions JSP-96-05	7
G.	Supplemental Revisions JSP-18-01HH	8
H.	Utilities JSP-93-26F	16
I.	Pot Holing For Utility Facilities	26
J.	Concrete Adjacent to Ameren Composite Poles	27
K.	Liquidated Damages for Pedestrian Impacts	27
L.	Liquidated Damages Specified – Lane Shift and Bidirectional Lane Closure JSP-93-28A	28
M.	Contractor Quality Control NJSP-15-42	29
N.	Winter Months Requirements JSP-15-07A	31
O.	Delayed Access to Parcels Pending Acquisition	31
P.	Property Owner Notification	32
Q.	Access to Commercial and Private Entrances	32
R.	Coordination with MoDOT Project No. J6S3632 and their Contractor	33
S.	City of St. Louis Coordination	34
T.	School Bus Service	34
U.	Coordination with Metro Transit	34
V.	Parked Vehicles During Construction	36
W.	Site Restoration	36
X.	Balanced Mix Design Requirements for Sec 403 Asphalt JSP-24-01C	37
Y.	Polymer Modified Emulsion Tack	69
Z.	Linear Grading Class 2 – Modified	69
AA.	Guardrail Requirements	70
BB.	ADA Compliance and Final Acceptance of Constructed Facilities JSP-10-01C	71
CC.	ADA Material Testing Frequency Modifications JSP-23-01	72
DD.	Median Island Cut-Throughs – St. Louis District Version 10-18-23	73
EE.	ADA Curb Ramp – St. Louis District Version 01-17-24	74
FF.	Paved Approach and Paved Approach, High Early Strength	76
GG.	Concrete Sidewalk and Curb Jointing at Utility Poles	78
HH.	Drainage Maintenance During Construction	78
II.	Metropolitan Sewer District of St. Louis Permit (Job No. 24MSD-00480)	78
JJ.	Metropolitan Sewer District of St. Louis As-Built Submittals (Job No. 24MSD-00480)	79
KK.	Remove and Replace Top of Inlet with Manhole	79
LL.	Convert Grate Inlet to Curb Inlet	80
MM.	Special Drainage Structures	81
NN.	Adjust To Grade Items	81
OO.	Lump Sum Temporary Traffic Control JSP-22-01B	82
PP.	Temporary Striping	84
QQ.	Solid White Thermoplastic Pavement Marking, Bike Symbol	85
RR.	Solid White Thermoplastic Pavement Marking, Bicycle Shared Lane Marking	86
SS.	Contractor Designed, Furnished and Installed Steel Plates	86
TT.	Contractor Designed, Furnished and Installed Shoring for Excavation	87
UU.	Asphalt Coldmilling / Paving Requirement	88
VV.	Reinforcing Fibers for Bituminous Pavement Material NJSP-17-06C	89

WW.	Pavement Marking	92
XX.	Optional Temporary Pavement Marking Paint NJSP-18-07G	92
YY.	Island Tubular Marker	93
ZZ.	Landscaping Restoration	94
AAA.	Wood Fence (48 IN.) and Temporary Fence	95
BBB.	Decorative Fence	96
CCC.	Structural Sidewalk with Rebar	97
DDD.	Pass Through	97
EEE.	Grated Trough	98
FFF.	Pass Down	99
GGG.	Island Drainage Cover	99
HHH.	Covered Inlet Extension	100
III.	Sewer (Granular Backfill)	100
JJJ.	Optional Curb	101
KKK.	Miscellaneous Special Curb for Passing Obstacles	102
LLL.	Signs in Concrete	102
MMM.	Removal and Delivery of Existing Signs JSP-12-01C	102
NNN.	Removal and Replacement of Traffic Signs	103
OOO.	Removal and Delivery of Adopt-A Highway Signs	103
PPP.	Truck Mounted Attenuator (TMA) for Stationary Activities JSP-23-04	104
QQQ.	Rectangular Rapid Flashing Beacon Assembly	104
RRR.	Temporary Traffic Signals	107
SSS.	MoDOT TS2 Type 1 Cabinet Assembly	108
TTT.	ATC Traffic Signal Controller	111
UUU.	16-Position Backpanel Flashing Yellow Arrow	112
VVV.	Coordination with MoDOT Signal Shop for Cabinet Entry	113
WWW.	Partial Acceptance of Signalized Intersections	113
XXX.	Traffic Signal Maintenance and Programming	114
YYY.	Maintenance of St. Louis County Traffic Signal Facilities	118
ZZZ.	St. Louis County Owned Signals	121
AAAA.	Liquidated Damages Specified Traffic Signal Loops at Route 231 at River City Casino Blvd JSP-93-28A	121
BBBB.	Work for St. Louis County Requirements- Route 231 at River City Casino Blvd	122
CCCC.	Accessible Pedestrian Push Button and Signing	125
DDDD.	Combination Pad Mounted 120V/240V Power Supply and Lighting Controller with Uninterruptible Power Supply (UPS) – TS2 Traffic Signal Cabinet	127
EEEE.	Maintenance of Roadway Lighting	134
FFFF.	Top Mount Light Pole	134
GGGG.	Luminaire Arm	135
HHHH.	SL District Traffic Signal Detection System	135
IIII.	Signal Cabinet Base Wrap and Cabinet Shift	145
JJJJ.	MoDOT ITS Equipment Within Project Limits	145
KKKK.	Coordination with ITS Staff and Utility Locates	146
LLLL.	Contractor Furnished and Installed (F&I) IP-ADDRESSABLE Power Strip	146
MMMM.	Contractor Furnished and Installed Closed Circuit Television (CCTV) Assembly	147
NNNN.	Relocate Existing CCTV Assembly	150
OOOO.	CCTV Extension Pole Installation	151
PPPP.	ITS Pullbox	151
QQQQ.	ITS Asset Management Tool	152
RRRR.	Install New or Relocate Existing Communication Equipment	153
SSSS.	Installation and Relocation of Fiber Optic Cable	154
TTTT.	ITS Conduit	161

Job No.: J6S3631

Route: 231

County: St. Louis

UUUU. Disposal of Existing MoDOT Assets

164

VVVV. MoDOT Buried Cable Drivable Delineator Post

164

 Dennis J Koscielski – Civil MO PE – 2005000712	MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION 105 W. CAPITOL AVE. JEFFERSON CITY, MO 65102 Phone 1-888-275-6636
	Hanson Professional Services Inc. 600 Washington Ave., Suite 950 Saint Louis, MO 63101
	Certificate of Authority: 001632 Consultant Phone: (314) 942-5291
	If a seal is present on this sheet, JSP's have been electronically sealed and dated.
	JOB NUMBER: J6S3631 ST. LOUIS COUNTY, MO DATE PREPARED: 04/28/2025
ADDENDUM DATE: R001 August 27, 2025	
Only the following items of the Job Special Provisions (Roadway) are authenticated by this seal: A to HHHH.	

 Margaret Ann Bruns - Civil MO PE-2010000798	MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION 105 W. CAPITOL AVE. JEFFERSON CITY, MO 65102 Phone 1-888-275-6636
	EFK Moen, LLC, 13523 Barrett Pkwy Dr # 250 Ballwin, MO 63021
	Certificate of Authority: 001578 Consultant Phone: (314) 394-3100
	If a seal is present on this sheet, JSP's have been electronically sealed and dated.
	JOB NUMBER: J6S3631 ST. LOUIS COUNTY, MO DATE PREPARED: 04/28/2025
ADDENDUM DATE:	
Only the following items of the Job Special Provisions (Roadway) are authenticated by this seal: IIII to VVVV.	

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 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 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.

Job No.: J6S3631
Route: 231
County: St. Louis

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 Contract Completion date specified below. Completion by this date shall be in accordance with the requirements of Sec 108.7.1.

Notice to Proceed Date: ~~October 1, 2025~~ **January 1, 2026**  REVISED
Contract Completion Date*: October 1, 2027

2.1 Calendar Days. The count of calendar days will begin on the date the contractor starts any construction operations on the project.

Job Number	Calendar Days	Daily Road User Cost
J6S3631	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 above 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 Traffic Congestion. The contractor shall, upon approval of the engineer, take proactive measures to reduce traffic congestion in the work zone. The contractor shall immediately implement appropriate mitigation strategies whenever traffic congestion reaches an excess of **15 minutes** to prevent congestion from escalating beyond this delay threshold. If disruption of the traffic flow occurs and traffic is backed up in queues equal to or greater than the delay time threshold listed above, then the contractor shall immediately review the construction operations which contributed directly to disruption of the traffic flow and make adjustments to the operations to prevent the queues from reoccurring. Traffic delays may be monitored by physical presence on site or by utilizing real-time travel data through the work zone that generate text and/or email notifications where available. The engineer monitoring the work zone may also notify the contractor of delays that require prompt mitigation. The contractor may work with the engineer to determine what other alternative solutions or time periods would be acceptable. When a Work Zone Analysis Spreadsheet is provided, the contractor will find it in the electronic deliverables on MoDOT's Online Plans Room. The contractor may refer to the Work Zone Analysis Spreadsheet for detailed information on traffic delays.

2.5 Traffic Congestion. The contractor shall, upon approval of the engineer, take proactive measures to reduce traffic congestion in the work zone. The contractor shall immediately implement appropriate mitigation strategies whenever traffic congestion reaches an excess of 10 minutes to prevent congestion from escalating to 15 minute or above threshold. If disruption of the traffic flow occurs and traffic is backed up in queues of 15 minute delays or longer, then the contractor shall immediately review the construction operations which contributed directly to disruption of the traffic flow and make adjustments to the operations to prevent the queues from reoccurring. Traffic delays may be monitored by physical presence on site or by utilizing real-time travel data through the work zone that generate text and/or email notifications where available. The engineer monitoring the work zone may also notify the contractor of delays that require prompt mitigation. The contractor may work with the engineer to determine what other alternative solutions or time periods would be acceptable.

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.

3.0 Work Hour Restrictions.

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

Memorial Day
Labor Day
Thanksgiving
Christmas
New Year's Day

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

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

3.1.2 The contractor's working hours will be restricted for the Special Events as shown below. All lanes shall be scheduled to be open to traffic during these Special Events.

Funeral Processions Identified by Engineer

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.

4.0 Detours and Lane Closures.

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

4.2 At least one lane of traffic in each direction shall be maintained at all times except for brief intervals of time required when the movement of the contractor's equipment will seriously hinder the safe movement of traffic. Periods during which the contractor will be allowed to interrupt traffic will be designated by the engineer.

5.0 Basis of Payment. No direct payment will be made to the contractor to recover the cost of equipment, labor, materials, or time required to fulfill the above provisions, unless specified elsewhere in the contract document. All authorized changes in the traffic control plan shall be provided for as specified in Sec 616.

D. DBE Prompt Payment Reporting JSP-24-05B

1.0 Description.

1.1 This provision will only apply to contracts that have a Disadvantaged Business Enterprise (DBE) goal greater than 0% and have at least one DBE subcontractor.

1.2 MoDOT monitors the payments made by prime contractors and subcontractors to DBEs for compliance with DBE payment monitoring rules as outlined in 49 CFR 26.37. To facilitate this monitoring, MoDOT requires prime contractors to report their remitted payments to DBEs and subcontractors to report their remitted payments to lower-tier DBEs.

1.3 Tracking of DBE payments are made through the Signet™ application (Signet). Signet is a third-party service, supported by the vendor, for usage by the prime contractor and all subcontractors. Signet is only a reporting tool; it does not process financial transactions. MoDOT does not provide direct technical support for Signet. Information about Signet may be found at <https://signet-help.zendesk.com/hc/en-us>.

1.4 Upon completion of the first pay estimate on the contract, Signet will automatically send an email to the prime contractor prompting registration. The prime will be required to pay a one-time, fixed fee of \$1,000 for this contract directly to the Signet vendor. Use of Signet to track DBE payments will be available for the life of the contract, regardless of the contract value, contract duration, number of subcontractors, or payments reported. No additional

fee will be charged to subcontractors that are required to report payments or DBEs that are required to verify payments through Signet. The contractor may also, at no additional cost, report payments through Signet to subcontractors that are not DBEs.

1.5 After each estimate, when contractor reporting of payments is complete, the subcontractor will receive an email notifying them of the payment and requesting verification of the reported payment. A subcontractor that has not completed registration with Signet will be prompted to do so at this time.

1.6 Users will be set up automatically based on information in MoDOT's vendor list. Additional users under each contractor may be added once registration has been completed within Signet. The current vendor list can be found at <https://www.modot.org/bid-opening-info>.

1.7 For purposes of this requirement, payer is defined as the prime contractor or subcontractor that reports a payment in Signet to a vendor that is either a subcontractor, trucker, manufacturer, regular dealer, or broker. Payee is defined as the vendor that receives notification of payment through Signet from the prime contractor or a higher-tier subcontractor. Payment is defined as issuing an Electronic Funds Transfer (EFT) or mailing a check to a payee.

2.0 Requirements. Payers must report remitted payment to DBEs within Signet, for work performed by the DBE subcontractor, DBE trucking, materials supplied from a DBE manufacturer, dealer, or broker, as well as a return of retainage (and/or other amounts withheld), within 15 calendar days.

2.1 Prime contractors must report remitted payments to DBEs within 15 calendar days of each payment it receives from MoDOT. Prime contractors must also report payments to non-DBE subcontractors if that subcontractor is making payment to a lower tier DBE subcontractor, trucker, manufacturer, regular dealer, or broker.

2.2 The payer must report the following information within Signet:

- a. The name of the payee.
- b. The dollar amount of the payment to the payee.
- c. The date the payment was made.
- d. Any retainage or other amount withheld (if any) and the reason for the withholding (if other than retainage).
- e. The DBE function performed for this payment (e.g., contracting, trucking, or supplying as a manufacturer, dealer, or broker).
- f. Other information required by Signet.

The payer must report its return of retainage (and/or other amounts withheld) in separate, standalone payment entries (i.e., without being comingled with a payment for work performed or materials supplied).

2.3 In the event that no work has been completed by a DBE during the estimate period, such that no payment is due to a DBE subcontractor, trucker, manufacturer, regular dealer, or broker, then the prime contractor will mark payment complete within Signet, and no other payments are required to be reported.

2.4 Each subcontractor making a payment to a lower-tier DBE must report remitted payments within Signet, as detailed in Section 2.2, within 15 days of receipt of each payment from the prime contractor.

2.5 DBE payees must verify in Signet each payment reported by a payer within 15 calendar days of the payment being reported by the payer. This verification includes whether the payment was received, and if so, whether it was as expected.

3.0 Basis of Payment. A fixed cost of \$1,000 will be paid on this contract for the required software to report payments to DBEs through Signet. Regardless of the number of projects in a contract, a single payment will be made under item 108-10.00, SIGNET DBE REPORTING, per lumpsum. The engineer reserves the right to underrun this item for any reason. Any additional costs for registration, software, usage, time, labor, or other costs will be considered incidental and no direct payment will be made.

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

1.0 The contractor shall have communication equipment on the construction site or immediate access to other communication systems to request assistance from 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: 636-300-2800		
St. Louis County Sheriff: 314-615-4724		
Saint Louis County	Saint Louis City	
Fire 314-631-4500	Fire 314-533-1681	
Police 636-529-8210	Police 314-231-1212	

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

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

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

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

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

Stuart McNeil, P.E.
Transportation Project Manager – St. Louis District
1590 Woodlake Drive
Chesterfield, MO 63017

Telephone Number: (314) 370-3104
Email: Stuart.McNeil@modot.mo.gov

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

G. Supplemental Revisions JSP-18-01HH

- 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 and Steel.

On all federal-aid projects, the contractor's attention is directed to Title 23 CFR 635.410 *Buy America Requirements*. Where steel or iron products 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. Furthermore, any coating process of the steel or iron shall be performed in the USA. 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 Buy America Requirements for Iron and Steel for Manufactured items.

A manufactured item will be considered iron and steel if it is "predominantly" iron or steel. Predominantly iron or steel means that the cost of iron or steel content of a product is more than 50 percent of the total cost of all its components.

106.9.2 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.

106.9.3 “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.

106.9.4 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.

106.9.4.1 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 the following. That 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.

106.9.4.2 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.

106.9.4.3 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.

106.9.5 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.

106.9.6 Buy America Requirements for Construction Materials other than iron and steel materials.

Construction materials means 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

106.9.6.1 Minimal Use allowance for Construction Materials other than iron or steel.

"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.

106.9.7 Buy America Requirements for Manufactured Products.

Manufactured products means:

- (a) Articles, materials, or supplies that have been:
 - (i) Processed into a specific form and shape; or
 - (ii) Combined with other articles, materials, or supplies to create a product with different properties than the individual articles, materials, or supplies.
- (b) If an item is classified as an iron or steel product, a construction material, or a section 70917(c) material under § 184.4(e) and the definitions set forth in this section, then it is not a manufactured product. However, an article, material, or supply classified as a manufactured product under § 184.4(e) and paragraph (1) of this definition may include components that are construction materials, iron or steel products, or section 70917(c) materials.

106.9.7.1 Manufactured products are exempt from Buy America requirements. To qualify as a manufactured product, items that consist of two or more of the listed construction materials that have been combined together through a manufacturing process, and items that include at least one of the listed materials combined with a material that is not listed through a manufacturing process, should be treated as manufactured products, rather than as construction materials.

106.9.7.2 Manufactured items are covered under a general waiver to exclude them from Buy America Requirements. To qualify for the exemption the components must comprise of 55% of the value of materials in the item. The final assembly must also be performed domestically.

- 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 ± 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.

- **Delete Sec 102.1 - 102.2.5 and substitute the following:**

102.1 Notice of Bid Opening. After the date is fixed for the receipt of bids, the notice of bid opening will be posted on MoDOT's website and published as required by law. The notice of bid opening will contain a description of the proposed work, instructions and information to the potential bidder regarding bid forms, plans, specifications, combination bids and the reservation of the right of the Commission to reject any and all bids.

102.2 Contractor Questionnaire. Each prospective bidder, including a joint venture, shall file a contractor questionnaire on the form furnished by the Commission, which is available on MoDOT's website. The contractor questionnaire shall be furnished to the Commission as a separate document apart from any other document submitted. A bid will not be opened and read unless a fully responsive contractor questionnaire is on file with the Commission at least seven days prior to the time set for the opening of the bids. A new contractor questionnaire shall be filed as described in **Title 7 CSR 10-15.010**, except the Commission reserves the right to request a contractor questionnaire from any contractor as of any date if the Commission has shown reason to believe that the contractor's experience data may have changed from that shown on the questionnaire on file. This document shall include a record of the bidder's experience data. The Commission will use this information as an aid to determine in each instance the lowest responsible bidder and nothing contained herein shall be construed as depriving the Commission of the Commission's discretion in the matter of determining the lowest responsible bidder.

102.2.1 At any time prior to award, as a condition of award and for a period of three years after the date of final acceptance, the Commission may request true copies of the bidder's financial data, including the bidder's balance sheet, profit and loss statement and similar financial data, as of the close of the bidder's most recent fiscal year prior to submission of the bid, and for each fiscal year between the contract award and final acceptance of the contract work. Unless specified otherwise by the Commission, financial data shall be prepared by an accountant and audited financial data shall be provided if it is available to the bidder for the fiscal period requested. A bidder who has not closed the first fiscal year prior to the date of the request shall supply the last periodic balance sheet, profit and loss statement and similar data.

102.2.2 Each prospective bidder shall sign the contractor questionnaire acknowledging that such bidder will fully comply with all written requests by the Missouri Department of Labor and Industrial Relations, Division of Labor Standards, to provide information for the purpose of establishing a prevailing wage.

102.2.3 The prospective bidder doing business in the State of Missouri shall submit the charter number with the contractor questionnaire. The entity must be in good standing on file with the Corporation Division of the Missouri Secretary of State's Office to be approved and successfully awarded a bid. Each corporation that is a party to a joint venture shall submit the same required report with the corporation's joint venture contractor questionnaire.

102.2.4 All prospective bidders who are corporations organized in states other than Missouri or countries other than the USA shall furnish, at the prospective bidder's cost, a certified copy of a current certificate of authority to do business in Missouri, with said certificate to remain on file with the Commission. Such a certified copy may be secured from the corporation supervisor in the Office of the Secretary of State, Jefferson City, Missouri. The prospective bidder agrees to cause the prospective bidder's authority to do business as a foreign corporation to be continued and extended throughout the life of any contract awarded and until all claims thereon and thereunder shall have been finally settled. All prospective bidders shall have a valid certificate of authority to transact business in Missouri at the time of bid opening as a condition of responsiveness.

- **Delete Sec 108.13.1 and substitute the following:**

108.13.1 The acts, omissions and liabilities of persons or firms affiliated with the contractor or of persons that are principals of the contractor, are those of the contractor, unless the circumstances clearly negate that conclusion. Persons or firms are "affiliates" of each other if, directly or indirectly, either one controls or has the power to control the other or a third person controls or has the power to control both. Examples of control include, but are not limited to: interlocking management or ownership, identity of interests among family members, shared facilities and equipment, common use of employees on projects or a new business entity organized following the determination of ineligibility or non-responsibility of a person or firm which has the same or similar management, ownership or principal employees as the ineligible person. A "principal" will be defined as an officer, director, owner, partner or other natural person within a firm with primary management, supervisory or contracting responsibilities, including participating in, or formulating, bids.

