MEMORANDUM

TO:	All Plan Holders
FROM:	City of Kirkwood
PROJECT:	Kirkwood Road Signal Optimization and Interconnect Project & South Kirkwood Road-Nipher Middle School Safe Route to School Project
DATE:	September 6, 2018
SUBJECT:	Addendum No. 2
PROJECT NUMBER:	CMAQ-5502(605) & TAP-5502(607)

This addendum forms a part of the Contract Documents for the Kirkwood Road Signal Optimization and Interconnect Project & South Kirkwood Road-Nipher Middle School Safe Route to School Project. Contractors are required to acknowledge the receipt of addenda by signing and including all addenda with each bid form. FAILURE TO ACKNOWLEDGE RECEIPT OF ADDENDUM MAY SUBJECT BIDDER TO DISQUALIFICATION.

Notice to Bidders:

1. **Revised Sheet 2, Typical Sections & General Notes, Sheet 1 of 3.**

Added General Note 16:

- Added a note to specify the City's standard drawings and detailed specifications for pavement restoration for any disturbed areas during construction within City R/W and a note to use MoDOT's Specifications and Standards for pavement restoration for any disturbed areas during construction with MoDOT R/W.

  16. THE CONTRACTOR SHALL FOLLOW THE CITY OF KIRKWOOD'S STANDARD DRAWINGS AND DETAILED SPECIFICATIONS FOR PAVEMENT RESTORATION FOR ANY DISTURBED AREAS DURING CONSTRUCTION INSIDE CITY R/W. THE CONTRACTOR SHALL FOLLOW MODOT SPECIFICATIONS AND STANDARD PLANS FOR PAVEMENT RESTORATION FOR ANY DISTURBED AREAS DURING CONSTRUCTION INSIDE MODOT R/W. THIS INCLUDES, BUT NOT LIMITED TO, BORING OPERATIONS, PAVEMENT CORING, AND ANY OTHER NECESSARY WORK NEEDED FOR CONSTRUCTION OPERATIONS. NO ADDITIONAL PAYMENT WILL BE MADE TO RESTORE THE AREAS BACK TO THEIR ORIGINAL CONDITIONS, UNLESS SPECIFICALLY SHOWN ON THE PLANS. THE CITY'S STANDARDS CAN BE FOUND AT: http://www.kirkwoodmo.org/mm/files/Engineering/Standard%20Construction%20Details.pdf

2. **Revised Sheet 155 (Signal Sheet at Big Bend Road).**

Clarified that the Uninterruptible Power Supply shall be mounted on the side of the signal cabinet:

- Revised the New Signal Cabinet call out to say:

  "New Signal Cabinet; Uninterruptible Power Supply shall be mounted on the side of the signal cabinet"

3. **Revised Job Special Provisions.**

Revised JSP DDD – Uninterruptible Power Supply (City Intersections):

- Added a note to this JSP to specify that this specification also applies to the intersection at Big Bend Road (MoDOT Intersection).

Revised JSP UUU – NEMA TS2 Traffic Controller Assemblies JSP-00-004:

- Clarified that the access to the rear side of the back panel shall be provided for troubleshooting and repair by means on hinged door located on the rear side of the cabinet, for MoDOT intersections at Manchester Road and Big Bend Road only. The City of Kirkwood intersections do no require a door on the rear side of the cabinet.

Name and Title of Signer (Print or type)
Contractor / Bidder Signature _____ (Signature of person authorized to sign)
Date Signed:

End of Addendum No. 2

CMAQ-5502 (605)
TAP-5502 (607)