H. Utilities JSP-93-26F

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:

Job No.: J6S3631

Route: 231

County: St. Louis

<u>Utility Name</u>	<u>Known Required Adjustment</u>	<u>Type</u>
Ameren Missouri Jay Bales Telephone: (314) 250-7720 Email: jbales2@ameren.com David Everding Telephone: (314) 992-9726 Email: deverding@ameren.com Steve Couch Telephone: (314) 532-9620 Email: scouch2@ameren.com	Yes	Overhead Electric Transmission and Distribution Lines (See Table 'ATT Pole Relocations' in this JSP)
City of St Louis Water Division Emmett Wood, PE Telephone: (314) 633-9026 Email: ewood@stlwater.com	Yes	Underground and At Grade Water Boxes/Valves Adjusted to Grade (See Table 'Adjust To Grade By Others' on Quantity Sheet 24 to 27 in Plan Set)
Spectrum (aka Charter Communications) Donald Hatfield Telephone: (314) 341-4450 Email: donald.hatfield@charter.com	Yes	Underground and Above Ground Fiber Communication Lines (See Table 'Charter Pole Relocations' in this JSP)
(continued see next sheet)		

<u>Utility Name</u>	<u>Known Required Adjustment</u>	<u>Type</u>
AT&T Distribution Jeremiah Kinealy (area of coordination is Mehlville Area) Telephone: (314) 810-9468 Email: jk036t@att.com Herb Conners (area of coordination is Melrose Area) Telephone: (314) 250-7971 Email: hc1549@att.com Gracey Moon (coordination of relocated utilities) Telephone: (314) 328-8395 Email: gmoon@F-W.com	Yes	Underground and Overhead Communication Lines and Poles (See Table 'ATT Pole Relocations' in this JSP) A representative of AT&T shall be notified prior to excavation within vicinity of their underground utilities.
City of St. Louis Traffic Division Justin Decarlo Telephone: (314) 768-2863 Email: decarloj@stlouis-mo.gov	No Known Conflicts	Communications
MCI/Verizon Cory Pittman Telephone: (636) 459-1771 Email: cory.pittman@verizon.com Domenic Nicastro Telephone: (636) 459-1600 Email: domenic.nicastro@verizon.com	No Known Conflicts	Underground Fiber Communication Lines Underground Fiber from Franru to Clyde adjacent to planned drainage improvements. Contractor shall adjust drainage as approved by Engineer to avoid fiber conflicts.
(continued see next sheet)		

<u>Utility Name</u>	<u>Known Required Adjustment</u>	<u>Type</u>
Missouri American Water Co Franklin Adams Telephone: (314) 996-2328 (office) (317) 656-9963 (mobile) Email: franklin.adams@amwater.com Mickie Redhage Telephone: (314) 705-7200 Email: mickie.redhage@amwater.com	Yes	Underground Water and At Grade Water Boxes (See Table 'Adjust To Grade By Others' on Quantity Sheet 24 to 27 of 105 in Plan Set)
MoDOT St. Louis District See ITS JSP's "KKKK.Coordination with ITS Staff and Utility Locates" for contact.	Yes	Electric, Fiber & Communications Facilities removed in project and installed see plans.
Phillips 66 Pipeline, LLC Dave Kee Telephone: (314) 960-2122 Email: David.c.kee@p66.com Mike Codd Telephone: (636) 527-8461 Email: Mike.Codd@p66.com	No Known Conflicts	Underground Pipeline
Spire Brian Langenbacher, PE Telephone: (314) 768-7767 Email: Brian.Langenbacher@spireenergy.com Nathan Tenholder Telephone: (314) 575-0975 Email: Nathan.Tenholder@spireenergy.com	Yes	Underground Natural Gas. Adjusting to grade facilities at surface for valves and boxes. (See Table 'Adjust To Grade By Others' on Quantity Sheet 28 to 29 of 105 in Plan Set)
(continued see next sheet)		

<u>Utility Name</u>	<u>Known Required Adjustment</u>	<u>Type</u>
St. Louis County Highway – Traffic Ray Gawlik, PE Telephone: (314) 615-8592 Email: rgawlik@stlouiscountymo.gov	Yes	Traffic Signal Detector Loops (See JSP AAAA. Liquidated Damages Specified Traffic Signal Loops at Route 231 at River City Blvd.)
Metropolitan Sewer District of Saint Louis (MSD) Mark Kuelker, PE Telephone: (314) 335-2064 Email: mkuelker@stlmsd.com	Yes	Sewer Manholes Adjusted to Grade. See JSP II. Metropolitan Sewer District of St. Louis Permit JSP. (Job No. 24MSD-00480) for permit requirements. (For manholes adjusted See Table 'Adjust To Grade' on Quantity Sheet 30 of 105 in Plan Set)

Ameren is in process of completing multiple projects within the corridor. Projects are planned for completion by Ameren by December 2025. Power poles where electric, fiber and communication lines are present are subject for removal at an unknown date.

Ameren Pole Relocations				
Ameren Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
192.1	17+22.85	31.92	Right	Ameren is in the process of relocating pole approximately 4.5' South & 4.5' East
192	17+29.55	27.79	Left	Ameren is in the process of relocating pole approximately 4.28' North & 4.57' West
191	18+82.23	27.45	Left	Ameren is in the process of relocating pole approximately 2.22' North & 6.46' West
190	20+21.39	28.07	Left	Ameren is in the process of relocating pole approximately 3.34' South & 7.94' West
189	21+72.52	29.65	Left	Ameren is in the process of relocating pole approximately 2.48' North & 3.92' West
191.1	18+68.59	31.26	Right	Ameren is in the process of relocating pole approximately 6.99' South & 6.51' East
190.1	20+30.23	31.97	Right	Ameren is in the process of relocating pole approximately 2.21' North & 7.82' East
188	-	-	-	Ameren is in the process of installing a new pole
187	24+14.39	31.04	Left	Ameren is in the process of relocating pole approximately 2.6' North & 1.8' West
186	25+82.56	29.03	Left	Ameren is in the process of relocating pole approximately 1.1' North & 5.2' West

Ameren Pole Relocations (continued)				
Ameren Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
185	27+31.29	28.61	Left	Ameren is in the process of relocating pole approximately 1.4' North & 5.0' West
184	28+33.11	28.13	Left	Ameren is in the process of relocating pole approximately 5.8' North & 4.0' West
183	29+02.70	28.29	Left	Ameren is in the process of relocating pole approximately 1.6' North & 5.8' West
182	30+62.71	31.59	Left	Ameren is in the process of relocating pole approximately 1.5' North & 1.4' West
181.1	-	-	-	Ameren is in the process of installing a new pole
181	32+99.75	27.1	Left	Ameren is in the process of relocating pole approximately 4.5' North & 4.3' West
181.3	31+52.62	31.06	Right	Ameren is in the process of relocating pole approximately 4.4' South & 7.0' East
181.2	32+74.89	31.09	Right	Ameren is in the process of relocating pole approximately 7.6' South & 5.3' East
180	34+26.13	28.34	Left	Ameren is in the process of relocating pole approximately 4' North & 3.5' West
179	35+52.83	28.93	Left	Ameren is in the process of relocating pole approximately 3.6' North & 3' West
180.1	33+72.67	31.12	Right	Ameren is in the process of relocating pole approximately 3' South & 5' East
179.1	35+47.33	30.69	Right	Ameren is in the process of relocating pole approximately 10.5' East
174	40+60.48	44.15	Left	Ameren is in the process of relocating pole approximately 1.4' North & 0.8' West
1	50+68.31	32.29	Right	Ameren is in the process of relocating pole approximately 5' South & 3.5' East
2	51+43.53	33.93	Right	Ameren is in the process of relocating pole approximately 15.5' South & 14.5' West
2.1	54+71.85	32.35	Right	Ameren is in the process of relocating pole approximately Pole South West of Existing Location
3	61+72.96	33.55	Right	Ameren is in the process of relocating pole approximately 14.2' South & 0.3' East
4	70+61.15	33.66	Left	Ameren is in the process of relocating pole approximately 5' North
5	81+31.31	36.9	Left	Ameren is in the process of relocating pole approximately 2.5' North
6	94+84.02	38.32	Right	Ameren is in the process of relocating pole approximately 0.5' North & 1.5' East
8	101+64.44	32.81	Left	Ameren is in the process of relocating pole approximately 12.5' South & 5' West

Ameren Pole Relocations (continued)

Ameren Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
10	103+09.95	30.04	Left	Ameren is in the process of relocating pole approximately 9' North & 1.5' East
11	104+08.50	26.95	Left	Ameren is in the process of relocating pole
12	107+63.83	26.71	Left	Ameren is in the process of relocating pole approximately 19.5' South & 1' West
13	108+44.87	23.66	Left	Ameren is in the process of relocating pole approximately 4.9' North & 0.8' East
15	109+21.98	23.68	Left	Ameren is in the process of relocating pole approximately 2.5' North & 0.25' West
16	110+31.41	23.56	Left	Ameren is in the process of relocating pole approximately 4' North & 0.25' West
93	-	-	-	Ameren is in the process of installing a new pole
92	112+35.94	23.65	Left	Ameren is in the process of relocating pole
91	112+47.94	23.27	Left	Pole anticipated to remain in place
96	112+66.59	24.44	Right	Ameren is in the process of relocating pole approximately 4' East
89	113+25.49	22.37	Right	Ameren is in the process of removing pole
88	113+26.62	23.27	Left	Pole anticipated to remain in place
83	113+84.37	23.47	Left	Pole anticipated to remain in place
84	113+92.86	25.18	Right	Ameren is in the process of relocating pole approximately 4' East
115	114+47.88	25.12	Right	Ameren is in the process of relocating pole approximately 4' East
82	-	-	-	Ameren is in the process of installing a new pole
81	115+09.71	22.85	Left	Pole anticipated to remain in place
80	115+93.32	23.7	Left	Pole anticipated to remain in place
116	-	-	-	Ameren is in the process of installing a new pole
78	117+45.33	23.73	Left	Ameren is in the process of relocating pole approximately 4' South
77	118+68.32	23.46	Left	Pole anticipated to remain in place
76	119+33.14	23.87	Left	Ameren is in the process of relocating pole approximately 5' South
117	116+52.67	23.15	Right	Ameren is in the process of removing pole
118	117+39.20	22.85	Right	Pole anticipated to remain in place
119	118+84.42	24.6	Right	Ameren is in the process of relocating pole approximately 7' North & 11.3' East
120	119+92.69	24.65	Right	Ameren is in the process of relocating pole approximately 4' East
75	120+55.47	23.12	Left	Pole anticipated to remain in place
74	-	-	-	Ameren is in the process of installing a new pole

Ameren Pole Relocations (continued)				
Ameren Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
73	121+85.34	23	Left	Ameren is in the process of relocating pole approximately 3' South
72	122+74.04	23.19	Left	Pole anticipated to remain in place
71	-	-	-	Ameren is in the process of installing a new pole
70	124+27.76	23.40	Left	Pole anticipated to remain in place
121	121+11.50	24.56	Right	Ameren is in the process of relocating pole approximately 4' East
122	122+28.99	24.31	Right	Ameren is in the process of relocating pole approximately 4' East
123	124+62.71	26.96	Right	Ameren is in the process of relocating pole approximately 4' East
69	-	-	-	Ameren is in the process of installing a new pole
68	125+67.88	23.3	Left	Pole anticipated to remain in place
63	128+69.10	24.88	Left	Pole anticipated to remain in place
126	126+48.66	23.62	Right	Ameren is in the process of relocating pole
67	126+81.23	23.21	Left	Pole anticipated to remain in place
66	127+24.49	22.93	Left	Pole anticipated to remain in place
65	-	-	-	Ameren is in the process of installing a new pole
127	127+72.03	25.14	Right	Ameren is in the process of relocating pole approximately 8' East
64	-	-	-	Ameren is in the process of installing a new pole
128	128+98.05	24.52	Right	Ameren is in the process of relocating pole approximately 4' East
62	130+13.23	23.28	Left	Pole anticipated to remain in place
61	131+58.95	23.98	Left	Ameren is in the process of relocating pole approximately 5' North
57	134+56.18	22.71	Left	Ameren is in the process of relocating pole approximately 12' North & 1.5' East
129	130+30.98	24.98	Right	Ameren is in the process of relocating pole approximately 1.5' North & 5' East
130	-	-	-	Ameren is in the process of installing a new pole
131	132+13.56	23.39	Right	Ameren is in the process of relocating pole approximately 5-feet East
60	-	-	-	Ameren is in the process of installing a new pole
59	-	-	-	Ameren is in the process of installing a new pole
58	-	-	-	Ameren is in the process of installing a new pole
133	-	-	-	Ameren is in the process of installing a new pole
134	134+03.24	23.74	Right	Ameren is in the process of removing pole
55	135+56.55	22.71	Left	Pole anticipated to remain in place
54	136+31.17	23.5	Left	Pole anticipated to remain in place
53	137+53.54	23.05	Left	Ameren is in the process of relocating pole approximately 7-feet northwest
52	139+15.38	29.93	Left	Pole anticipated to remain in place

Ameren Pole Relocations (continued)				
Ameren Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
51	140+26.60	23.71	Left	Ameren is in the process of relocating pole approximately 3-feet North & 5-feet East
50	-	-	-	Ameren is in the process of installing a new pole
49	141+52.93	24.05	Left	Ameren is in the process of relocating pole approximately 6.1' South & 7.9' West (10' parallel to curb)
47	142+48.39	24.18	Left	Pole anticipated to remain in place
46	134+64.28	23.28	Left	Ameren is in the process of relocating pole approximately 3.6' North & 4.8' East
45	-	-	-	Ameren is in the process of installing a new pole
44	144+62.83	23.17	Left	Pole anticipated to remain in place
43	145+50.57	23.81	Left	Pole anticipated to remain in place
42	146+00.80	23.62	Left	Pole anticipated to remain in place
41	146+49.93	23.69	Left	Pole anticipated to remain in place
40	147+22.45	25.59	Left	Pole anticipated to remain in place
39	148+61.17	23.73	Left	Pole anticipated to remain in place
38	149+93.11	23.48	Left	Pole anticipated to remain in place
136	140+77.45	40.71	Right	Ameren is in the process of relocating pole approximately 4.2' South & 2.8' East
37	151+38.85	22.96	Left	Pole anticipated to remain in place
17	152+38.27	22.88	Left	Ameren is in the process of relocating pole approximately 2.4' South & 3.5' West
18	154+97.77	23.24	Left	Ameren is in the process of relocating pole approximately 1' North & 2' East
19	155+74.10	36.68	Left	Ameren is in the process of relocating pole approximately 1.6' South & 3.8' East
21	156+27.21	23.85	Left	Ameren is in the process of relocating pole approximately 3' South & 10' West
22	157+25.25	24.15	Left	Ameren is in the process of relocating pole approximately 1' North & 4.5' West
23	158+41.98	25.58	Left	Ameren is in the process of relocating pole approximately 5' North & 2' East
24	161+27.61	24.69	Left	Ameren is in the process of relocating pole approximately 11.75' South & 8.75' West
25	161+79.94	24.17	Left	Ameren is in the process of relocating pole approximately 1.5' North & 3.5' West
27	163+28.59	25.11	Left	Ameren is in the process of relocating pole approximately 0.5' South & 5.25' West
28	165+38.27	35.31	Right	Pole anticipated to remain in place

ATT Pole Relocations				
ATT Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
-	21+45.32	31.59	Right	ATT is in the process of relocating pole
-	22+60.80	30.59	Right	ATT is in the process of relocating pole
-	24+07.27	30.26	Right	ATT is in the process of relocating pole
-	25+51.96	29.74	Right	ATT is in the process of relocating pole
-	26+87.96	31.7	Right	ATT is in the process of relocating pole
-	36+62.44	31.44	Right	ATT is in the process of relocating pole
-	115+09.71	22.85	Right	ATT is in the process of relocating pole
-	120+58.74	23.42	Right	ATT is in the process of relocating pole
-	135+41.27	24.58	Right	ATT is in the process of relocating pole
-	136+23.33	22.97	Right	ATT is in the process of relocating pole
-	138+08.10	23.89	Right	ATT is in the process of relocating pole

AT&T Handhole Adjust to Grade and Relocations				
AT&T Asset ID	EXISTING STA	OFFSET	LOCATION	ADJUSTMENT DETAILS
HH1016B	36+63	33	Right	Handhole to be adjusted/relocated in the same vicinity of existing. Scope of work is being determined by AT&T.
HH1016A	39+97	35	Right	Handhole to be adjusted/relocated in the same vicinity of existing. Scope of work is being determined by AT&T.

Spectrum (Charter Communication) Pole Relocations				
Charter Pole ID	EXISTING STA	OFFSET	LOCATION	POWER POLE RELOCATION DETAILS
-	117+71.49	21.02	Right	Charter is in the process of relocating pole
-	125+56.48	27.96	Right	Charter is in the process of relocating pole
-	133+49.35	25.64	Right	Charter is in the process of relocating pole

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: The Contractor shall be aware there are numerous utilities present within the project limits.

2.1 Contractor shall notify all representatives of underground communication facilities prior to construction commencing, below or around the communication line. Representatives of communication facilities shall be present as required by Engineer throughout construction. Construction within the vicinity of underground fiber shall not commence without representation present as designated by Engineer.

I. Pot Holing For Utility Facilities

1.0 Description. The contractor shall field verify that the proposed traffic signal bases, light poles, RRFB's, sign posts and roadway drainage structure locations (inlets, manholes or pipes) will not need to be shifted to avoid utilities prior to ordering any necessary RRFB's, sign posts, drainage structures, light poles, or signal equipment. The contractor shall be proactive in the discovery of potential utility conflicts. The contractor shall submit One Call tickets where existing utilities are located in close proximity to proposed improvements and coordinate with the utility company and the engineer to determine if a conflict will be encountered due to the work proposed in the contract. If a conflict is anticipated, the contractor shall perform test holes to field verify whether conflicts exist with proposed roadway improvement locations.

If utility facilities are discovered the contractor shall contact MoDOT St. Louis District Utilities Coordinator Steven Belcher at (314) 453-5040. The engineer will determine whether relocation of the utility is necessary to accommodate construction or if the work can be installed in accordance with Missouri Standard Plans for Highway Construction for the item of work specified. The contractor shall coordinate construction activities with the utilities and take measures to ensure the integrity of the existing facilities are not disturbed during construction.

The Contractor shall field verify that the proposed traffic signal base locations will not need to be shifted to avoid utilities prior to ordering the traffic signal equipment. The Contractor shall be proactive in the discovery of potential utility conflicts. The Contractor shall submit One Call tickets where existing utilities are located in close proximity to proposed signal base locations and coordinate with the utility company and the Engineer to determine if a conflict will be encountered due to the work proposed in the contract. If a conflict is anticipated, the Contractor shall perform test holes to field verify no conflicts exist with proposed traffic signal base locations.

If a conflict is determined, the Contractor shall shift the signal base location, as approved by the Engineer. The Contractor shall coordinate construction activities with the utilities and take measures to ensure the integrity of the existing facilities are not disturbed during construction.

The contractor will be compensated for the additional mast arm length if required. The Contractor shall not order materials until measurements are field verified.

The contractor shall not order materials until measurements are field verified.

2.0 Basis of Payment.

2.1 All labor, equipment, materials, and restoration necessary to pothole buried utilities at proposed signal bases, light poles and drainage structure (inlets, manholes or pipes) locations shall be paid for under:

	Pay Item Number	Unit
902-99.02	Pot Holing For Utility Facilities	Each

J. Concrete Adjacent to Ameren Composite Poles

1.0 Description. There are Ameren composite poles located in the project limits that will be located adjacent to proposed sidewalk. Ameren requires 1" of separation between the new sidewalk and composite poles. Ameren is requiring the Contractor to double up ½ mastic (flex board) around each composite pole prior to pouring the concrete sidewalk adjacent to the composite poles.

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

K. 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 and minimize delays and the inconvenience it causes 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. To provide this, the contractor shall work on only one side of Route 231 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-foot 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 231 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 \$500.00 per day for a delay that closes a walkway for more than 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.

L. Liquidated Damages Specified – Lane Shift and Bidirectional Lane Closure JSP-93-28A

1.0 Description. Per JSP C – Work Zone Traffic Management, the contractor will be allowed to shift Route 231 westbound traffic by closing the bidirectional lane in the specified station range shown below and reducing the typical section to two through lanes in each direction. This is to allow the contractor to construct one hundred and eighty five (185) narrow private entrances in a short timeframe on both sides of Route 231 within the specified station range listed below in this provision. The completed driveway work shall include all the necessary removal work, curb and gutter work, sidewalk work, drainage work, and miscellaneous roadside work inside the specified station range on both sides of Route 231. If the work described in the preceding sentence is not completed within twenty-one (21) consecutive calendar days of the traffic control lane shift and bidirectional lane closure commencing, the Commission, the traveling public, and state and local police and governmental authorities will be damaged in various ways, including but not limited to potential liability, traffic and traffic flow regulation cost, traffic congestion and motorist delay, with its resulting cost to the traveling public.

1.1 For clarification purposes, the locations on this project where the one hundred and eighty five (185) narrow private entrances are located are:

Route 231 from Sta. 14+44 to Sta. 166+28

The contractor will be allowed to close multiple narrow private entrances at a time. Once any of the one hundred and eighty five (185) narrow private entrances are closed, the closure timeframe and parking accommodations provided within JSP – Access to Commercial and Private Entrances must also be followed.

1.2 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 day for each day, or partial day thereof, that the lane shift and bidirectional lane closure is in place and all lanes are not open to traffic in excess of the limitation as specified elsewhere in this special provision. It shall be the responsibility of the Engineer to determine the quantity of excess closure time.

1.3 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.

M. 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).

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 requires 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.

N. 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 contractor's operation. Temporary striped areas shall be re-striped 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.

O. 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 Temporary Construction Easement or Permanent Easement on any of these parcels until the Right of Way 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.

Parcel 2, anticipated possession by May 31, 2026
Parcel 3, anticipated possession by May 31, 2026
Parcel 9, anticipated possession by January 5, 2026
Parcel 11, anticipated possession by January 5, 2026
Parcel 12, anticipated possession by May 31, 2026
Parcel 13, anticipated possession by May 31, 2026
Parcel 20, anticipated possession by May 31, 2026
Parcel 21, anticipated possession by May 31, 2026

Parcel 22, anticipated possession by May 31, 2026
Parcel 23, anticipated possession by January 5, 2026
Parcel 24, anticipated possession by January 5, 2026
Parcel 29, anticipated possession by May 31, 2026
Parcel 30, anticipated possession by January 5, 2026
Parcel 32, anticipated possession by May 31, 2026
Parcel 35, anticipated possession by January 5, 2026
Parcel 36, anticipated possession by January 5, 2026
Parcel 38, anticipated possession by January 5, 2026
Parcel 39, anticipated possession by January 5, 2026
Parcel 41, anticipated possession by January 5, 2026
Parcel 42, anticipated possession by January 5, 2026
Parcel 44, anticipated possession by May 31, 2026
Parcel 46, anticipated possession by May 31, 2026
Parcel 47, anticipated possession by May 31, 2026
Parcel 49, anticipated possession by May 31, 2026
Parcel 50, anticipated possession by May 31, 2026
Parcel 53, anticipated possession by May 31, 2026
Parcel 57, anticipated possession by January 5, 2026
Parcel 60, anticipated possession by May 31, 2026
Parcel 65, anticipated possession by January 5, 2026

4.0 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.

P. Property Owner Notification

1.0 Description. It shall be the contractor's responsibility to inform and notify the adjacent property owner at least one week 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, unless specified more specifically in the Property Owner Agreements provision. The 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.

Q. 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, commercial or private, 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

2.1 Commercial Entrances and Private/Residential Entrances over 20 Feet Wide. The contractor shall always provide ingress and egress for each property owner along the project either by constructing the new approach half at a time or by providing temporary access as approved by the engineer.

2.1.1 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. However, in the case of a property having one approach used exclusively as an entrance and another approach used exclusively as an exit, the approaches shall be built one half at a time to provide for safe traffic movement into and out of the properties.

2.1.2 On commercial entrances less than 20 feet 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 the completion of the entrance.

2.2 Private/Residential Entrances less than 20 Feet Wide. The contractor may completely close a residential entrance to remove and replace. The contractor shall work diligently and continuously to complete this work. The contractor shall have a maximum of seventy-two (72) consecutive hours to remove and replace each residential driveway unless otherwise approved by the engineer and property owner. This may require the use of concrete strength accelerators.

2.2.1 The contractor shall provide temporary parking area for the residents during the closure. This may include staging the parking lane construction so that residents are able to use during entrance construction.

2.3.1 Completion Time (Greater than 20-Foot Wide Residential or Commercial Entrances). The contractor shall complete the entrances as quickly as possible and shall take no longer than 28 consecutive calendar days to complete any one entrance over 20 feet wide once the entrance is disturbed and the improvement process begins.

2.3.2 Completion Time (Less than 20-Foot Wide Residential or Commercial Entrances). The contractor shall take no longer than 72 consecutive hours to complete any one narrow residential or commercial entrance with a width less than 20 feet once the narrow entrance is disturbed and the improvement process begins.

2.4 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.

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

R. Coordination with MoDOT Project No. J6S3632 and their Contractor

1.0 Description. MoDOT may have an active construction project on Route 231 that intersects with the Route 231 (Telegraph Road) project limits. This project shall be under construction at the same time as this project.

2.0 Requirements. If necessary, the J6S3632 contractor shall coordinate with MoDOT and the J6S3631 contractor at least 14 days in advance of foreseeing any overlap in temporary traffic control and/or active construction staging.

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

S. City of St. Louis Coordination

1.0 Description. The city of St. Louis are including bus stop improvements in their city limits along the corridor.

2.0 Contact Requirements. The J6S3631 contractor shall coordinate with MoDOT and the commissioner of streets at least 14 days in advance of any work on bus stop pads and bus stop locations to assist in allowing the two city's improvements to take place. The City contact is:

City of St. Louis Street Department
1900 Hampton Ave
Saint Louis, MO 631039
Telephone Number: (314) 768-2806

Kent Flake
Commissioner of Streets
Email: flakek@stlouis-mo.gov

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

T. School Bus Service

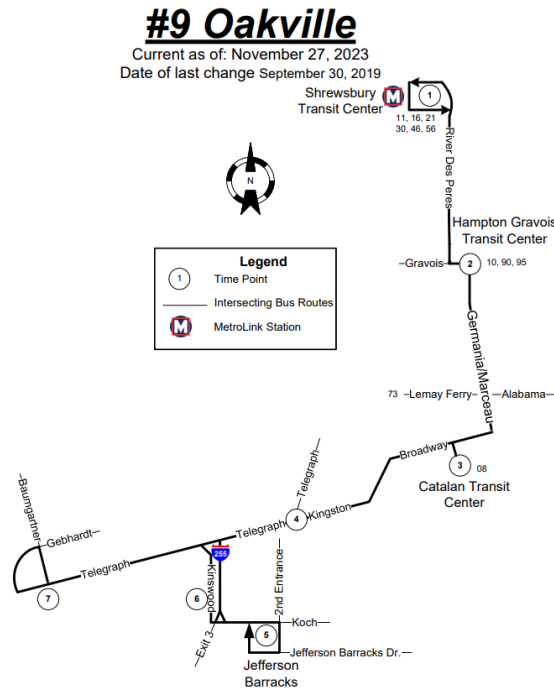
1.0 The contractor shall be aware Hancock Place School District operates several different routes along various portions of Route 231 with bus stops located along the entire corridor. The contractor shall always maintain pedestrian access to each bus stop, unless approved by the Engineer and the school district. All active bus stop signs shall always remain visible 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 the school districts two weeks prior to beginning work so temporary bus stop locations can be identified.

Hancock Place School District
Dr. Kevin Carl – Superintendent
Office: 314-544-1300, Ex 11040
Email: kcarl@hpsd.school

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

U. Coordination with Metro Transit

1.0 Description. The contractor shall contact Metro Transit prior to do any work at any bus stop on the project. The project has Bus Route #9, Oakville using Route 231, see system map below. 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: rhthomas@metrostlouis.org

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

Mr. Lance Peterson, Director of Service Planning
 Office: (314) 982-1520

Cell: (314) 220-6756
Email: llpeterson@MetroStLouis.org

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

V. Parked Vehicles During Construction

1.0 Description. Along certain portions of the project, on-street parking may be allowed if the Engineer allows for staging purposes. In addition to the potential for on-street parking during construction, 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.

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

1.1 The Contractor shall be responsible for the damage or destruction of the parked cars of any character resulting from neglect, misconduct, or omission in his/her manner or method of execution or nonexecution of the work, or caused by defective work or the use of unsatisfactory materials or equipment, and such responsibility shall not be released until the work has been completed and accepted and the requirements of the Specifications complied with.

1.2 Whenever parked vehicles are so damaged or destroyed, the Contractor shall, at no additional cost to the Commission, restore such vehicle to a condition equal to that existing before such damage or injury was done by repairing, rebuilding, or replacing it as may be directed, or the Contractor shall otherwise make good such damage or destruction in an acceptable manner. If the Contractor fails to do so, the Engineer may, after the expiration of a period of 48 hours after giving the Contractor notice in writing, proceed to repair, rebuild, or otherwise restore such vehicle as may be deemed necessary, and the cost thereof will be deducted from any compensation due, or which may become due, the Contractor under this or any other contract between the Commission and the Contractor.

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.

W. 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.

2.3 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.

X. 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), 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.

Superpave Nomenclature	
SP	Superpave
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.

Design Traffic (ESALs)	Design
< 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:

Shingle Aggregate Gradation	
Sieve Size	Percent Passing by Weight
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.

Percent Passing by Weight							
Sieve Size	SP250	SP190	SP125	SP095	SP048	SP125xSM(R)	SP095xSM(R)
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 $\leq$ 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

^a 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_{be} 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_{be}) shall be between 0.8 and 1.6. For SP048, the ratio of minus No. 200 material to effective asphalt binder (P_{be}) 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_{MIX} of SMA mixtures shall be less than or equal to the VCA_{DRC} 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_{CA}	=	bulk specific gravity of the combined coarse aggregate (AASHTO T 85),
Y_s	=	unit weight of coarse aggregate in the dry-rodded condition (DRC) (lb/ft ³) (AASHTO T 19),
Y_w	=	unit weight of water (62.34 lb/ft ³),
P_{bp}	=	percent aggregate by total mixture weight retained on No. 4 sieve and
PA_{bp}	=	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 ± 0.5 percent or 6.0 ± 0.5 percent for SMA mixtures.

403.4.11.1 Cracking Tolerance Index (CT_{Index}) Testing. The CT_{Index} testing shall be completed in accordance with ASTM D8225 and at a test temperature of 25 ± 0.5 C.

Mix Type	Minimum CT_{Index}	$CT_{Index, (Long-Term Aged)^*}$
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_{Index}) Testing. The RT_{Index} testing shall be completed in accordance with ASTM D8360 and at a test temperature of 50 ± 1 C.

PG Grade High Temperature*	Minimum RT _{Index}
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 ± 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:

PG Grade High Temperature*	Minimum $RT_{Index}^{(a)}$
58-28H / 64-22	50
64-22H / 70-22	65
64-22V / 76-22	80

*Determined by the binder grade specified in the contract.

^(a)Mixtures not meeting the minimum RT_{Index} shall be tested by the Hamburg Wheel Track Test and meet a minimum of $\frac{1}{2}$ " 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 – $1.16 \pm .02^\circ$ internal angle	12 ^a
Gyratory Compactor - T 312	Verify	1 ^c
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 ^b
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 ^b
Timers	Check Accuracy	12

^aCalibrate and/or verify after each move.

^bVerify after each move.

^cIncludes 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_t) 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
Pay Factors			
Mat Density (% of theoretical maximum density) ^(a)	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 _a , N _{des}	AASHTO T 312 and R 35	1 / Sublot	1 / Lot
CT _{Index}	ASTM D 8225	1 / 3000 tons	1 / 12000 tons
Pay Factor Adjustments			
Unconfined Longitudinal Joint Density ^(a)	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 _{Index}	ASTM D 8360	1 / 3000 tons	1 / 12000 tons
Tensile Strength and TSR	AASHTO T 283	1 / 12000 tons (maximum)	1 / Project
Other Testing			
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)
Required Fabrication for CT_{Index} and RT_{Index} QC Frequency: 1 Set per 3000 tons QA Frequency 1 Set per 12000 tons		
Cracking Tolerance Index (CT_{Index})	5 Compacted Specimens	62 (± 1 mm) ^(b)
Rutting Tolerance Index (RT_{Index})	3 Compacted Specimens	62 (± 1 mm) ^(b)
Retained Loose Mix ^(a) (QA sample only)	125 lbs	N/A

Required Fabrication for Volumetrics and % Asphalt Content QC Frequency: 1 Set per sublot QA Frequency 1 Set per Lot		
% 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 ^(c)	30 lbs	N/A
Required Sampling for TSR QC Frequency: 1 Sample per 12,000 tons QA Frequency: 1 Sample per Project		
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 ± 0.5 percent or 6.0 ± 0.5 percent for SMA mixtures. The compacted test specimens shall be allowed to cool to 77 ± 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: $\bar{x}_a = (\sum x_j)/n$

Where: $\bar{x}_a$ = 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: $s = (\sum (x_i - \bar{x}_a)^2 / (n - 1))^{1/2}$

The Upper Quality Index is: $Q_u = (USL - \bar{x}_a)/s$

The Lower Quality Index is: $Q_l = (\bar{x}_a - LSL)/s$

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 ± 0.5 percent, asphalt content within ± 0.2 percent, and density within ± 1.3 percent. QA CT_{Index} results shall be within ± 30 of the QC testing that falls nearest result for SuperPave and ± 60 for SMA. For the CT_{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_{Index} results shall be within ± 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:

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

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:

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

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_{Index} 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_{Index} results for the tonnage according to the following table provided that acceptable RT_{Index} or Hamburg and TSR results are obtained. The lower adjusted contract unit price from the CT_{Index} and TSR results shall apply.

SuperPave Mixtures		
Cracking Tolerance Index (CT_{Index})	Tensile Strength Ratio (TSR) ^(a)	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_{Index})	Tensile Strength Ratio (TSR) ^(a)	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_T 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_{Index} less than 40 shall be considered unacceptable material. For SMA mixtures, any material with a CT_{Index} 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_{Index} 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_{Total} shall apply. Adjustments due to joint density will apply to the subplot from which the cores are obtained.

Longitudinal Joint Density	
Field Density (Percent of Laboratory Max. Theoretical Specific Gravity)	Percent of Contract Unit Price
SuperPave Mixtures	
≥ 90.5	PF_{Total} not changed by longitudinal joint density
89.5 – 90.4	Maximum $PF_{Total} = 100\%$; Correction Required ^(a)
< 89.5	Remove and Replace

SMA Mixtures	
≥ 92.0	PF _{Total} not changed by longitudinal joint density
90.0 – 91.9	Maximum PF _{Total} = 100%; Correction Required ^(a)
< 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)
For all SP mixtures other than SMA:	
92.5 to 98.0 inclusive	100
90.5 to 92.4 inclusive	Correction ^(a)
Above 98.0 or Below 90.5	Remove and Replace
For SMA mixtures:	
>94.0	100
92.0 to 93.9 inclusive	Correction ^(a)
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 1st and 15th 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
$DRS \leq 25.0^{\circ}F$	Low
$25^{\circ}F < DRS \leq 35^{\circ}F$	Moderate
$35^{\circ}F < DRS \leq 50^{\circ}F$	Moderate-High
$DRS \geq 50^{\circ}F$	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.

Y. Polymer Modified Emulsion Tack

1.0 Description. This work shall consist of preparing and treating an existing bituminous or concrete surface with a low-tracking or non-tracking tack coat material prior to an asphalt overlay in accordance with Section 407, except as revised by this specification.

2.0 Material. The tack coat shall be a hard penetration asphalt emulsion (SS-1vh) with the material properties in accordance with Sec 1015.20.5.4.

3.0 Method of Measurement. Measurement of asphalt emulsion to the nearest gallon shall be made as specified in Sec 1015. The measurement of asphalt emulsion shall be based upon undiluted material.

4.0 Basis of Payment. The accepted quantity of low-tracking or non-tracking tack coat or polymer modified emulsion tack will be made at the contract unit price for:

Item Number	Description	Unit
407-99.12	Misc. Tack Coat – Low-Tracking or Non-Tracking	Gallon

Z. 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 subgrade for shoulder, pavement widening, sidewalk, paved approaches, curb and gutter, roadside retaining wall, or other roadside appurtenances by excavating, compacting, fin-grading, and shaping existing shoulder and ditch for-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, paved approaches, roadside retaining wall, guardrail or other roadside appurtenances 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 Linear Grading Class 2, Modified. 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

AA. Guardrail Requirements

1.0 Safety Devices. Before any guardrail or crashworthy end terminals including crash cushions are installed, the contractor shall layout the proposed alignment in the field to insure 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. The contractor is advised that 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, it is suggested that the field inspection meeting mentioned above 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 Curb Beneath Crashworthy End Terminals. Curb beneath or within the vicinity of crashworthy end terminals shall have a maximum height of 2 inches. If curb needs to be replaced due to this height requirement, the

contractor shall remove the existing curb and install 2-inch curb for a length of 60 linear feet in front of **and** through the length of the end terminal, unless site conditions dictate less curb as approved by the Engineer.

3.0 Guardrail Posts Next to Obstacles. The contractor will have the option to skip 1 guardrail post next to an obstacle instead of installing a long span guardrail section shown within the Standard Plans. An additional post on either side of the skipped location shall be used.

4.0 Removal of Existing Guardrail – In Paved Areas. The contractor shall place either cold mix asphalt or hot pour in locations where guardrail or bridge anchor section posts have been removed and leave holes or voids within asphalt or concrete shoulders or concrete drain basins. The coldmix asphalt or hot pour shall cap any cavities as to prevent water from undermining the shoulder or slope. The cap shall consist of a minimum of 2 inches. The space below this 2-inch cap may be filled with rock, dirt, sand, or other material as approved by the engineer. No direct payment shall be made to fill any cavities described above.

5.0 Removal of Existing Guardrail - In Soil. The contractor shall fill any holes or voids with either rock or dirt after removal of existing guardrail or bridge anchor section posts. No direct payment shall be made to fill any cavities described here within.

BB. 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.

CC. ADA Material Testing Frequency Modifications JSP-23-01

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 Quality Control (QC) testing frequency for the Sections identified below are to be revised as specified.

2.0 Compaction Test on Base Rock Under Sidewalk, Curb Ramps and Paved Approaches.
(Revises ITP Sec 304.3.4) The required test frequency will 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 will be one per 500 tons.

4.0 Concrete Plant Checklists. (Revises ITP Sec 501) Submittal of the 501 Concrete Plant Checklist will 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, and Curb. (Revises ITP Sec 608) The required frequency will be the first truckload for the project and each 100 CUYDs for air and slump thereafter. Strength will be verified by use of cylinders or maturity meters at a minimum rate of one per 100 CUYD.

6.0 Paved Approaches. (ITP Sec 608) The required testing of one test from the first truckload per day and each 100 CUYDs for air and slump will remain per ITP. Strength will be verified by use of cylinders or maturity meters at a minimum rate of one per 100 CUYD.

7.0 Curb Concrete. (Revises ITP Sec 609) The required frequency will be the same as Sec 5.0 above.

8.0 Basis of Payment. No direct payment will be made to the contractor to fulfill the above requirements.

DD. Median Island Cut-Throughs – St. Louis District Version 10-18-23

1.0 Description. This work shall consist of providing a median or median island cut-through that is compliant with current Americans with Disabilities Act (ADA) and MoDOT guidelines at locations shown on the plans and as directed by the Engineer.

2.0 Construction Requirements. The contractor shall be responsible for removing the existing median and if necessary, the existing pavement and base prior to installing the new cut-through as shown in the plans and as per Section 608 in both the Standard Plans and Standard Specifications. If new pavement/sidewalk is to be installed, it shall be minimum 7" Concrete Sidewalk on a 4" Type 5 Aggregate Base with new median island doweled into this new sidewalk. Truncated domes installed within the island or median cut-throughs shall be placed flush with the face of the curb/island.

2.1 ADA Ramps. If there is an actual ramp 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, and not per quantities noted below.

2.2 Cross Slope through Cut-Throughs. The contractor shall meet ADA requirements regarding cross slope through the cut-through.

3.0 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 for each item listed in the Basis of Payment.

4.0 Basis of Payment. Payment for furnishing and installing a new median or median island cut-through shall include all excavation, base compaction, saw cuts, removal of existing pavement and median island, new sidewalk and base, new median island, new truncated domes, 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.

Pay Item Number	Description	Unit
202-20.10	Removal of Improvements	Lump Sum
304-05.04	Type 5 Aggregate for Base (4 In. Thick)	S.Y.
608-60.04	Concrete Sidewalk, 4 In.	S.Y.
608-30.06	6" Concrete Median Strip	S.Y.
608-10.12	Truncated Domes	S.F.

EE. 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, 10 feet beyond the landing is considered part of the ADA ramp. Payment for the ramp will be 10 feet beyond the landing and no adjustment in sidewalk length/quantity will be made if this 10-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	Description	Unit
608-10.12	Truncated Domes	S.F.
608-99.02	Misc Concrete Curb Ramp	Each

FF. Paved Approach and Paved Approach, High Early Strength

1.0 Description. This work shall consist of providing a concrete mix design with 24-48 Hour high early strength to be placed as specified in the contract documents or as directed by the Engineer. The high early strength properties shall be in accordance with this provision.

1.1 This job special provision shall also apply to areas Paved Approach, 7-Inch and Paved Approach, 8-Inch is used on the project.