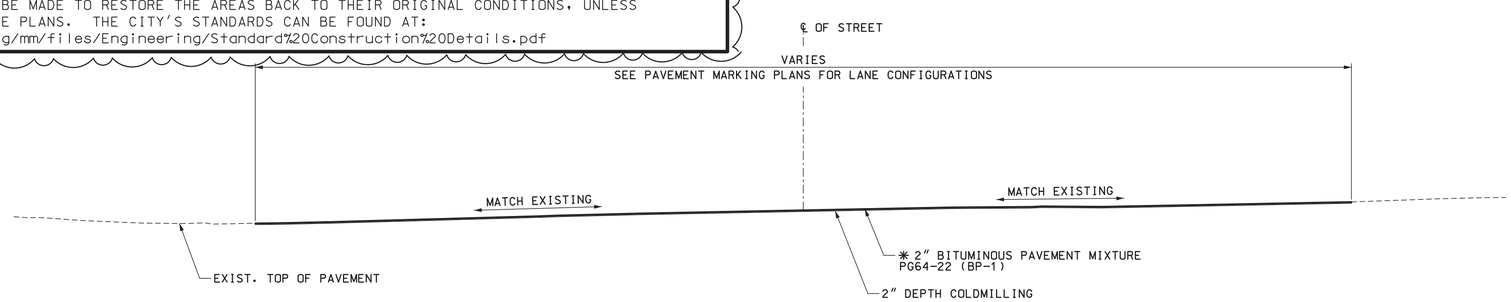
GENERAL NOTES

1. ANY WORK INDICATED ON THE PLANS THAT EXTENDS BEYOND THE PROJECT LIMITS IS CONSIDERED INCIDENTAL TO AND PART OF THE CONSTRUCTION OF THIS PROJECT.
2. THE BASIS OF BEARING IS GRID NORTH, MISSOURI COORDINATE SYSTEM 1983, EAST ZONE. VERTICAL DATUM IS NAVD88.
3. SEE SIGNING SHEETS FOR SIGNING RELATED REMOVALS.
4. SEE SIGNAL SHEETS FOR SIGNAL RELATED REMOVALS.
5. UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEY AND RECORDS. THE CITY DOES NOT WARRANT THE LOCATIONS OF THESE FACILITIES AS PRECISE. IT IS POSSIBLE THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN OR SHOWN. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXISTENCE AND PRECISE LOCATION OF ALL FACILITIES AND TO AVOID DAMAGE. SEE THE JOB SPECIAL PROVISIONS FOR A LIST OF UTILITY COMPANIES ON OR WITHIN THE VICINITY OF THE PROJECT LIMITS.
6. CONTRACTOR SHALL REFERENCE AND FOLLOW THE MODOT ADA CHECKLIST WHEN LAYING OUT AND CONSTRUCTING CURB RAMPS, LANDINGS, SIDEWALK, PAVED APPROACH SIDEWALK CONNECTIONS, PEDESTRIAN SIGNALS, AND ANY OTHER PEDESTRIAN ITEMS ON THIS PROJECT.
7. THERE SHALL BE A MINIMUM OF 4′ OF HORIZONTAL SIDEWALK CLEAR SPACE AROUND FEATURES SUCH AS EXISTING POWER POLES, NEW SIGNAL MAST ARMS, NEW SIGNAL 8′ TALL POSTS, AND ANY OTHER FEATURES THAT PROTRUDE ABOVE THE GROUND.
8. RADII AT INTERSECTION QUADRANTS SHALL MATCH EXISTING, UNLESS THERE ARE RADIUS IMPROVEMENTS AS SHOWN ON THE PLANS.
9. SAWCUTS ARE REQUIRED ALONG FACE OF EXISTING CURBS AT INTERSECTION QUADRANTS. SAWCUT LINES ARE NOT CALLED OUT ON THE PLANS.
10. SAWCUTS ARE REQUIRED AT THE FRONT AND BACK OF PAVED APPROACHES. SAWCUT LINES ARE NOT CALLED OUT ON THE PLANS.
11. TRUNCATED DOMES SHALL BE RED IN COLOR ON ALL CURB RAMPS / LANDINGS.
12. ALL DRAINAGE STRUCTURES ARE TO BE USED IN PLACE UNLESS NOTED. ADJUSTMENTS OF STRUCTURES WILL CONFORM WITH MSD REQUIREMENTS.
13. INSTALLATION OF SIGNAL CONDUIT, PULL BOXES, AND POST FOUNDATIONS WILL RESULT IN EXISTING AREAS BEING DISTURBED. NO ADDITIONAL PAYMENT WILL BE MADE TO RESTORE THE AREAS BACK TO THEIR ORIGINAL CONDITIONS, UNLESS SPECIFICALLY SHOWN ON THE PLANS.
14. REFER TO THE JSPs FOR ADDITIONAL REQUIREMENTS AT MODOT INTERSECTIONS & CITY INTERSECTIONS.
15. EXISTING CITY OF KIRKWOOD RIGHT OF WAY ON THE PROJECT IS CALLED OUT AS "EXIST. R/W". EXISTING MODOT RIGHT OF WAY ON THE PROJECT IS CALLED OUT AS "EXIST. MODOT R/W".
16. THE CONTRACTOR SHALL FOLLOW THE CITY OF KIRKWOOD'S STANDARD DRAWINGS AND DETAILED SPECIFICATIONS FOR PAVEMENT RESTORATION FOR ANY DISTURBED AREAS DURING CONSTRUCTION INSIDE CITY R/W. THE CONTRACTOR SHALL FOLLOW MODOT SPECIFICATIONS AND STANDARD PLANS FOR PAVEMENT RESTORATION FOR ANY DISTURBED AREAS DURING CONSTRUCTION INSIDE MODOT R/W. THIS INCLUDES, BUT NOT LIMITED TO, BORING OPERATIONS, PAVEMENT CORING, AND ANY OTHER NECESSARY WORK NEEDED FOR CONSTRUCTION OPERATIONS. NO ADDITIONAL PAYMENT WILL BE MADE TO RESTORE THE AREAS BACK TO THEIR ORIGINAL CONDITIONS, UNLESS SPECIFICALLY SHOWN ON THE PLANS. THE CITY'S STANDARDS CAN BE FOUND AT: http://www.kirkwoodmo.org/mm/files/Engineering/Standard%20Construction%20Details.pdf