1.2 This work shall include placing concrete lips and mountable curbs between the roadway pavement and the driveway approaches as indicated in the plans. When high early strength concrete is used for the approach it shall be used for the lips and mountable curbs. The lips and mountable curbs are used to establish the ADA pedestrian access routes across the driveways as indicated in the profiles in the project plans.

2.0 Materials. All material, proportioning, air-entraining, mixing and transporting of concrete shall be in accordance with Sec 501 as applicable to pavement concrete, except as noted herein.

2.1 High Early Cement Requirements. The cement shall meet the requirements of ASTM C1600 for Type VRH or Type URH. Other cement types are not allowed.

2.2 High Early Cement Admixtures. The use of chemical admixtures is allowed and shall be in accordance with AASHTO M 194. Chloride accelerators are not allowed.

2.3 High Early Mix Requirements. The concrete mix design shall meet a minimum compressive strength of 3000 psi within 4-hours; while maintaining initial workability to effectively place the concrete and meet the requirements of this specification.

The concrete mix design shall not exceed 700 lb/yd³ of cement.

The concrete mix design shall not exceed 0.04% shrinkage at 28 days in accordance with ASTM C 157 with the following modifications:

1. The demold time shall be determined by ASTM C 403 Final Set plus 25% of that time.
2. Initial measurement shall be taken immediately after demolding.
3. The shrinkage specimens shall be air cured until 28 days.

2.4 High Early Certification. In addition to the mix design information required in Sec 501.3; the contractor shall submit ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing test results from an independent laboratory with a concrete mixture containing similar cement type and amount in comparison to the approved mix design. For acceptance, the concrete mixture tested, shall meet a minimum durability factor of 80 percent.

3.0 Construction. All construction requirements shall be in accordance with Sec 502 except as follows:

3.1 General Inspection. All materials shall be subject to inspection and sampling by MoDOT at the source of manufacture, intermediate shipping terminal or destination. MoDOT will be allowed free access to all facilities and records as required for inspection and sampling.

3.2 Trial Mix Requirement. The contractor shall construct a test pad (used during maturity testing) or a small pavement repair location using the approved mix design prior to production. The test pad or repair area will be evaluated and will be subject for approval from the engineer before any further production.

3.3 Mix Design Representative. During construction and concrete placement, the cement manufacturer's representative shall be present on the project to provide technical expertise.

3.4 Compressive Strength Requirements. The concrete opening strength to all traffic shall be a minimum compressive strength of 3000 psi. Light construction traffic is allowed when the concrete achieves a minimum compressive strength of 2000 psi. The opening strength shall be verified by the maturity method in accordance with Sec 507, except the strength-maturity relationship shall be developed using 2-hour, 4-hour, 6-hour, 1-day, 7-day, and 28-day time intervals.

3.5 Curing. After concrete placement and after surface irregularities have been removed, the concrete surface shall be given a uniform roughened finished by a broom, wet burlap drag, or other methods approved by the engineer for a temporary surface texture. Immediately after texturing, the concrete shall have a wet burlap cure until the concrete has achieved a minimum compressive strength of 2000 psi. When the wet burlap is removed, the concrete shall have a white pigmented membrane applied in accordance with Sec 502.

3.6 Testing. The concrete mixture shall be within the specified limits for compressive strength, pavement thickness, and air content. The QC and QA test frequencies shall follow Sec 613.10.

4.0 Payment. The contract unit price shall be considered as full compensation for all the labor, equipment, materials, and other construction involved to complete the work. The following is the Pay Item Number:

Pay Item Number	Description	Unit
608-99.05	Misc Paved Approach, 7 In., High Early Strength	Square Yards
608-99.05	Misc Paved Approach, 8 In., High Early Strength	Square Yards
608-50.07	Paved Approach, 7 In.	Square Yards
606-50.08	Paved Approach, 8 In.	Square Yards

GG. 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 and fire hydrants. 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 and fire hydrant 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.

HH. 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.

II. Metropolitan Sewer District of St. Louis Permit (Job No. 24MSD-00480)

1.0 Description. Metropolitan St. Louis Sewer District (MSD) issued permit 24MSD-00480 for improvements associated with project J6S3631. A copy of the approved plans and permit requirements are available for download at <https://aca3.accela.com/STLMSD/>.

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

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 documents.

JJ. Metropolitan Sewer District of St. Louis As-Built Submittals (Job No. 24MSD-00480)

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 Job No. 24MSD-00480 (Pending) and subsequent revisions after all drainage structures related to the project have been constructed or adjusted.

2.0 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.

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

2.2 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.

KK. Remove and Replace Top of Inlet with Manhole

1.0 Description. This work shall consist of converting an existing inlet to a manhole at the locations shown in the plans.

2.0 Material. Material shall be as specified in Sec. 604.10.2.

3.0 Construction Requirements. Work to convert existing inlets to manholes shall be done in accordance with Sec 604.10.3 and as specified herein.

3.1 Contractor shall remove approximately 2.5 feet of the existing inlet, including the existing inlet stone, sill and adjustment rings. Contractor shall rebuild the structure to grade as a manhole in accordance with MoDOT standard details and specifications.

3.2 New manhole steps, adjusting rings and new manhole frames and covers (Type 1-A) shall be provided as necessary.

4.0 Method of Measurement. Measurement of converting inlet to manhole will be made per each.

5.0 Basis of Payment. The accepted quantity of converting inlet to manhole, complete in place, will be paid for at the contract unit price:

Pay Item Number	Description	Unit
206-30.00	Class 3 Excavation	Cubic Yard
614-30.11	Manhole Frame and Cover, Type 1B	Each
726-99.24	Sewer (Granular Backfill)	Cubic Yard
731-00.60	Precast Concrete Manhole 60 In	Linear Feet

5.1 No direct payment will be made for reinforcement, removals, steps, adjusting rings, backfilling or other incidental items required to complete the work.

LL. Convert Grate Inlet to Curb Inlet

1.0 Description. This work shall consist of converting an existing grate inlet to a curb inlet at the locations shown in the plans.

2.0 Material. Material shall be as specified in Sec. 604.10.2.

3.0 Construction Requirements. Work to convert existing grate inlets to curb inlets shall be done in accordance with Sec 604.10.3 and as specified herein.

3.1 Contractor shall remove approximately 3.0 feet of the existing inlet, including the existing grate and bearing plate, frame and adjustment rings. Contractor shall rebuild the structure to grade as a curb inlet in accordance with MoDOT standard details and specifications.

4.0 Method of Measurement. Measurement of converting grate inlet to curb inlet will be made per each. Excavation completed for this work to be measured per cubic yard and backfill shall be granular measured to the cubic yard.

5.0 Basis of Payment. The accepted quantity of converting grate inlet to curb inlet, complete in place, will be paid for at the contract unit price:

Pay Item Number	Description	Unit
206-30.00	Class 3 Excavation	Cubic Yard

614-30.20	Curb Inlet	Each
726-99.24	Sewer (Granular Backfill)	Cubic Yard

5.1 No direct payment will be made for reinforcement, removals, steps, adjusting rings, frame and covers, backfilling or other incidental items required to complete the work.

MM. Special Drainage Structures

1.0 Description. This work covers the furnishing and installation of special drainage structures as shown in the plans and details.

2.0 Construction Requirements. Construction shall be in accordance with the Missouri Department of Transportation Standard Specifications and Plans, latest edition.

3.0 Method of Measurement.

3.1 Measurement of Special Inlet No. 1 shall be the depth for payment, as per the Special Sheets and as shown in the Culvert Section Plan Sheets. Contractor shall adjust the height of the walls as directed by Engineer to meet the lines and grades of the sidewalks, curbs and other items in the vicinity of the special structures to provide an ADA compliant pedestrian access route.

3.2 Excavation and Granular Backfill for Special Inlets is included in this scope of work.

4.0 Basis of Payment. The contract unit price shall be considered as full compensation for all labor, equipment, materials, or other construction involved to complete the work. The following is the Pay Item Numbers for each type of structure listed below:

Pay Item Number	Description	Unit
614-99.02	Misc East Drainage Structure (18'-8" x 6'-6")	Each
614-99.02	Misc West Drainage Structure (22'-6" x 6'-10")	Each

NN. Adjust To Grade Items

1.0 Description. This work shall consist of adjusting water valves, water meters, basins/inlets, and manholes 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. The Contractor shall install a reinforced concrete collar around a manhole frame and cover or utility valve as indicated in the plans and as approved by the Engineer.

2.0 Construction Requirements. Adjusting manholes 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 current MSD Standards and Specifications. 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.

2.2 Concrete used for manhole collars shall be the same used for full depth pavement repairs as specified in Section 613.10 of the Standard Specifications. Contractor shall place a concrete manhole collar around each manhole adjusted to grade on the project. The concrete as per the construction detail in the plans for concrete manhole collar.

2.3 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 collar 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.

2.4 Joint Sealing. Per MoDOT Standard Specification 613.3.3, the contractor shall seal the joint between the asphalt surface and the new concrete collar along with seal any overcut created from the sawcutting operation when removing the portion of pavement to be replaced with manhole collar 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.

3.0 Basis of Payment.

3.1 All costs for materials, equipment, labor and installation shall be included in the cost for adjusting the manholes. All costs for the concrete manhole collar shall be incidental to the Adjust to Grand Manhole.

Pay Item Number	Description	Unit
604-20.10	Adjust to Grade Manhole	Each

3.2 No direct payment will be made for any required hauling, cutting, joining, backfilling, concrete, reinforcing steel or adjusting rings, steel plating, wedging 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.

OO. 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 and maintenance of traffic 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. Temporary Traffic Control

PP. Temporary Striping

1.0 Description. The Contractor shall furnish and install temporary white and/or yellow, longitudinal and/or transverse, pavement markings, and white legend/symbol markings, as shown in the plans, details, specifications and in accordance with Part VI of the Manual on Uniform Traffic Control Devices (latest adopted revision) and shall maintain them for the duration of the project. Temporary pavement markings shall be defined as markings that are required for long-term, stationary temporary traffic control work zones during the construction of the project. Long-term, stationary work is defined as that which occupies a location more than 3 days.

2.0 Materials. The material for temporary pavement markings shall be in accordance with this specification.

2.1 Approved Materials List. All material for temporary pavement markings used by the Contractor shall be from MODOT's PAL list. It is important that users be completely knowledgeable of all application requirements and procedures prior to product application. It is the responsibility of the installer to contact the supplier of all temporary pavement marking materials if questions regarding application procedures or conditions arise.

3.0 Construction Requirements

3.1 Method of Installation. The temporary pavement markings shall be installed true to line according to the plans, details, Manual on Uniform Traffic Control Devices (latest edition) and this specification. Temporary pavement markings shall be installed the same day that the existing pavement markings are damaged, removed or covered up.

3.2 Method of Removal. The method of pavement marking removal shall be by a high-pressure water blast method, a low-pressure water and sand blast method, a steel shot blast method, burning method, peel-off method or a grinding method. Overlaying existing markings with black paint or asphalt shall not be allowed. However, the use of removable, non-reflective, preformed tape is permitted where markings need to be covered temporarily.

All pavement marking materials shall be removed without structurally damaging the pavement or scarring the surface, unless the surface is to be overlaid with the project. Existing pavement markings shall be thoroughly removed as to be unidentifiable as pavement markings under day or night, wet or dry conditions to eliminate confusion with the temporary pavement markings.

All material deposited on the pavement, as a result of the removal operation shall be removed as the work progresses by methods approved by the Engineer.

4.0 Measurement and Payment Lump Sum - The Engineer will measure the temporary pavement marking as indicated on the plans, complete in-place and accepted, including symbols and legends, as a unit lump sum quantity for all work necessary. Payment for "Temporary Pavement Marking" at the contract lump sum price bid is full compensation for all labor, equipment, tools, traffic control, materials, etc to complete the work.

No payment shall be made for "Removal of Existing Pavement Markings" nor for the "Removal of Temporary Pavement Markings". Any work required to remove the existing pavement markings or temporary pavement markings shall be considered subsidiary to the bid item "Temporary Pavement Markings".

All traffic control necessary for installation and removal of the existing pavement markings and temporary markings shall be subsidiary to the bid item "Temporary Pavement Markings".

QQ. Solid White Thermoplastic Pavement Marking, Bike Symbol

1.0 Description. The contractor shall install Preformed Thermoplastic Pavement Marking, Bicycle Symbols at locations indicated on the plans.

2.0 Installation Requirements. The contractor shall install preformed thermoplastic pavement marking, bike symbols. Pavement marking materials proposed for use shall be approved by engineer prior to installation.

2.1 All pavement markings shall be in accordance with the latest edition of the MUTCD and the FHWA Standard Highway Signs.

2.2 Bike symbols shall be placed according to the plans within the proposed bike lanes. The bike symbols shall be have a straight arrow placed in vicinity of each bike symbol. The straight arrow shall be constructed following MoDOT standard drawings.

2.3 Damage to pavement marking as a result of the contractor's operations shall be repaired or replaced at the contractor's expense.

3.0 Method of Measurement The basis of measurement for Preformed Thermoplastic Pavement Marking, Bicycle Symbol's and Preformed Thermoplastic Pavement Marking, Straight Arrow should be measured by each pavement marking placed along the proposed bike trail.

4.0 Basis of Payment. Payment for Preformed Thermoplastic Pavement Marking, Bicycle Symbol and Preformed Thermoplastic Pavement Marking, Straight Arrow should be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
620-00.24	Preformed Thermoplastic Pavement Marking, Straight Arrow	Each
620-00.57	Preformed Thermoplastic Pavement Marking, Bicycle Symbol	Each

RR. Solid White Thermoplastic Pavement Marking, Bicycle Shared Lane Marking

1.0 Description. The contractor shall install Solid White Thermoplastic Pavement Marking, Bicycle Shared Lane Markings at locations indicated on the plans.

2.0 Installation Requirements. The contractor shall install thermoplastic pavement marking, bicycle shared lane markings. Pavement marking materials proposed for use shall be approved by engineer prior to installation.

2.1 All pavement markings shall be in accordance with the latest edition of the MUTCD and the FHWA Standard Highway Signs.

2.2 Bicycle Shared Lane Markings shall be placed according to the plans within the proposed shared lanes.

2.3 Damage to pavement marking as a result of the contractor's operations shall be repaired or replaced at the contractor's expense.

3.0 Method of Measurement The basis of measurement for Solid White Thermoplastic Pavement Marking, Bicycle Shared Lane Markings should be measured by each pavement marking placed along the proposed shared lanes.

4.0 Basis of Payment. Payment for Solid White Thermoplastic Pavement Marking, Bike Symbol's should be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
620-99.02	Misc Solid White Thermoplastic Pavement Marking, Bicycle Shared Lane Marking	Each

SS. Contractor Designed, Furnished and Installed Steel Plates

1.0 Description. The Contractor may elect to utilize steel plating to cover open trenches on Route 231, on crossroads 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 Temporary Traffic Control lump sum pay item**.

TT. 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 constructing retaining walls and bridges, 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, is considered incidental to the drainage and excavation pay items.

UU. 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 1 ½ inch lower lift of 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 that produces a 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.

VV. Reinforcing Fibers for Bituminous Pavement Material NJSP-17-06C

1.0 Description. This work shall consist of adding a high tensile strength synthetic fiber to the bituminous mixture to be placed as specified in the contract documents. The Fiber Reinforced Asphalt Concrete (FRAC) mixture produced shall meet all Sec 403 requirements. The material properties, handling, mixing and placement of the fibers shall be in accordance with this provision.

2.0 Materials.

2.1 Fiber Properties. The reinforcing fibers shall contain aramid fibers and a dispersion aid that meet the following material requirements as detailed in Table 1 below:

Table 1 – Aramid Reinforcing Fibers Material Properties		
Property	Test Method	Criteria
Form	Manufacturer Certification	Aramid Fibers
Length (in)	Manufacturer Certification	0.75
Melting Temperature	Manufacturer Certification	800 F
Nominal Specific Gravity (g/cm ³)	ASTM D276	1.44
Tensile Strength ¹ (psi)	ASTM D7269	400,000

2.2 Performance Testing. A FRAC mixture shall meet the following performance test detailed in Table 2 below. Non-aramid fiber blends will not be considered alternatives to this specification. All performance testing results from previous laboratory trial FRAC mixtures shall be submitted to the engineer along with the job mix formula.

Table 2 – FRAC Mixture Performance Requirements			
Performance Measure	Test Method	Standard	Requirement
Dispersion Efficiency, %	Aramid Dispersion State Ratio (ADSR)	Modified ASTM D2172	≥ 85 %

Cracking Resistance, % increase	Indirect Tensile Strength (IDT)	AASHTO T 322 or ASTM D6931	≥ 20 % increase
Resistance to Permanent Deformation (Rutting)	Flow Number	AASHTO TP 79	≥ 35 % increase
	Hamburg	AASHTO T 324	< 3 mm

Performance testing shall be from previous completed laboratory trials performed on plant mixed FRAC. Testing is not required on samples from the job mix. Performance testing shall be from laboratory trials at a fiber dosage rate equal to the rate proposed for the project. Tests must be performed by an AASHTO accredited testing lab and must be reviewed and approved by the engineer.

Aramid Dispersion State Ratio (ADSR) tests shall be conducted from a minimum of three separate laboratory FRAC trials in accordance with the following:

1. Perform ADSR test in accordance with Modified ASTM D2172 (test method documentation available in the Electronic Deliverables).
2. The average extracted aramid fiber quantity shall equal 0.007 percent by total sample weight with no individual result less than 0.005 percent of the total sample weight.
3. All tested fiber mixes shall achieve a minimum ADSR of 85%.

Indirect Tensile (IDT) Strength Tests shall be conducted from a minimum of three (3) separate laboratory trials in accordance with the following:

1. Perform indirect tensile tests using the protocol from AASHTO T322 or ASTM D6931.
2. Tests results shall include a control and a fiber reinforced mix. FRAC mix shall be identical to control mix except for the inclusion of fibers added at the same dosage as proposed on the project.
3. Indirect tensile test results from fiber specimens shall show an average tensile strength increase of 30 percent over control specimen with no samples having less than 25 percent increase of average tensile strength.

Resistance to Permanent Deformation (Rutting) shall be measured on the FRAC mixture by one of the following test methods: Flow Number Test or Hamburg.

Flow Number (FN) testing shall be performed on a minimum of three (3) separate laboratory trials in accordance with the following:

1. Perform flow number testing in accordance with AASHTO TP79.
2. Test results shall include a control mixture and a FRAC mixture. The FRAC mixture shall be identical to the control mix except for the inclusion of fibers added at the same dosage rate as proposed on the project.
3. Results from the FRAC specimens shall each show an average FN increase of at least 35 percent over the control specimens.

Hamburg testing shall be performed on a minimum of three (3) separate laboratory trials in accordance with the following:

1. Perform Hamburg testing in accordance with AASHTO T324.
2. Test results may include only the FRAC mixture at the same dosage rate as proposed on the project.
3. Results from the FRAC specimens shall show less than 3 mm of rutting.

2.3 Required Information. The contractor shall furnish a manufacturer's certification to the engineer for each lot of material furnished stating the name of the manufacturer, the chemical composition, and certifying that the material supplied is in accordance with this specification.

3.0 Construction.

3.1 Delivery, Storage, and Handling. The fiber-reinforcement material shall be delivered, stored, and handled in accordance with the manufacturer's recommendations and specifically as follows:

1. Deliver fiber-reinforcement in sealed, undamaged containers with labels intact and legible, indicating material name and lot number.
2. Deliver fiber-reinforcement to location where it shall be added to each batch or loaded into the mixer.
3. Store materials covered and off the ground. Keep sand and dust out of boxes and do not allow boxes to become wet.

3.2 Mixing and Production. The system for adding fibers to the mix shall be approved by the fiber manufacturer. The engineer shall be informed in writing that the system being used to add the fibers in the asphalt mixture meets the fiber manufacturer's recommendations.

The fiber reinforcement shall be added at the dosage rate that meets the FRAC Mixture Performance Requirements listed in Table 2 as prescribed by the manufacturer. A fiber manufacturer shall be on site during the mixing and production of FRAC material.

The following construction steps shall be used when producing the FRAC or as required by the manufacturer.

Batch Plant: When a batch plant is used, add fiber to the aggregate in the weigh hopper and increase both dry and wet mixing times. Ensure that the fiber is uniformly distributed before the injection of asphalt cement into the mixture.

Drum Plant: For drum plants, inject fibers through the reclaimed asphalt pavement (RAP) collar using an automatic, metered air blown system to promote rapid and complete fiber dispersion. System must automatically record fiber addition data so as to remove human error. Rate the feeding of fibers with the rate the plant is producing asphalt mix. If there is any evidence of fiber bundles at the discharge chute, increase the mixing time and/or temperature or change the angle of the fiber feeder line to increase dry mixing time.

For small quantity projects less than 2000 tons, manual feeding of the fibers may be allowed in accordance with the manufacturer's recommendations. For projects greater than 2000 tons, manual feeding of the fibers is not allowed.

For blower tube system, add fibers continuously and in a steady uniform manner. Provide automated proportioning devices and control delivery within $\pm 10\%$ of the mass of the fibers required. Perform an equipment calibration to the satisfaction of the fiber manufacturer's representative to show that the fiber is being accurately metered and uniformly distributed into the mix.

Include the following for blower tube system:

1. Low level indicators
2. No-flow indicators
3. A printout of feed rate status in pounds/ minute

4. A section of transparent pipe in the fiber supply line for observing consistency of flow or feed.

3.3 Quality Control. A minimum of 25 pounds FRAC sample shall be collected during the first 50 tons of production. The sample shall be visually inspected to determine the uniform dispersion of the aramid fibers in an individual state (no bundles or agitated bundles). If undistributed bundles exist, the plant shall adjust the mixing operations until the aramid fibers are in an individual state.

3.4 Placement. In addition to the visual inspection the FRAC mix shall be visually observed in the back of first three trucks and every tenth truck thereafter to confirm the adequate blending of the fibers.

4.0 Basis of Payment. Payment for the high tensile strength synthetic fibers shall be paid for at the contract unit price per ton for Item Number 403-01.09 Asphaltic Concrete Mixture PG 76-22 (SP125CLP Mix) With Reinforcing Fibers.

WW. Pavement Marking

1.0 Description. Before beginning striping the contractor shall contact the sign shop at least 24 hours in advance. No additional pay shall be made to comply with this provision. Contact information is provided below.

Michael Love
Signing / Striping Supervisor
Office: (314) 205-7310
Cell: (314) 624-3318

XX. 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 2027, 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, 2026 and March 1, 2027, both dates inclusive, except as stated herein. When the contractor has begun application of PPMP prior to October 1, 2026, 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, 2026, 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, 2027. All PPMP shall be completed prior to June 1, 2027. 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, 2026, even when there is sufficient time to complete the PPMP prior to October 1, 2026. 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
620-99.01	Misc. Temporary Pavement Marking Paint	Lump Sum

YY. 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 Section 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 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	Description	Unit
620-99.02	18 IN. White Island Tubular Marker	Each
620-99.02	18 IN. Yellow Island Tubular Marker	Each

ZZ. Landscaping Restoration

1.0 Description. This work shall consist of restoring existing landscaped areas that are disturbed by construction activities as shown on the plans or as directed by the Engineer.

In “cut” areas, the existing landscape material (decorative rock, mulch, etc.), fabric and vegetation shall be removed within the grading limits and then the existing ground shall be cut to grade. After the existing ground is cut to grade, the existing fabric, vegetation, and landscape material shall be placed back in their original locations as directed by the Engineer.

In “fill” areas, additional “in-kind” landscape material shall be added to the existing landscape material to bring it up to the proposed grade as directed by the Engineer. Existing vegetation may need to be removed and replanted to bring it up to proposed grade as directed by the Engineer.

Any existing landscape material, fabric or vegetation damaged by the Contractor during construction shall be replaced “in-kind” at his/her expense as directed by the Engineer.

2.0 Method of Measurement and Basis of Payment. Landscaping restoration will be measured and paid for at the unit bid price per square yard. Payment will be considered full compensation for all labor, equipment and material to complete the described work. All expense incurred by the contractor in compliance with the above requirements shall be considered as completely covered by unit prices for:

Item Number	Description	Unit
803-99.05A	Misc Landscaping Restoration	Square Yard

AAA. Wood Fence (48 IN.) and Temporary Fence

1.0 Description. The contractor shall install the wooden fences, wood walk gates, and temporary fences at locations indicated on the plans.

2.0 Wooden Fence and Wooden Gate Installation Requirements. The contractor shall install wooden fencing and gates. Fencing and walk gate materials proposed for use shall be approved by engineer prior to installation. Contractor shall provide fence foundations for wooden fence using concrete. Concrete shall be installed for footings 12 inches in diameter at a minimum 36-inch depth. Concrete used for footings shall have a minimum compressive strength of 4,000 psi. All fence posts shall be a minimum of 4-inch by 4-inch using pressure treated lumber. All fences shall be assembled using exterior graded hardware.

2.1 All materials for fencing and walk gates shall be treated wood, or wood of natural resistance to decay, hot-dip galvanized steel, or plastic materials. All wood shall be construction grade 2 or better.

2.2 Fence posts shall consist of one of the following for a five- to 6 1/2-foot fence: four-inch by four-inch wood post.

2.3 Fence posts shall be spaced a maximum of 8-feet on center.

2.4 Four-inch by four-inch wood fences posts shall be set in a minimum twelve-inch diameter concrete pier, extending a minimum of three feet deep.

2.5 Any wooden fence shall have a minimum of three two-inch by four-inch rails.

2.6 Vertical wooden fence boards or pickets shall be a minimum of one inch in thickness and all pickets shall be spaced such that a sphere three inches in diameter cannot pass through.

2.7 All walk gates shall have a minimum of three two-inch by four-inch top and bottom rail with matching vertical member to form a "Z" pattern.

2.8 All walk gates shall have positive stops to prevent the gates from swinging into the right of way.

3.0 Temporary Fence Installation Requirements. The contractor shall install temporary fencing. Fencing materials proposed for use shall be approved by engineer prior to installation.

3.1 Contractor shall provide footings that are anchored using plates and sandbags or other equivalent material. No penetrations into earth to be permitted.

3.2 Temporary fence shall have a maximum gap of 3-inches around the perimeter of the area fenced that does not allow a 3-inch sphere to pass. This maximum gap requirement includes the connection between existing fence and temporary fence.

3.3 Temporary fence height shall match or be higher than the existing fence height at the location installed.

4.0 Acceptance Testing. The wooden and temporary fencing shall be constructed within 1-inch of the finished grade ground

line.

5.0 Basis of Payment. Measurement and payment for Wood Fence (48 IN.) includes the removal of the old fence and providing connections for any existing fence to remain in place. Payment will be made as follows:

Item Number	Description	Unit
607-99.03	Misc. Wood Fence (48 IN.)	Linear Foot
607-99.03	Misc. Temporary Fence	Linear Foot

Measurement and payment for all Wooden Walk Gates includes the removal of the old walk gates and providing connections for any new fence or existing fence to remain in place. Payment will be made as follows:

Item Number	Description	Unit
607-99.02	Misc Walk Gate (Wood)	Each

BBB. Decorative Fence

1.0 Description. The contractor shall remove and reinstall the decorative fences at locations indicated on the plans.

2.0 Installation Requirements. The contractor shall remove and reinstall decorative fencing. Fencing materials proposed for use shall match existing and match approved by engineer prior to installation.

2.1 Fence color shall match existing.

2.2 Fence posts spacing shall match existing.

3.0 Acceptance Testing. The decorative fencing shall be installed matching existing. Below is a picture of the fence at location 2842 Telegraph Rd at Approximate Station 21+27.74.



4.0 Basis of Payment. Measurement and payment for decorative fence includes removing and relocating the existing fence. Payment will be made as follows:

Item Number	Description	Unit
607-99.03	Misc Decorative Fence	Linear Foot

CCC. Structural Sidewalk with Rebar

1.0 Description. The contractor shall install Structural Sidewalk with Rebar at locations indicated on the plans.

2.0 Installation Requirements.

2.1 Concrete sidewalks of 6-inches in thickness or greater shall be constructed of pavement concrete. Concrete sidewalks of less than 6-inches in thickness shall be constructed of either Class B-1 concrete or Pavement concrete.

2.2 When items are constructed on a subgrade, the subgrade shall be compacted to the specified density of the applicable subgrade material. The subgrade shall have a sufficient moisture content such that moisture is not drawn out of the concrete. Transparent membrane shall be used in lieu of pigmented membrane for curing concrete sidewalk.

2.3 Required reinforcement and tie bars shall be positioned by bar chairs or other approved devices during the placing of concrete.

2.4 All joints shall be constructed at such intervals and locations as shown on the plans or as directed by the engineer.

2.5 Unless otherwise specified, reinforcement shall be deformed bars in accordance with AASHTO M 31.

3.0 Acceptance Testing. Concrete strength and air content shall be tested at the required QC and QA frequencies. Concrete strength shall be tested with either cylinders or the maturity method. Concrete shall have a minimum 28-day strength of 4000 psi. The contractor shall measure concrete strength at a frequency of one test per 100 cubic yards. The contractor shall measure air content from the first truck load and thereafter at a frequency of one test per 100 cubic yards. The engineer shall measure concrete strength and air content at a frequency of one test per 500 cubic yards.

4.0 Basis of Payment. Measurement and payment for Structural Sidewalk with Rebar will be paid for at the contract unit price for each of the pay items included in the contract.

Item Number	Description	Unit
608-99.05	Misc Structural Sidewalk with Rebar	Square Yard

DDD. Pass Through

1.0 Description. The contractor shall install Pass Throughs in the locations indicated in the plans prepared by the engineer.

2.0 Installation Requirements. Pass throughs shall be constructed of structural steel meeting the requirements of ASTM A 36 and shall be fabricated as shown on the plans. Welds shall be of full section and sound throughout. Obvious dimensional defects and structural discontinuity of welds will be cause for rejection. All welding residues shall be removed. All tightly contacting surfaces shall be completely sealed by welding. Removal of welding beads will not be required except on bearing surfaces.

2.1 Bolts, nuts and washers shall be galvanized in accordance with AASHTO M 232 or shall be mechanically galvanized. If mechanically galvanized, the coating thickness, adherence and quality requirements shall be in accordance with AASHTO M 232, Class C.

2.2 Damaged spelter coating shall be repaired in accordance with Section 1081 of the MoDOT Standard Specifications.

3.0 Acceptance Testing. Pass throughs shall be installed as shown on the plans.

4.0 Basis of Payment. Payment for Pass Throughs shall be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
614-99.02	Misc Pass Through	Each

EEE. Grated Trough

1.0 Description. The contractor shall install Grated Troughs in the locations indicated in the plans prepared by the engineer.

2.0 Installation Requirements Grated troughs shall be constructed of cast gray iron, meeting the requirements of AASHTO M 306 and shall be fabricated as shown on the plans. Stainless bolts and washers shall be in accordance with Section 901.3 of the MoDOT Standard Specifications.

2.1 Grated Troughs shall be installed by the contractor perpendicular to water flow as shown in the plans prepared by the engineer.

2.2 Grated Troughs shall not interfere with the flow of automobile, pedestrian, bicycle, or any other flow of traffic.

2.3 Grated Troughs installed by the contractor shall be free of any debris.

2.4 Grated troughs shall be installed at low points to collect water at locations indicated in the plans prepared by the engineer.

2.5 Grated troughs shall be installed by the contractor to connect to the proposed drainage system indicated by the plans prepared by the engineer.

2.6 The dimensions of each grated trough installed by the contractor shall be in accordance with the dimensions shown in the plans prepared by the engineer.

3.0 Acceptance Testing. Grated troughs shall be installed securely by the contractor at locations shown in the plans prepared by the engineer.

4.0 Basis of Payment. Payment for Grated Troughs shall be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
614-99.02	Misc Grated Trough	Each

FFF. Pass Down

1.0 Description. The contractor shall install Pass Downs in the locations indicated in the plans prepared by the engineer.

2.0 Installation Requirements Pass downs shall be installed by the contractor at locations indicated in the plans by the engineer.

2.1 Pass downs shall be constructed of structural steel meeting the requirements of ASTM A 36 and shall be fabricated as shown on the plans. Welds shall be of full section and sound throughout. Obvious dimensional defects and structural discontinuity of welds will be cause for rejection. All welding residues shall be removed. All tightly contacting surfaces shall be completely sealed by welding. Removal of welding beads will not be required except on bearing surfaces. Work shall include excavation and granular backfill needed to install the pass down.

2.2 Bolts, nuts and washers shall be galvanized in accordance with AASHTO M 232 or shall be mechanically galvanized. If mechanically galvanized, the coating thickness, adherence and quality requirements shall be in accordance with AASHTO M 232, Class C.

3.0 Acceptance Testing. Pass downs shall be installed as indicated on the plans prepared by the engineer.

4.0 Basis of Payment. Payment for pass downs shall be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
614-99.02	Misc Pass Down	Each

GGG. Island Drainage Cover

1.0 Description. The contractor shall install Island Drainage Covers in the locations indicated in the plans prepared by the engineer.

2.0 Installation Requirements Island Drainage Covers shall be installed at median locations in accordance with the plans prepared by the engineer. Work shall include excavation and granular backfill needed to install the island drainage cover.

3.0 Acceptance Testing. Island Drainage Covers shall be installed securely by the contractor in accordance with the plans prepared by the engineer.

4.0 Basis of Payment. Payment for Island Drainage Covers shall be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
614-99.02	Misc Island Drainage Covers	Each

HHH. Covered Inlet Extension

1.0 Description The contractor shall install Covered Inlet Extensions in the locations indicated in the plans prepared by the engineer.

2.0 Installation Requirements Excavation and backfilling for covered inlet extensions shall be in accordance with Section 206 of the MoDOT Standard Specifications.

2.1 Covered inlet extensions shall be constructed as shown on plans prepared by the engineer. Work shall include excavation and granular backfill needed to install Covered Inlet Extension.

2.2 Footings shall be constructed as shown on the plans. Concrete shall be float finished and shall be cured in accordance with Section 502 of the MoDOT Standard Specifications. Forms will required as per direction of engineer.

3.0 Method of Measurement Covered Inlet Extensions shall be measured by each inlet placed by the contractor in accordance with the plans prepared by the engineer.

4.0 Basis of Payment. Payment for Covered Inlet Extensions shall be paid at the contract unit price for each of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
731-99.02	Misc Covered Inlet Extension	Each

III. Sewer (Granular Backfill)

1.0 Description. The contractor shall install Granular Backfill at sewer structures as indicated in the plans and by the engineer.

2.0 Installation Requirements Aggregate used for backfill material may consist of gravel, or crushed stone. The requirements for the gradation of the material, the general makeup of the material, and the testing of the material will apply to all potential uses of this material, unless otherwise specified on the plans or in the contract documents.

2.1 The frequency of sampling of the backfill material necessary to assure gradation control throughout construction shall be as directed by the engineer.

2.2 The contractor shall furnish to the engineer written certification that the backfill material provided complies with Section 1010.5.1 of the Missouri Department of Transportation (MoDOT) Standard Specifications.

3.0 Acceptance Testing. Acceptance will be based on the written certification, accompanying test reports, and any applicable tests performed as directed by the engineer.

4.0 Basis of Payment. Payment for Sewer Granular Backfill should be paid at the contract unit price for at the contract unit price for each cubic yard of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
726-99.24	Sewer (Granular Backfill)	Cubic Yard

JJJ. Optional Curb

1.0 Description: This work shall consist of constructing a Portland cement concrete curb on a prepared subgrade. This work shall be performed in accordance with the standard specifications and as shown on the plans or established by the engineer. The optional curb construction shall be Modified Integral Type B Curb, in substitution of the Type S Curb shown in the plans, with the appropriate curb height as indicated in the plans.

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

3.0 Method of Measurement: The quantity of optional curb shall be measured per linear foot.

4.0 Basis of Payment: No additional payment will be made for Modified Integral Type B Curb, in substitution of the Type S Curb shown in the plans. Accepted optional curb, complete in place, will be paid for by the contract unit bid price per linear foot, and will be full compensation for all labor, equipment, and material to complete the above described work using these pay items below based upon height regardless of curb type implemented.

Item Number	Description	Unit
609-10.10	Concrete Curb (6-In. Height and Under) Type S	Linear Foot
609-10.11	Concrete Curb (Over 6-In. Height) Type S	Linear Foot

KKK. Miscellaneous Special Curb for Passing Obstacles

1.0 Description: This work shall consist of constructing a Portland cement concrete curb on a prepared subgrade. This work shall be performed in accordance with the standard specifications and as shown on the plans or established by the engineer. The optional curb construction shall be a Special Curb for Passing Obstacles with the appropriate curb height as indicated in the plans. This item shall be used to avoid obstacles as directed by the engineer. The curb height shall be over 9-inches and as indicated in the plans prepared by the engineer.

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

3.0 Method of Measurement: The quantity of optional curb shall be measured per linear foot. Each work item listed in Section 3.1 completed shall be measured per the unit identified and include all labor and materials necessary to install the drainage features and associated work.

4.0 Basis of Payment: The accepted optional curb, complete in place, will be paid for by the contract unit bid price per linear foot, and will be full compensation for all labor, equipment, and material to complete the above described work:

Item Number	Description	Unit
609-99.03	Misc. (Special Curb for Passing Obstacles)	Linear Foot

LLL. Signs in Concrete

1.0 Description. There are proposed signs located in areas to be covered with new concrete (concrete islands, concrete medians, concrete approaches, concrete sidewalks, etc.). It is recommended to the Contractor that they install the sign post anchor or footing prior to covering the area with new concrete. If the Contractor elects to cover the area with the new concrete prior to installing the proposed sign post anchor or footing, there will be no direct payment for the work required to cut or drill a hole in the new concrete in order to install the proposed sign post anchor or footing.

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

MMM. 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.	Description	Unit
202-20.10	Removal of Improvements	Lump Sum

NNN. Removal and Replacement of Traffic Signs

1.0 Description. Existing traffic signs that have to be removed prior to proposed traffic signs being installed and that are determined essential to the safe and orderly flow of traffic by the Engineer shall be temporarily re-erected immediately by the Contractor at temporary locations in a manner approved by the Engineer. The existing signs shall remain temporarily erected until the final permanent signing has been installed. The Contractor shall maintain the existing signs in a straight and neat condition for the duration of the temporary mounting.

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

OOO. Removal and Delivery of Adopt-A Highway Signs

1.0 Description. All Commission-owned Adopt-A-Highway signs shall be disassembled, stored, transported, and disposed of as specified herein by the MoDOT maintenance before sign installation for the J6S3631 project. Sign supports, structures and hardware would be also removed as a part of that. If the signs/structures are not taken down by the MoDOT maintenance, the contractor needs to contact the appropriate Maintenance Building.

Teresa Gentry
Phone: 314-343-7382

2.0 Basis of Payment. No payment would be made for this.

PPP. Truck Mounted Attenuator (TMA) for Stationary Activities JSP-23-04

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

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

2.1 TMA shall be used for stationary construction work for the installation of traffic signals, lighting and signage locations when an aerial lift or aerial work platforms are used on the project.

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

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

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

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

Item No.	Description	Unit
612-30.01	Truck Mounted Attenuator (TMA)	Lump Sum

QQQ. Rectangular Rapid Flashing Beacon Assembly

1.0 Description. Rectangular Rapid Flashing Beacon (RRFB) Assemblies shall be installed at the locations indicated in the plans. Rectangular Rapid Flashing Beacon Assemblies shall consist of one signal post with pedestrian crossing signs and rapid flashing beacons (RRFBs) facing traffic. At minimum, each pedestrian crossing shall have two RRFB post assemblies, one on each side. See the special detail sheet(s) for the exact number of RRFB post assemblies being constructed for each pedestrian crossing shown within the plans.

2.0 Beacon Requirements.

2.1 General Conditions. RRFB assemblies shall meet requirements set forth by this JSP and in the MUTCD 11th Edition and found at:

[MUTCD 11th Edition - Part 4](#)

An RRFB assembly shall consist of two rapidly-flashed rectangular-shaped yellow indications, each with a LED-array based pulsing light sources, and shall be designed, located, and operated in accordance with the detailed requirements specified below.

- a. Each Rectangular Rapid Flashing Beacon Assembly – Front & Rear Facing (2 Sided) shall have front and rear facing signs and RRFBs for a total of 2 pedestrian (W11-2) crossing warning signs, 2 instructional signs (R10-25), 2 diagonal downward arrow plaques (W16-7P) and 4 RRFBs.
- b. Each Rectangular Rapid Flashing Beacon Assembly – Front Facing Only (1 Sided) shall have front facing signs and RRFBs for a total of 1 pedestrian crossing warning sign (W11-2), 1 instructional sign (R10-25), 1 diagonal downward arrow plaque (W16-7P) and 2 RRFBs.
- c. Power for the RRFBs (1 or 2 sided) shall be supplied from the new power supply provided at each location. The power supplies are combination and shall power the RRFB and the adjacent lighting system.
- d. The yellow warning signs shall be fluorescent yellow signs.

2.2 Restrictions.

- a. An RRFB shall only be used to supplement a W11-2 (Pedestrian) with a diagonal downward arrow (W16-7p) plaque, located at or immediately adjacent to a marked crosswalk.
- b. An RRFB shall not be used for crosswalks across approaches controlled by YIELD signs, STOP signs, or traffic control signals. This prohibition is not applicable to a crosswalk across the approach to and/or egress from a roundabout.
- c. An RRFB shall not be installed independent of the crossing signs for the approach the RRFB faces. The RRFB shall be installed on the same support as the associated W11-2 (Pedestrian) and plaque.

2.3 Beacon Dimensions and Placement in Sign Assembly.

- a. Each RRFB shall consist of two rapidly-flashed rectangular-shaped yellow indications, each with an LED-array based pulsing light source. Each RRFB indication shall be a minimum of approximately 5 inches wide by approximately 2 inches high.
- b. The two RRFB indications shall be aligned horizontally, with the longer dimension horizontal and with a minimum space between the two indications of approximately seven inches (7 in), measured from nearest edge of one indication to nearest edge of the other indication.
- c. The outside edges of the RRFB indications, including any housings, shall not project beyond the outside edges of the W11-2 sign that it supplements.