ADDENDUM #2

MSD NOTES

1. ALL STORM AND SANITARY SEWER STRUCTURES AND APPURTENANCES TO BE DEDICATED TO MSD, OR TO BE PRIVATE UNDER MSD INSPECTIONS, SHALL CONFORM TO THE METROPOLITAN ST. LOUIS SEWER DISTRICT, STANDARD CONSTRUCTION SPECIFICATIONS FOR SEWERS AND DRAINAGE FACILITIES, 2009. THAT WILL INCLUDE STANDARD DETAILS SHOWN THEREIN, AND SHALL INCLUDE ALL SUBSEQUENT CHANGES MADE THERETO.
2. A MINIMUM 6 INCH CURB OPENING SHALL BE MAINTAINED AT ALL INLETS IN OVERLAY AREAS. (SEE DETAIL SHEET #59 IN MSD'S STANDARD CONSTRUCTION SPECIFICATIONS FOR SEWERS AND DRAINAGE FACILITIES, 2009). SEE TYPICAL SECTION SHEET 3 FOR THIS DETAIL.



TYPICAL COLDMILL AND OVERLAY OF STREETS

ESSEX AVE.	STA. 9+52.17 TO STA. 10+48.65
KIRKWOOD RD.	STA. 587+45.78 TO STA. 588+21.25
WASHINGTON AVE.	STA. 9+48.71 TO STA. 10+48.26
KIRKWOOD RD.	STA. 603+85.89 TO STA. 604+79.32
ADAMS AVE.	STA. 9+39.99 TO STA. 10+57.97
KIRKWOOD RD.	STA. 607+53.02 TO STA. 608+75.15
JEFFERSON AVE.	STA. 9+42.37 TO STA. 10+48.57
KIRKWOOD RD.	STA. 611+45.98 TO STA. 612+28.92
ARGONNE DR.	STA. 9+42.20 TO STA. 10+65.11
ARGONNE DR.	STA. 9+57.19 TO STA. 10+67.69
KIRKWOOD RD.	STA. 615+25.32 TO STA. 616+23.66
MADISON AVE.	STA. 9+79.10 TO STA. 10+57.06
KIRKWOOD RD.	STA. 620+24.53 TO STA. 621+18.30
MONROE AVE.	STA. 9+45.67 TO STA. 10+64.06
KIRKWOOD RD.	STA. 623+71.32 TO STA. 624+97.47
WOODBINE AVE.	STA. 9+43.85 TO STA. 10+22.80
KIRKWOOD RD.	STA. 640+61.77 TO STA. 641+80.22
ROSEHILL AVE.	STA. 9+48.38 TO STA. 10+53.49
KIRKWOOD AVE.	STA. 654+38.81 TO STA. 655+31.40

✳ NOTE:

EXTRA TONNAGE IS INCLUDED IN THE QUANTITIES TO WARP IN NEW PAVEMENT ELEVATIONS WHERE THE CURB RAMPS/LANDINGS MEET THE EDGE OF PAVEMENT, AS NEEDED FOR ADA COMPLIANCE.