2.4 Beacon Flashing Requirements.

- a. When activated, the two yellow indications in each RRFB unit shall flash in a rapidly flashing sequence. As a specific exception to the requirements for the flash rate of beacons provided in Paragraph 3 of Section 4S.01, RRFBs shall use a much faster flash rate and shall provide 75 flashing sequences per minute.
- b. The flash rate of each individual yellow indication, as applied over the full flashing sequence, shall not be more than 5 flashes per second, to avoid frequencies that might cause seizures.
- c. The light intensity of the yellow indications during daytime conditions shall meet the minimum specifications for Class 1 yellow peak luminous intensity in the publication “Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles J595,” 2005, Society of Automotive Engineers (SAE).

2.5 Beacon Operation.

- a. The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation at a predetermined time after the pedestrian actuation. The length of actuation shall be programmable and changeable.
- b. All RRFBs associated with a given crosswalk (including those with an advance crossing sign, if used) shall, when activated, simultaneously commence operation of their alternating rapid flashing indications and then shall also cease operation simultaneously.
- c. A pedestrian instruction sign with the legend PUSH BUTTON TO TURN ON WARNING LIGHTS should be mounted adjacent to or integral with each pedestrian pushbutton. Push buttons shall meet American's with Disabilities Act (ADA) requirements in both location and design with Tactile (if braille is required by project), visible and audible feedback when pushed, as well as the requirements set forth in the JSP titled "Audible Pedestrian Signals and Signing."
- d. The audible message should be a speech message that says, "Warning lights are flashing to cross XX Street." The audible message should be spoken twice.
- e. The duration of a predetermined period of operation of the RRFBs following each actuation should be based on the MUTCD procedures for timing of pedestrian clearance times for pedestrian signals.
- f. A small light directed at and visible to pedestrians in the crosswalk will be installed integral to the RRFB or push button to give confirmation that the RRFB is in operation.

2.6 Other.

- a. Except as otherwise provided above, all other provisions of the MUTCD applicable to Warning Beacons shall apply to RRFBs.
- b. The signs shall meet the requirements of Sec 903. The minimum height of the lowest sign shall be seven feet if mounted in sidewalk to meet ADA requirements.
- c. The post shall be meet MoDOT signal standards in Sec 902. The post will be located so that a minimum of four feet of walkable sidewalk is maintained.
- d. The Engineer and the District Engineer or his/her designee must approve the site for the RRFB installation. 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 installation date. The contractor should coordinate with them in advance and follow their instructions and recommendations. Contact Information is below:
 - Lisa Kuntz, PE
 - Phone: (314) 568-7252
 - Email: lisa.kuntz@modot.mo.gov

3.0 Method of Measurement. Measurement for installation of RRFBs will be made per each post assembly. No measurement will be made for individual items that make up a RRFB post assembly. As described in Section 2.1 above, the RRFBs will be measured depending on whether the signs and the yellow indications of each assembly faces front only or if the assembly faces both directions of travel along the given roadway.

4.0 Basis of Payment. All labor, equipment, and materials necessary to install the beacons, signs, pedestrian actuation, post, foundation, all components required to connect to the power supply, and other equipment to have a fully operational RRFB system will be included in the pay item below.

Item No.	Unit	Description
----------	------	-------------

902-99.02	Each	Misc Rectangular Rapid Flashing Beacon Assembly – Front & Rear Facing (2 Sided)

RRR. Temporary Traffic Signals

1.0 Description. This work shall include furnishing, installing, relocating, maintaining and removing temporary traffic signals at the intersections of MO-231 at Telegraph Rd and MO-231 at Ripa Ave. The contractor will be required to modify as well as furnish and install additional equipment in accordance with the traffic control plan. This work shall conform to Sec 902 except as herein modified.

2.0 Construction Requirements. Temporary traffic signals shall be furnished, installed, modified, and maintained to properly handle traffic at the intersections of MO-231 at Telegraph Rd and MO-231 at Ripa Ave, until such time as the permanent traffic signal is installed at this intersection. The temporary signal shall remain connected to MoDOT's Intelligent Transportation System (ITS) network at all times, unless otherwise approved by the Engineer and MoDOT's ITS personnel.

2.1 The existing traffic signal and lighting equipment, including controller, can be utilized for this installation but will require relocation as shown on the traffic control plan. The contractor will be required to install additional equipment, such as new signal heads, control cable, and video detection equipment as required by the signal layout and staging. Existing signal head shall be relocated over relocated travel lanes as directed by the Engineer.

2.1 The contractor shall relocate and modify the temporary traffic signals and lighting as shown on the plans.

2.2 The temporary traffic signal installation shall be completely maintained by the contractor. MoDOT personnel shall not be directly involved in the installation, maintenance or timing of the signal or preempt system. Signal timing and phasing revisions shall be approved by the Engineer, but programmed by the Contractor. See also the Job Special Provision herein for TRAFFIC SIGNAL MAINTENANCE AND PROGRAMMING.

2.3 During periods of shutdown for required maintenance or when relocating equipment between stages, the contractor shall provide adequate traffic control, including flaggers. Sign W020-7b, Flagger (symbol), shall be displayed in advance of the flaggers. The contractor shall submit traffic control plans to the Engineer for approval.

2.4 The temporary traffic signal shall be removed by the Contractor after the permanent traffic signal is operational. All other signal and lighting equipment shall become the property of MoDOT. See also the Job Special Provision herein for DISPOSITION OF EXISTING SIGNAL AND LIGHTING EQUIPMENT.

3.0 Method of Measurement. No measurement will be completed for this item.

4.0 Basis of Payment. Payment for furnishing, installation, operation, modification, maintenance, relocation and removal of the temporary traffic signal and lighting, will be completely covered by:

Item Number	Description	Unit
902-94.00	Temporary Traffic Signals	Lump Sum

SSS. 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.

2.6 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.

2.7 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.

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

2.9 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.

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

2.11 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.

2.12 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.

2.13 Detection Configuration.

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

2.13.2 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.

2.14 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.

2.15 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.

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

2.17 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.

2.18 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.

2.19 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.

2.20 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.

2.21 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).

2.22 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 the following pay item:

Item No.	Description	Unit
902-42.83	Controller Assembly Housing, NEMA TS2 Controller	Each

6.1 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.

TTT. 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 a 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	Misc ATC Traffic Signal Controller

UUU. 16-Position Backpanel Flashing Yellow Arrow

1.0 Definition. This work will include modifying the cabinets to provide new Special and Standard Overlaps to accommodate Flashing Yellow Arrow installation and programming as detailed on the plan sheets. The installation, cabinet modification, and programming of 3-section permissive only FYA and 4-section protected/permissive FYA signal heads and new FYA signs will vary by intersection. There are four categories for the cabinet modifications:

- One-approach modification
- Two-approach modification
- Three-approach modification
- Four-approach modification

The contractor shall refer to the plans for more details.

1.1 Default Load Switch Assignment – 16 position cabinets

1.1.1 Description. The contractor shall apply 16-compact Flashing Yellow Arrow installation method on all 16-position traffic signal cabinets. The NEMA Load Switch assignment for 16- compact FYA installation method is as follows:

12-Position Cabinet FYA NEMA Load Switch Assignments												
1	2	3	4	5	6	7	8	9	10	11	12	13-16
OLA FYA	PHASE 2	OLB FYA	PHASE 4	OLC FYA	PHASE 6	OLD FYA	PHASE 8	PHASE 2 PED	PHASE 4 PED	PHASE 6 PED	PHASE 8 PED	<i>Assignment as directed per Engineer</i>
								PHASE 1 LEFT	PHASE 3 LEFT	PHASE 5 LEFT	PHASE 7 LEFT	

1.2.2 Wiring. The contractor shall use following color code for the installation of Flashing Yellow Arrow:

If separate 7-conductor cable is present for the existing left turn signal head:

- Red Wire = Load Switch 1, 3, 5, or 7 Red output = 4-section Red Left Arrow
- Orange Wire = Load Switch 1, 3, 5, or 7 Yellow output = 4-section Steady Yellow Arrow
- Black/White Wire = Load Switch 1, 3, 5, or 7 Green output = 4-section Flashing Yellow Arrow
- Green Wire = Load Switch 9, 10, 11, or 12 Yellow output = 4-section Green Arrow

If no separate 7-conductor cable is present for the existing, permissive only, left turn signal head:

- Black Wire = Load Switch 1, 3, 5, or 7 Red output = 3-section Red Left Arrow
- Blue Wire = Load Switch 1, 3, 5, or 7 Yellow output = 3-section Steady Yellow Arrow
- Black/White Wire = Load Switch 1, 3, 5, or 7 Green Output = 3-section Flashing Yellow Arrow

If existing cabinet wiring does not allow the described color code to be met, the contractor shall tag all wires with assigned phases and direction used for the successful completion of the installation of Flashing Yellow Arrow.

1.2.3 Signal Monitor programming. The contractor shall use 16 channel programming mode for the signal monitor.

1.2.4 The contractor shall notify the engineer 24 hours after any successful modification to the load switch assignment, wiring, Controller and MMU programming described in this document.

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.

VVV. 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.

1.1 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).

1.2 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 to coordinate which padlocks are to be used.

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

WWW. 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.

XXX. 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.

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.

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:

- Proposed Timing Plan changes and any models
- Anticipated locations of concern
- 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.
- 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 bid.

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:

- Intersection Impact
- Construction Stage Traffic Switch
- Response to Customer Concern
- New Intersection Turn-On (along with any subsequent revisions)
- Final completion of improvements
- 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 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 the same controller type is used, all previous databases 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.

- Power Meter 1 – Away from power meter with meter centered
- Power Meter 2 – Close up with power meter number
- Cabinet 1 – Away with cabinet centered and door closed
- Cabinet 2 – Close up of entire cabinet with door opened
- Cabinet 3 – Close up of center cabinet interior
- Cabinet 4 – Close up of left cabinet interior
- Cabinet 5 – Close up of right cabinet interior
- Cabinet 6 – Close up of back panel

4.8 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 detect vehicles 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.

4.9 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.

4.10 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.

4.11 Temporary Traffic Signal Programming.

See also the Job Special Provision herein for Temporary Traffic Signals.

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.

- 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 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.	Description	Unit
902-99.01	Misc Traffic Signal Maintenance & Programming	Lump Sum

YYY. Maintenance of St. Louis County Traffic Signal Facilities

1.0 Description. St. Louis County Traffic Signal Specifications

1.1 Unless noted otherwise, any and all traffic signal work on this project shall be in accordance with St. Louis County Standard Specifications for Road and Bridge Construction, “Division 900, Section 904 – St. Louis County Traffic Signals”, available at:

<https://stlouiscountymo.gov/st-louis-county-departments/transportation-and-public-works/roadway-publications-and-manuals/dot-construction-manual-current/standard-specifications-for-road-and-bridge-construction1/>

1.1 and with “St. Louis County Standard Drawings – Traffic Signal Details”, available at

<https://stlouiscountymo.gov/st-louis-county-departments/transportation-and-public-works/roadway-publications-and-manuals/dot-standard-drawings-current/construction-standard-drawings/>

1.2 The Contractor shall have said references on the job site at all times during construction of this project. The Section 904 specifications in effect for this project will be those available for viewing on the date the plans were approved.

1.3 The contractor shall be responsible for checking the Standard Drawings Errata Sheet to ensure their set of drawings is current. The Standard Drawings in effect for this project will be those drawings available for viewing on the date the plans were approved.

2.0 Location of Existing Traffic Signal Facilities

2.1 Description. It is the responsibility of the contractor to locate and mark existing traffic signal facilities in advance of construction work.

2.2 If unanticipated disruption of, or damage to, a traffic signal facility occurs as a result of permitted work conducted by a Contractor, the Contractor's construction work within the right-of-way shall be halted. The Contractor's work within the right-of-way shall not be allowed to proceed until a repair is completed within 24 hours, unless approved otherwise by a representative from the St. Louis County Department of Transportation's Construction Division.

2.3 If the repair required to make the signal facility operational within the stated 24 hour time period is a temporary repair, then the Contractor shall, within 72 hours, effect a permanent repair to restore all traffic signal facilities to the same condition prior to the unanticipated disruption or damage, or to the condition specified in the approved construction plans.

2.4 Failure to comply with these requirements will result in liquidated damages being assessed or escrow funds being withheld.

3.0 Maintenance of Interconnect Facilities During Construction

3.1 The County's traffic signal communication links are all vital to the operation of County's signal systems and shall be maintained for the duration of all construction projects. It shall be the Contractor's responsibility to maintain these links within their work zones. Any approved scheduled disruption of a traffic signal communication link shall be kept to an absolute minimum and shall only be allowed during the following times:

Monday thru Friday 9:00AM to 3:00PM

Monday thru Friday 7:00PM to 5:00AM

Saturday and Sunday All Day

3.2 The Contractor performing the permitted work shall contact the St. Louis County Transportation's Division of Operations, Signal Shop at (314) 615-0213 a minimum of two business days prior to any approved scheduled disruption of a traffic signal communication link. The County reserves the right to revise the time periods listed above.

3.3 If the scheduled disruption cannot occur during the approved times, then the Contractor shall submit a plan, for the County's approval, to provide a TEMPORARY traffic signal communication link. If approved, the Contractor shall install the TEMPORARY communication link and verify the link is functional before proceeding with the scheduled disruption.

3.3.1 Failure to comply with these requirements shall result in the Contractor's construction work within the public right-of-way being halted until all requirements are met.

3.4. If an unanticipated disruption of a traffic signal communication link occurs as a result of permitted work conducted by a Contractor, the Contractor's construction work within the right-of-way shall be halted. The Contractor's work within the right-of-way shall not be allowed to proceed until a temporary repair to the link is

completed, unless approved otherwise by a representative from the St. Louis County Department of Transportation, Construction Division. Temporary repairs shall not be considered final repairs. The Contractor shall be responsible for restoring all traffic signal communication links to the same condition prior to the unanticipated disruption or to the condition specified in the approved construction plans.

3.4.1 Failure to comply with these requirements will result in liquidated damages being assessed or escrow funds will be withheld.

4.0 Maintenance Of Vehicle Detection Systems During Construction

4.1 Description Vehicle detection systems are essential to the efficient operation of all traffic signals. Prior to any disruption of service to an existing vehicle detection system, the Contractor shall furnish and install a temporary vehicle detection system for the approach(es) where the existing vehicle detection system is to be disrupted. The Contractor shall make any and all necessary adjustment(s) for the proper operation of the temporary detection equipment. The Contractor will also be responsible for the maintenance of the temporary detection system equipment until the permanent vehicle detection system is installed and operational.

4.1.1 The Contractor shall provide to the County the type of temporary vehicle detection system to be used a minimum of two business days in advance of installing the temporary equipment for approval, by contacting the St. Louis County Signal Shop at (314) 615-0213. The County has the sole right to approve, modify, or reject the temporary vehicle detection system proposed by the Contractor. The Contractor shall not disrupt any existing vehicle detection system before a temporary vehicle detection system is operational and approved by the County.

4.1.2 Failure to comply with these requirements shall result in the Contractor's work within the public right-of-way being halted until all requirements are met.

4.2 In the event the Contractor causes a disruption to a vehicle detection system and there is no temporary vehicle detection system in place, the Contractor's construction work within the public right-of-way shall be halted. The Contractor's construction work within the public right-of-way shall not be allowed to proceed until a temporary vehicle detection system is installed, unless approved otherwise by a representative from the St. Louis County Department of Transportation Construction Division.

4.2.1 If the Construction Division approves the Contractor's construction work to proceed without providing a temporary vehicle detection system, the Contractor has a maximum of 14 calendar days to either install an approved temporary or permanent vehicle detection system. The Contractor shall provide to the County within two business days of the disruption of the vehicle detection system:

- (a) The vehicle detection system to be used
- (b) A schedule detailing the timeline for installation of the temporary vehicle detection system.

4.2.2 The County has the sole right to approve, modify, or reject the temporary vehicle detection system and schedule proposed by the Contractor. Temporary vehicle detection systems shall not be considered final improvements. The Contractor shall be responsible for restoring all vehicle detection systems to the same condition prior to the disruption or to the condition specified in the approved construction plan.

4.3 Failure to comply with these requirements will result in liquidated damages being assessed at a rate of \$100 per lane per day or escrow funds being withheld.

ZZZ. St. Louis County Owned Signals

1.0 Description. St. Louis County (County) owns the traffic signal at the intersection of Route 231 and River City Boulevard. Loop detection for this signal is in the intersections approach pavement to be milled on the south approach of Route 231. In addition, the project requires the contractor to remove existing and install new pedestrian pushbuttons at this intersection, at a pedestrian accessible location per the project plans. The Contractor shall not disturb the pedestrian signals on the northwest and northeast sides of the intersection. Contractor shall also not disturb the River des Peres Greenway which crosses South Broadway.

2.0 Construction Requirements.

2.1 Loop Detectors. Existing loop detectors shall be disconnected before milling near the detection area. Replacement loop detectors shall be as shown in the plans and meet St. Louis County standards. The contractor shall let the engineer know two weeks prior to milling each ramp to allow time for coordination with the County. Replacement loop detectors shall be installed within 5 calendar days of the removal of the existing detectors.

2.2 Pedestrian Pushbuttons. The contractor shall exercise care in removing existing and installing new pushbuttons. Should any new or existing pushbuttons be rendered inactive due to the contractor's negligence, they shall be replaced at the contractor's expense. The contractor shall be responsible for securing any permit which may be needed from the County. The contractor shall also coordinate this work, along with returning any existing pedestrian signal equipment as directed by the County, with the below contact at least two weeks before commencing any work on the County's signal facilities.

2.3 Contact. The contractor shall reach out to the following contact to coordinate all work on St. Louis County's signal facilities at least two weeks prior to commencing any work. The contractor shall also notify the engineer when contacting the County.

Scott Halter
St. Louis County Dept. of Transportation Traffic
Signals
Phone: 314-615-0202

3.0 Basis of Payment. Payment for removal and installation of in-pavement loop detectors and pedestrian signals will be made with the standard pay items included in the contract. No direct pay will be made for compliance with this provision.

AAAA. Liquidated Damages Specified Traffic Signal Loops at Route 231 at River City Casino Blvd JSP-93-28A

1.0 Description. If traffic signalization modification and pavement loops are not complete and open to traffic on or before 5 calendar days after asphalt resurfacing is completed, the Commission, the traveling public, and state and local police and governmental authorities will be damaged in various ways, including but not limited to, increased construction administration cost, potential liability, traffic and traffic flow regulation cost, traffic congestion and motorist 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 \$1,000.00 per day for each traffic signal loop that is not complete and open to traffic in excess of the limitation as specified elsewhere in this special provision. Traffic signal loops at this intersection shall be constructed according to Saint Louis County requirements – see St. Louis County Owned Signals JSP for these requirements. It shall be the responsibility of the engineer to determine the quantity of excess closure time.

1.1 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, as amended elsewhere in this contract.

BBBB. Work for St. Louis County Requirements- Route 231 at River City Casino Blvd

1.0 Description. The contractor shall install Indication Loop Detectors at locations indicated in the plans prepared by the engineer near the intersection of Route 231 and River City Casino Blvd.

2.0 Installation Requirements Installation of Indication Loop Detectors shall be installed by the contractor in accordance with the plans prepared by the engineer, MoDOT Standard Drawing 902.50M, and St. Louis County Department of Transportation and Public Works Standard Drawing C904.70.

2.1 The installation of the Indication Loop Detectors installed by the contractor shall include any item indicated by the engineer in accordance with the plans prepared by the engineer.

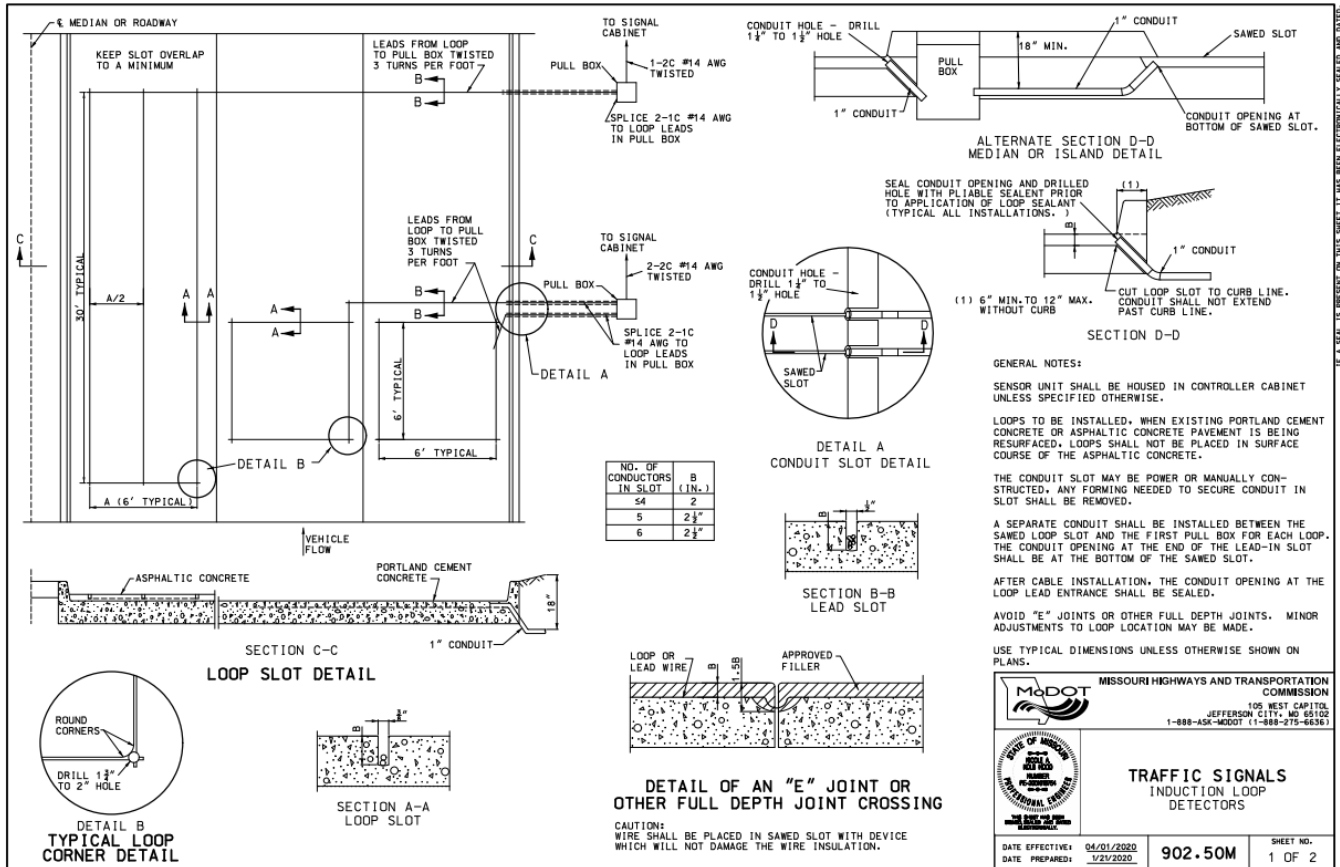
2.2 The contractor shall use typical dimensions indicated in MoDOT Standard Drawing 902.50M and St. Louis County Department of Transportation and Public Works Standard Drawing C904.70 unless otherwise shown on the plans prepared by the engineer.

3.0 Acceptance Testing. The Indication Loop Detectors installed by the contractor shall meet St. Louis County requirements and MoDOT Standard Drawing 902.50M, as well as St. Louis County Department of Transportation and Public Works Standard Drawing C904.70. Copies of standard plans are included for informational use in this JSP below.

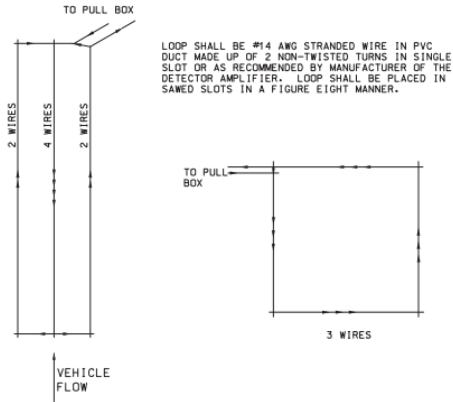
Job No.: J6S3631

Route: 231

County: St. Louis

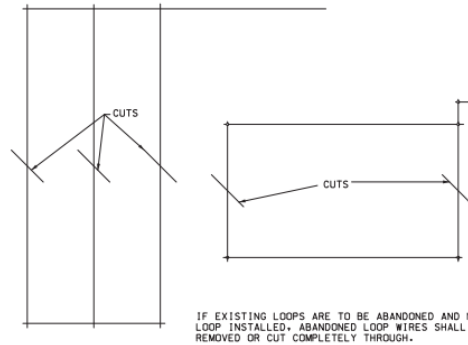


Job No.: J6S3631
 Route: 231
 County: St. Louis



LOOP CONFIGURATION

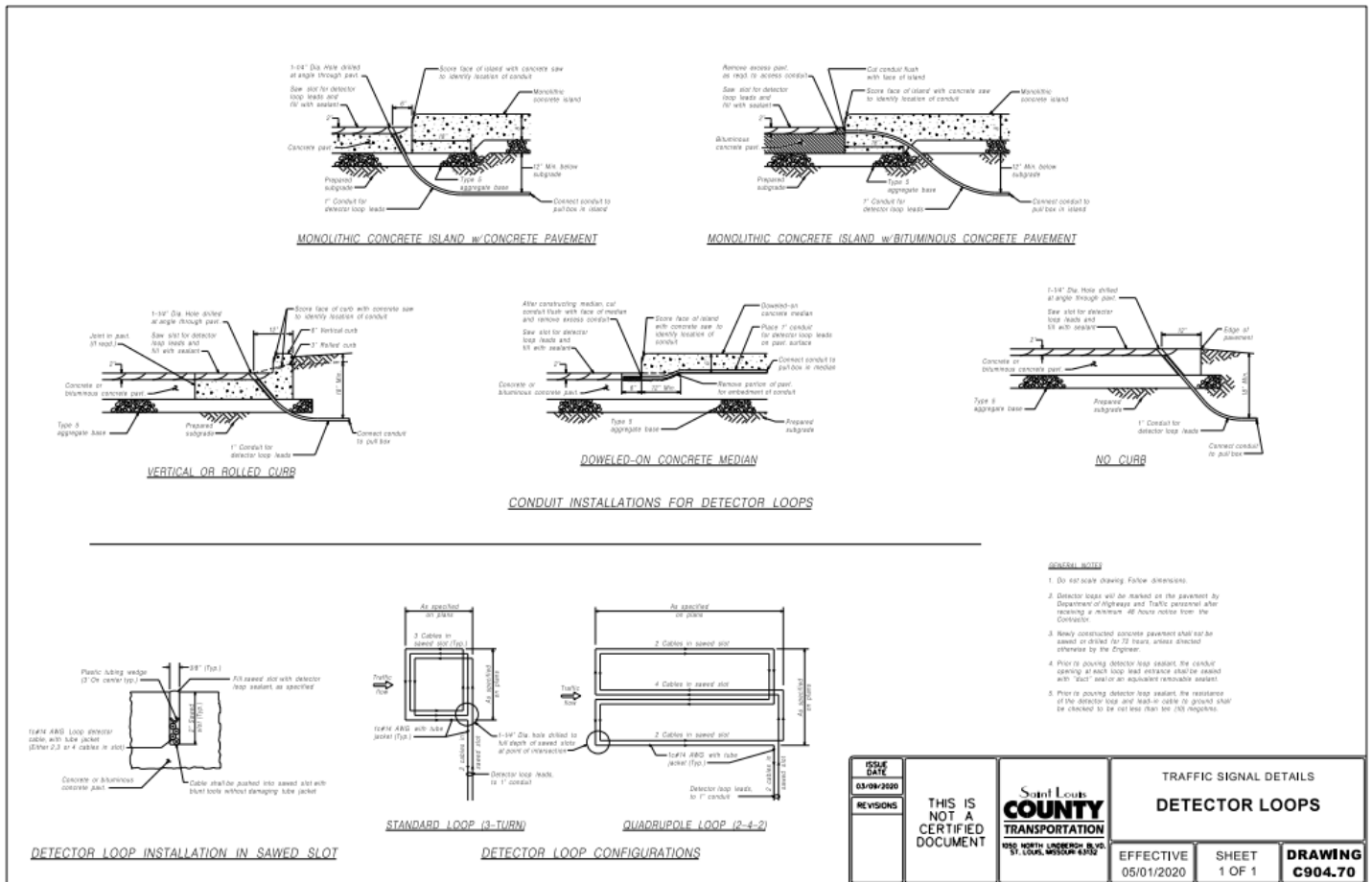
LOOP SHALL BE #14 AWG STRANDED WIRE IN PVC DUCT MADE UP OF 2 NON-TWISTED TURNS IN SINGLE SLOT OR AS RECOMMENDED BY MANUFACTURER OF THE DETECTOR AMPLIFIER. LOOP SHALL BE PLACED IN SAVED SLOTS IN A FIGURE EIGHT MANNER.



ABANDONED LOOPS

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION 105 WEST CAPITOL JEFFERSON CITY, MO 65102 1-888-ASK-MODOT (1-888-275-6636)	
STATE OF MISSOURI DEPARTMENT OF TRANSPORTATION MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION	TRAFFIC SIGNALS INDUCTION LOOP DETECTORS
DATE EFFECTIVE: 01/01/2020 DATE PREPARED: 10/17/2019	902.50M SHEET NO. 2 OF 2

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND SAVED.



4.0 Basis of Payment. Payment for Induction Loop Detectors installed for Work for St. Louis County Requirements- Route 231 at River City Casino Blvd shall be paid at the contract unit price for 1 Lump Sum of the pay items included in the contract installed by the contractor.

Item Number	Description	Unit
902-99.01	Work for St. Louis County Requirements-Route 231 at River City Casino Blvd	Lump Sum

CCCC. Accessible Pedestrian Push Button and Signing

1.0 Description. This work shall consist of furnishing, installing and placing intooperation an Accessible Pedestrian Signal (APS) that assist 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 Signal" will be paid for at the contract unit price. Payment will be considered full compensation for all labor, equipment, signage 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
902-49.21	Each	Accessible Pedestrian Signal

DDDD. 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 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 Test Point A 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 B 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 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.
- (h) The Alarm conditions include: line frequency, low output voltage, no temperature probe, overload,
- (i) unconnected batteries, high temperature (>55°C) and low temperature (<-20°C).
- (j) FAULT. The relay is activated after a specific or general fault is detected. These faults
- (k) include: short circuit, low battery voltage (<41VDC), high battery voltage (> 59VDC), overload and over temperature (>75°C).
- (l) OFF. The relay is disabled and will not activate under any condition.

- (m) TIMER 2. Same as TIMER 1.
- (n) TIMER 3. Same as TIMER 1.
- (o) 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.
- (p) 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 $\pm 100\text{mV}$ 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	Description	Unit
902-99.02	Misc. Combination Pad Mounted 120V/240V Power Supply and Lighting Controller with UPS	Each
901-99.02	Misc. Combination Pad Mounted 120V Power Supply with UPS and 240V Dual Meter Lighting Control	Each

EEEE. Maintenance of Roadway Lighting

1.0 Description. This work shall consist of maintaining the operation of the existing roadway lighting during the construction of the project.

2.0 Construction Requirements. Contractor shall schedule/stage work such as to minimize the duration that any roadway lighting will not be operational. Contractor shall provide a schedule of when the roadway lighting will not be operational to the Engineer for review and approval.

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

FFFF. 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 luminaires. 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	Misc Lighting Pole, 30-FT. or 9.0 M, Type AT Top Mount	Each

GGGG. Luminaire Arm

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	Misc Luminaire Arm, 6 FT. or 1.8 M., Top Mount	Each
901-99.02	Misc Luminaire Arm, 10 FT. or 3.0 M., Top Mount	Each
901-99.02	Misc Luminaire Arm, 12 FT. or 3.6 M., Top Mount	Each

HHHH. SL District Traffic Signal Detection System

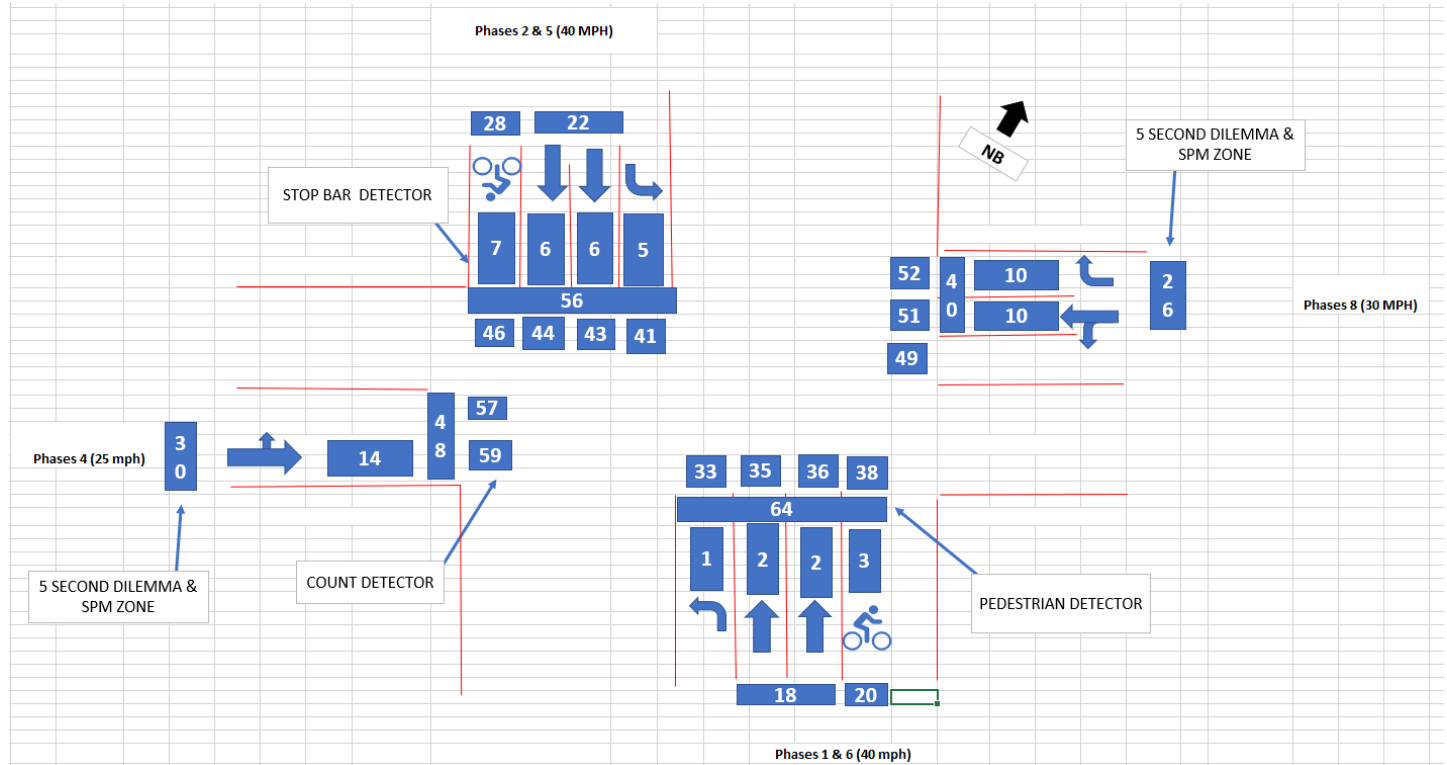
1.0 Description. This work shall consist of providing detectors for signalized installations that will support advance traffic signal performance measures (ATSPM) on the Commission's St. Louis District roadways. Detectors shall be in accordance with the Missouri Standard Specifications for Highway Construction (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:

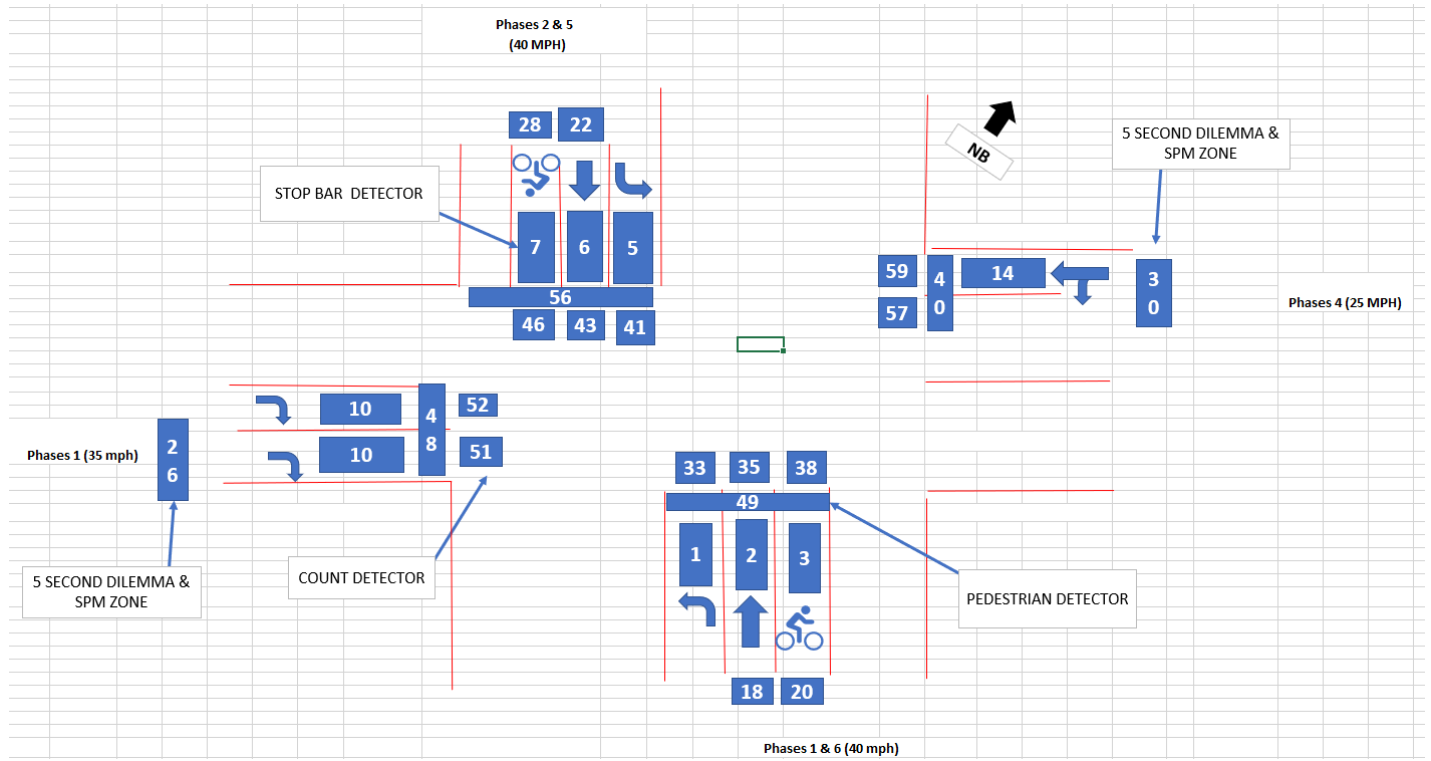
1. Stop Bar Detection
2. Advance Upstream (Performance Measures)

3. Dilemma Zone
4. Turn Counts
5. Advance Video Zones (if applicable)
6. Radar Zones (if applicable)
7. Advance Data Collector (if applicable)
8. Bicycle/Pedestrian (see Section 2.2)

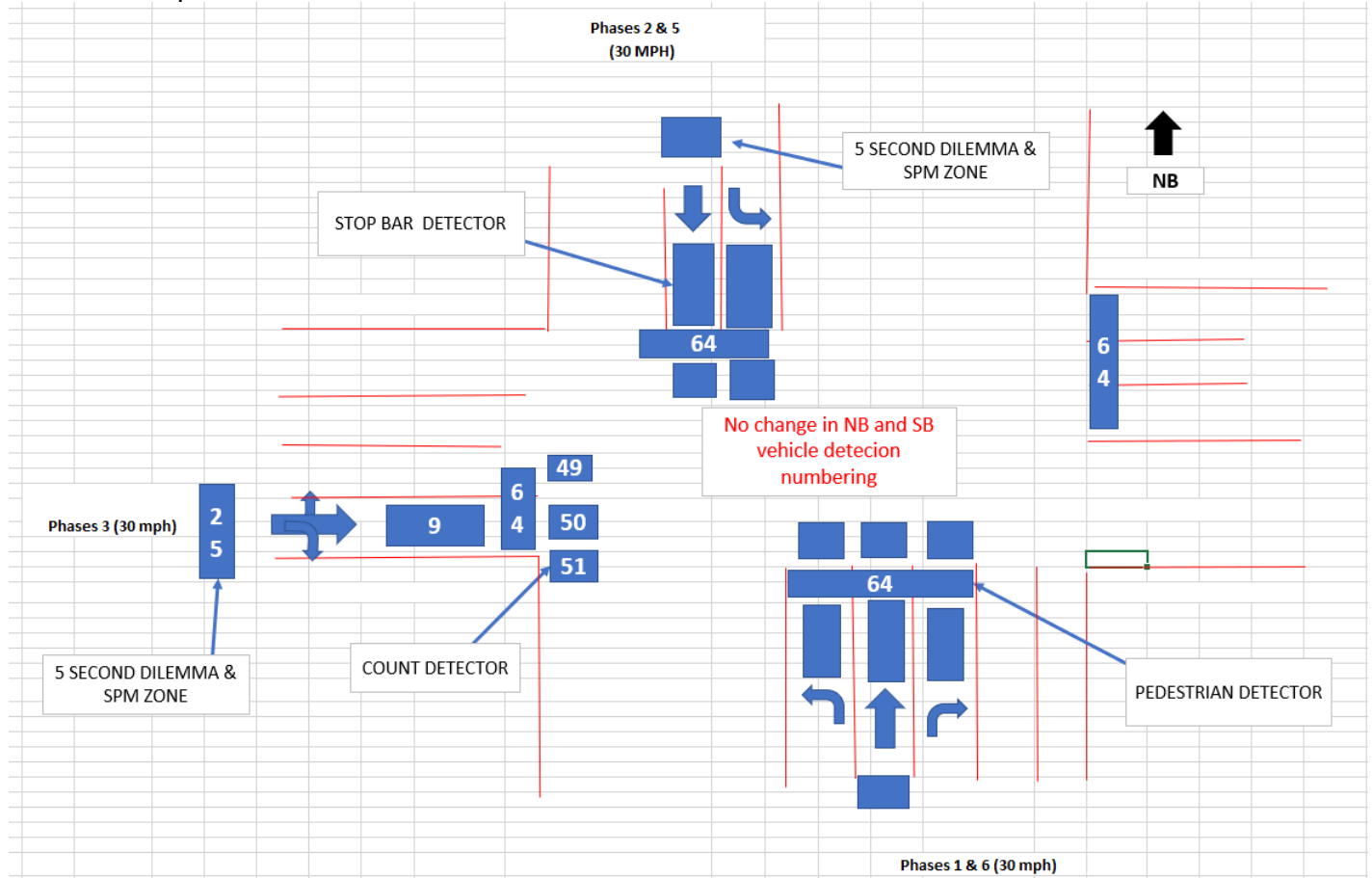
MO-231 at Jefferson Barracks/Jeffersonian Dr



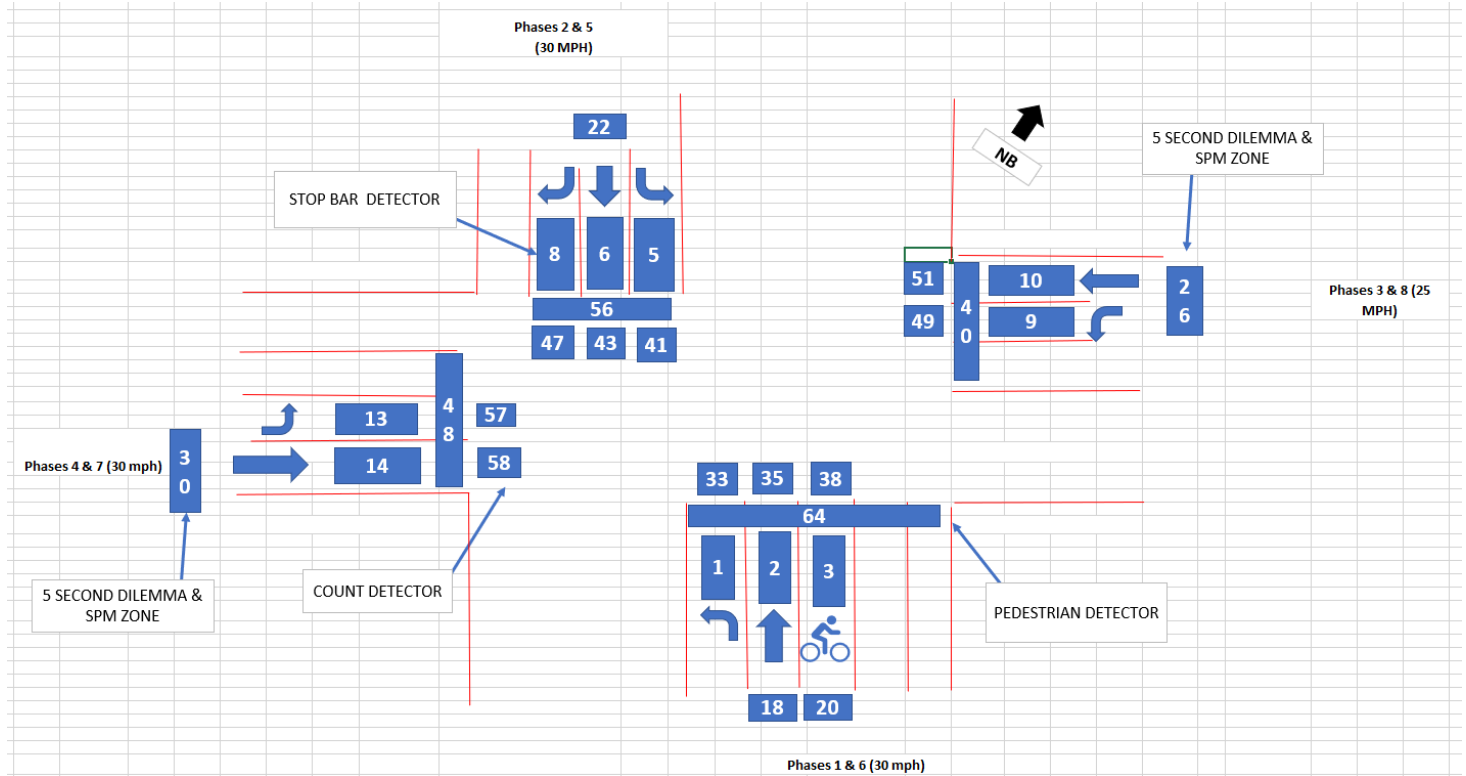
MO-231 at Telegraph/Kingston



MO-231 at Ripa



MO-231 at Hoffmeister



2.1 Advance Detector Zones. Advance detector zone detection shall be required for the following approaches for signal performance measures:

1. MO-231 @ Jefferson Barracks/Jeffersonian Dr
2. MO-231 @ Telegraph/Kingston
3. MO-231 @ Ripa
4. MO-231 @ Hoffmeister

Advance 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 5 secs Travel time	Advance Detector Placement 8 seconds travel time
25 mph	185	295
30 mph	220	355
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.

1. Speed
2. Volume
3. Lane Occupancy
4. Vehicle Classification
5. Other available performance measures

For speed calculations thru movements are required for all detection installations. Turning movement measurements are required for all detection installations. For volume measurements/calculations both mainline thru 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:

1. Video Image
2. Radar
3. Induction Loop

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.

1. Autoscope Vision
2. Iteris Vantage Next
3. 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.

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.

1. WAVETRONIX SmartSensor
 - a. Matrix

Provide a radar detection system with the following features.

1. Shall be able to track/detect a minimum of 64 objects
2. Shall be able to operate in a temperature range between -30 degrees and 165 degrees F
3. The detection zones shall be configurable based off several factors' such as classification, ETA, speed, presence, and delay.
4. The radar sensor shall be forward fire
5. The sensor shall operate in the 25 GHz band
6. 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.

1. WAVETRONIX SmartSensor
 - a. Advance
 - b. Advance Extended
2. Iteris Vector
 - a. In addition to the specifications listed in Section 4.2.2.1, the detection range shall also cover the advance detector zone distances prescribed in section 2.1.

4.2.2.3 Power and Communications.

1. Power and communications cabling shall be installed per manufacturer specifications
2. The radar sensor shall operate at 24 VDC
3. Power consumption shall be no more than 38 watts
4. 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:

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

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.

4.3 Induction Loops. Induction loops, if selected, shall be in accordance with the Missouri Standard Specifications for Highway Construction (latest version) and shall be installed to provide detection at locations as shown on the plans or as directed by the Engineer in accordance with Section 902. Detector channels shall be assigned as per the layout in this JSP or as directed by the Engineer.

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	Misc SL District Traffic Detection System

III. Signal Cabinet Base Wrap and Cabinet Shift

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

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

3.0 Construction Requirements. Construction requirements shall conform to Sec 902.15.2.

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

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

Item No.	Type	Description
910-99.02	Each	Misc Signal Cabinet Base Wrap and Cabinet Shift

JJJJ. MoDOT ITS Equipment Within Project Limits

1.0 Description. MoDOT owned fiber optic cable and conduit, critical MoDOT power supplies and power cables, and pull boxes for fiber and power cabling 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.

KKKK. 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 (J6S3631), 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.

LLLL. Contractor Furnished and Installed (F&I) IP-ADDRESSABLE Power Strip

1.0 Description. The contractor shall furnish and install an 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 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. The old power strip as well as any other inactive devices, if present, should be removed to make room. If the contractor has any question regarding the inactive devices, they should contact MoDOT signal shop supervisor. The power source shall be hardwired to cabinet auxiliary breaker with no plug in to any cabinet outlet allowed.

3.0 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.

4.0 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	Misc Contractor F&I IP-addressable Power Strip

MMMM. Contractor Furnished and Installed Closed Circuit Television (CCTV) Assembly

1.0 General.

1.1 Description. The contractor shall remove the existing CCTV Camera Assembly at the noted intersections (if applicable) and install a Contractor furnished IP (Internet Protocol) closed circuit television (CCTV) assembly on a new 4" x 20' extension metal pole (if there is no CL type pole at the noted location; this pole shall be paid separately) which will be mounted to the signal up-right pole (see detail drawing), and install a Contractor furnished power supply and surge protection in the new signal cabinet. Provide cable connecting the camera to the equipment in the cabinet and to ground, set up the camera assembly, and test for proper operation.

1.2 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):

CCTV Manufacturer	Model	Connection Type
CostarHD (formerly known as Cohu)	4220HD RISE 3 Dome	Outdoor cat5e
Axis	Q6315-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 μ s)
- 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.

3.2 The contractor shall use the manufacturer's latest 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:

Item No.	Type	Description
910-99.02	Each	Misc CCTV Camera Assembly
910-99.02	Each	Misc Install CCTV Camera Assembly
910-99.03	Linear Foot	Misc CCTV Camera Cable

NNNN. Relocate Existing CCTV 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 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:

Item No.	Type	Description
910-99.02	Each	Misc CCTV Camera Assembly Removal and Installation

0000. 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 Materials. 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 the extension pole includes materials, installation and all miscellaneous hardware required for a fully operational system.

Item No.	Type	Description
910-99.02	Each	Misc CCTV Extension Pole, 20' Metallic Finish

PPPP. ITS Pullbox

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

2.0 Materials.

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

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

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

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

3.1 If grading will result in an existing fiber pull box not being flush with the final grading, the pull box elevation should be adjusted to match the final ground surface. If the existing pull box is in a condition that can be adjusted without damage, it can be reused. If a pull box is raised, a split duck system shall be used to protect the cable into the adjusted pull box and the void below the box shall be backfilled and the stone drain installed. If the pull box is lowered, the stone drain shall be provided as shown on the pull box detail. Installing a new pull box or concrete sonotube over the existing ITS pull box is NOT allowed. A concrete pad shall also be installed around the adjusted box. If site conditions do not allow these construction requirements to be met, the contractor shall

suspend such a work and notify MoDOT ITS group via an email to SLITS@modot.mo.gov and carbon copy MoDOT construction inspector immediately for approval of any alternative fiber adjustment option.

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

Item No.	Type	Description
910-99.02	Each	Misc ITS Pull Box with Concrete Pad, Preformed Class 2
910-99.02	Each	Misc ITS Pull Box with Concrete Pad, Preformed Class 5

QQQQ. 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 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	Misc ITS Asset Management Tool

RRRR. Install New or Relocate Existing Communication Equipment

1.0 Description. This work shall consist of the installation and programming of all MoDOT Furnished communication equipment, including ethernet network switch(s) and SFP module(s), or the relocation of said equipment from existing ITS or signal cabinet to new cabinet as shown on the plans. MoDOT SLITS group will provide all IP addresses and switch configuration information needed. The work will include making all necessary connections and testing for proper network connection. This work shall be coordinated in advance with MoDOT SLITS Group via an email to SLITS@modot.mo.gov as described below.

2.0 Materials.

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

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

3.0 Construction Requirements.

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

3.2 The Contractor shall NOT move any cables from port to port on the network switches without prior MoDOT approval. For equipment installed in cabinets, mount the equipment in the rack as shown in the approved cabinet layout diagram or, for existing cabinets, as directed by the engineer, and connect the power cables and ground wires. If there are insufficient outlets in existing cabinets, provide MoDOT approved power strips as required. Connect the communication cables as shown on the connection diagrams in the plans. The equipment will be configured by the MoDOT SLITS group, and therefore do not change any configuration settings.

3.3 Assist MoDOT SLITS 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 MoDOT SLITS staff. It may also entail installing replacement equipment when a unit cannot be made to work properly.

3.4 Cisco Ethernet Switch & SFP Module. 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 SLITS group. 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 two (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 MoDOT SLITS Engineer for programming **at least 2 weeks** prior to the field installation.

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

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

4.0 Basis of Payment. Measurement and payment for communication equipment installation will be on a per cabinet basis. The unit price shall include patch cords, cabling, assistance to Commission staff in getting the equipment operational, documentation, 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	Misc Install or Relocate Ex. Commission Furnished Equipment

SSSS. Installation and Relocation of 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(s) 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 the 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). 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 (1 $\frac{3}{4}$ 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 (1 $\frac{3}{4}$ 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 (1 $\frac{3}{4}$ inch each) in the cabinet. It shall be made of powder-coated aluminum. Provide patch panel modules that are compatible with the connectors specified in section 2.3 of this provision, as needed. These enclosures are typically used in network node cabinets.

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

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

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

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

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

2.9.4 The closure shall accommodate 144 single mode fiber splices.

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

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

2.9.7 Designed for butt splicing.

2.9.8 No encapsulated materials shall be allowed.

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

3.0 Construction Requirements.

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

3.2 Cable Installation.

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

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

3.2.3 Remove existing cable to be relocated and install cable such that the optical and mechanical characteristics of the fiber are not degraded. Do not violate the minimum bend radius or the maximum tension, both during and after installation.

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

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

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

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

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

the length of fiber optic cable being relocated does not allow for fully meeting these slack requirements, maximize fiber slack at cabinets before providing slack in pull boxes.

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

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

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

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

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

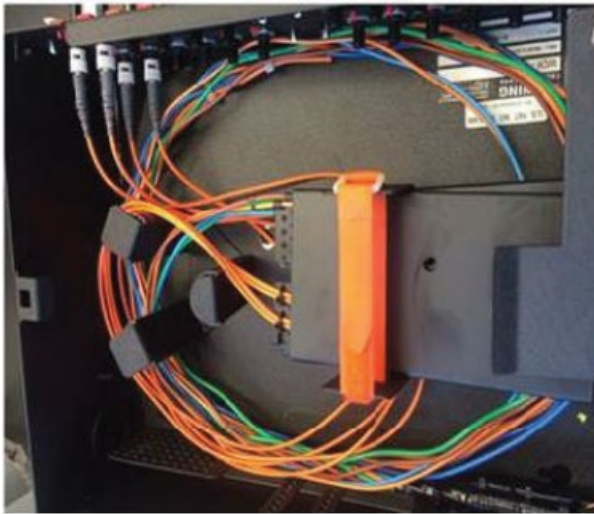
3.3.4 Use a different splice tray for each buffer tube color. If an enclosure contains multiple buffer tubes of the same color, but none of the fibers in one of the tubes are spliced to fibers in other tubes of the same color, use a separate splice tray for that tube.

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

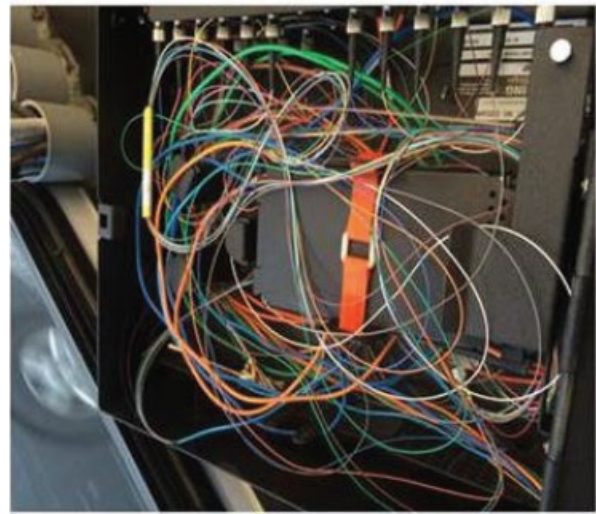
3.5 Tracer Wire. The contractor shall install a jacketed #14 AWG XHHW-2 standard blue tracer wire (also known as the locator wire) in conduit with new or replaced fiber optic cable(s). In the pull box nearest to the ITS or signal cabinet connect the tracer wire to a ground rod with a ground rod clamp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

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

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



Acceptable



Unacceptable

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

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

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

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

3.10 If grading will result in an existing fiber pull box not being flush with the final grading, the pull box elevation should be adjusted to match the final ground surface. If the existing pull box is in a condition that can be adjusted without damage, it can be reused. If a pull box is raised, a split duck system shall be used to protect the cable into the adjusted pull box and the void below the box shall be backfilled and the stone drain installed. If the pull box is lowered, the stone drain shall be provided as shown on the pull box detail. Installing a new pull box or concrete sonotube over the existing ITS pull box is NOT allowed. A concrete pad shall also be installed around the adjusted box. If site conditions do not allow these construction requirements to be met, the contractor shall

suspend such a work and notify MoDOT ITS group via an email to SLITS@modot.mo.gov and carbon copy MoDOT construction inspector immediately for approval of any alternative fiber adjustment option.

4.0 Acceptance Testing.

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

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

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

Maximum link loss = Measured loss over portion installed by others
+ (Fiber length in km) x (0.35 for 1310 nm and 0.25 for 1550 nm)
+ (Number of fusion splices) x (0.05)
+ (Number of mechanical splices [for temp. connection]) x (0.3)
+ (Number of connections) x (0.5)

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	Misc Fiber Optic Fusion Splice
910-99.02	Each	Misc Fiber Optic Pigtail
910-99.02	Each	Misc Fiber Optic Jumper
910-99.02	Each	Misc Wall Wall-Mounted Interconnect Center
910-99.03	Linear Foot	Misc Fiber Optic Cable 24 Strand Single Mode

TTTT. ITS Conduit

1.0 Description.

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

2.0 Materials.

2.1 Use PVC conduit meeting the requirements of Sec 1060.

2.2 Use HDPE conduit meeting the requirements of Sec 1060. Use orange conduit for communication cable and black for power cable.

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

3.0 Construction Requirements.

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

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

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

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

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

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

Conduit under non-paved areas for trench method shall be 30 inches of cover.

3.2 Directional Drilling.

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

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

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

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

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

3.3 Intercept Existing Conduit with Proposed Pull Box.

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

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

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

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

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

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

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

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

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

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

3.4 Install Conduit into Existing Pull Box.

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

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

3.4.3 Install the conduit.

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

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

4.0 Basis of Payment.

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

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

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

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

Item No.	Type	Description
910-99.03	Linear Foot	Misc 2-In Push Conduit

UUUU. Disposal of Existing MoDOT Assets

1.0 Existing assets shall be removed and delivered to a designated MoDOT facility as described herein. Existing assets, including signal cabinet assemblies and ITS facilities as noted in the plans shall be removed by the contractor, tagged with the time and date of removal and intersection name, and transported to the Missouri Department of Transportation's maintenance lot located at 2309a Barrett Station Road, Ballwin, Missouri 63021 within 48 hours. The contractor shall notify the following MoDOT signal shop Supervisors 24 hours prior to each delivery:

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

All other existing signal and lighting equipment to be removed as shown on plans or as directed by Engineer shall be removed and disposed of by the contractor.

2.0 The contractor shall exercise reasonable care in the handling of existing assets and the signal cabinet assemblies 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. All other equipment removed from the intersections shall become the property of the contractor and be removed from MoDOT right-of-way.

3.0 The contractor shall restore those areas disturbed by the equipment removal or installation according to specifications herein. This work will be considered included in the unit contract price for Removal of Improvements.

VVVV. MoDOT Buried Cable Drivable Delineator Post

1.0 Description. The contractor shall install a MoDOT 'Buried Cable' delineator post next to each ITS pull box within the project limits as indicated on the plans.

2.0 Materials. See detail in the plans. The post shall be supplied in orange color and incorporate a premium UV inhibitor package to resist harmful effects to the sun. The post shall withstand multiple directional impacts and provide a long lasting and extremely durable product requiring little field maintenance. The post shall have a minimum 0.20" wall thickness and shall stand up straight in all weather conditions and self-right to straight upon impact. Top of post shall be permanently sealed and partially flattened and transition to round to afford 360 degree visibility. The post materials shall include an anchor, a non-mechanical flexible joint, and a round delineator post.

The post assembly should allow for easy change-out of any one part if necessary.

3.0 Construction Requirements. Construction requirements shall conform to the delineator post manufacturer's recommendations and engineer's approval. If the plans show the post near a pull box, put it next to the box as an aid to finding the box. Do not drive it through the conduit.

4.0 Basis for Payment. Payment for the 'Buried Cable' delineator post shall be considered full compensation for all contractor-provided equipment items, labor, and material to complete the described work. Payment will be made as follows:

Item No.	Type	Description
910-99.02	Each	Misc MoDOT Buried Cable Drivable Delineator Post