DISCLAIMER
THE PROFESSIONAL WHOSE SIGNATURE AND PERSONAL SEAL APPEAR HEREON ASSUMES RESPONSIBILITY ONLY FOR WHAT APPEARS ON THIS PAGE, AND DISCLAIMS (PURSUANT TO SECTION 327.411 RSMO) SPECIFICATION, ESTIMATES, REPORTS, OR OTHER DOCUMENTS OR INSTRUMENTS NOT SEALED BY THE UNDERSIGNED PROFESSIONAL RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE PROJECT TO WHICH THIS PAGE REFERS.

LEGEND

EXISTING ROADWAY EASEMENT	
EXISTING RIGHT-OF-WAY	
SAWCUT LINE	
PROPOSED RIGHT-OF-WAY	
PROPERTY LINE	℄
FENCE	X
EXISTING CABLE TV LINE	CATV
PROPOSED POWER/CABLE TV LINE	
TELEPHONE LINE	T
OVERHEAD POWER LINE	
UNDERGROUND POWER LINE	P
PROPOSED UNDERGROUND POWER LINE	P
FIBER LINE	FO
GAS LINE	G
WATERMAIN	W
EXIST. GUARDRAIL	
GATE VALVE WITH VALVE BOX.	
FIRE HYDRANT ASSEMBLY	
MJ PLUG WITH THRUST BLOCK	
EXIST. VEGITATION	
EXIST. SANITARY SEWER MANHOLE	SAN
EXIST. STORM SEWER MANHOLE	STORM
ELECTRICAL MANHOLE	ELEC MH
ELECTRICAL METER	EM
TELEPHONE MANHOLE	TMH
GAS DISCONNECT	GD
TELEPHONE AND CABLE	T&C
FIRE HYDRANT	HYD
SPRINKLER HEAD	
WATER SPIGOT	
IRRIGATION CONTROL VALVE	ICV
WATER VALVE	WV
WATER METER	WM
GAS VALVE	GV
GAS METER	GM
POWER SUPPLY	MODOT
EXISTING POWER POLE	PP
POWER POLE	
TELEPHONE POLE	TELE POLE
GUY WIRE	
GUY WIRE	GUY
POWER AND LIGHT	PAL
TELEPHONE PEDESTAL	PED
MAILBOX	
PROPOSED ℄ ROAD	
SIGN	
TRAFFIC MOVEMENT	
ADJUST TO GRADE	(ATG)
TO BE REMOVED	(R)
TO BE REMOVED AND REPLACED	(R&R)
TO BE RELOCATED	(RELOC.)
USE IN PLACE	(UIP)
DO NOT DISTURB	(DND)
TO BE ABANDONED	(TBA)
TO BE ABANDONED AND FILLED	(TBA&F)
TO BE REMOVED BY OTHERS	(TBRBO)
REMOVED BY OTHERS	(RBO)
REMOVED AND RELOCATED	(R&RELOC.)
TYPICAL	(TYP.)
CURB AND GUTTER	(C&G)
SLOPE LIMITS	SLC/SLF
EXISTING HOUSE	H
EXISTING BUILDING	B
PERMANENT SIDEWALK AND UTILITY EASEMENT	P.S.U.E.
PERMANENT UTILITY EASEMENT	P.U.E.
TEMPORARY CONSTRUCTION EASEMENT	T.C.E.
CONCRETE	CONC.
PROFILE GRADE LINE	PGL

STATE OF MISSOURI
JOHN R. KEEVEN
NUMBER PE-2010000836
PROFESSIONAL ENGINEER

THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

JOHN R. KEEVEN
PROFESSIONAL ENGINEER
MO. P.E. LICENSE • 2010000836

REVISIONS

NUMBER	BY	DATE
2	CMT	9-5-2018

TYPICAL SECTIONS & GENERAL NOTES

SHEET 1 OF 3

CITY OF KIRKWOOD, MISSOURI
KIRKWOOD ROAD SIGNAL OPTIMIZATION AND INTERCONNECT
CMAQ-5502 (605) &
SOUTH KIRKWOOD ROAD-NIPHER MIDDLE SCHOOL
SAFE ROUTE TO SCHOOL TAP-5502 (607)

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ST. LOUIS, MO 63102 (314) 436-5500
ENGINEERING CORPORATION - 000631

LOCHMUELLER GROUP
411 N. 10th Street, Suite 200
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phone: 314.421.3391
fax: 314.421.3392

DATE: 9/6/2018

JOB No: 16401-04-00
16401-13-00

002_GENERAL NOTES.dgn

17MSD-00100, BASEMAPS 22M4, 23M1, 23M4, 24M1, 24M4

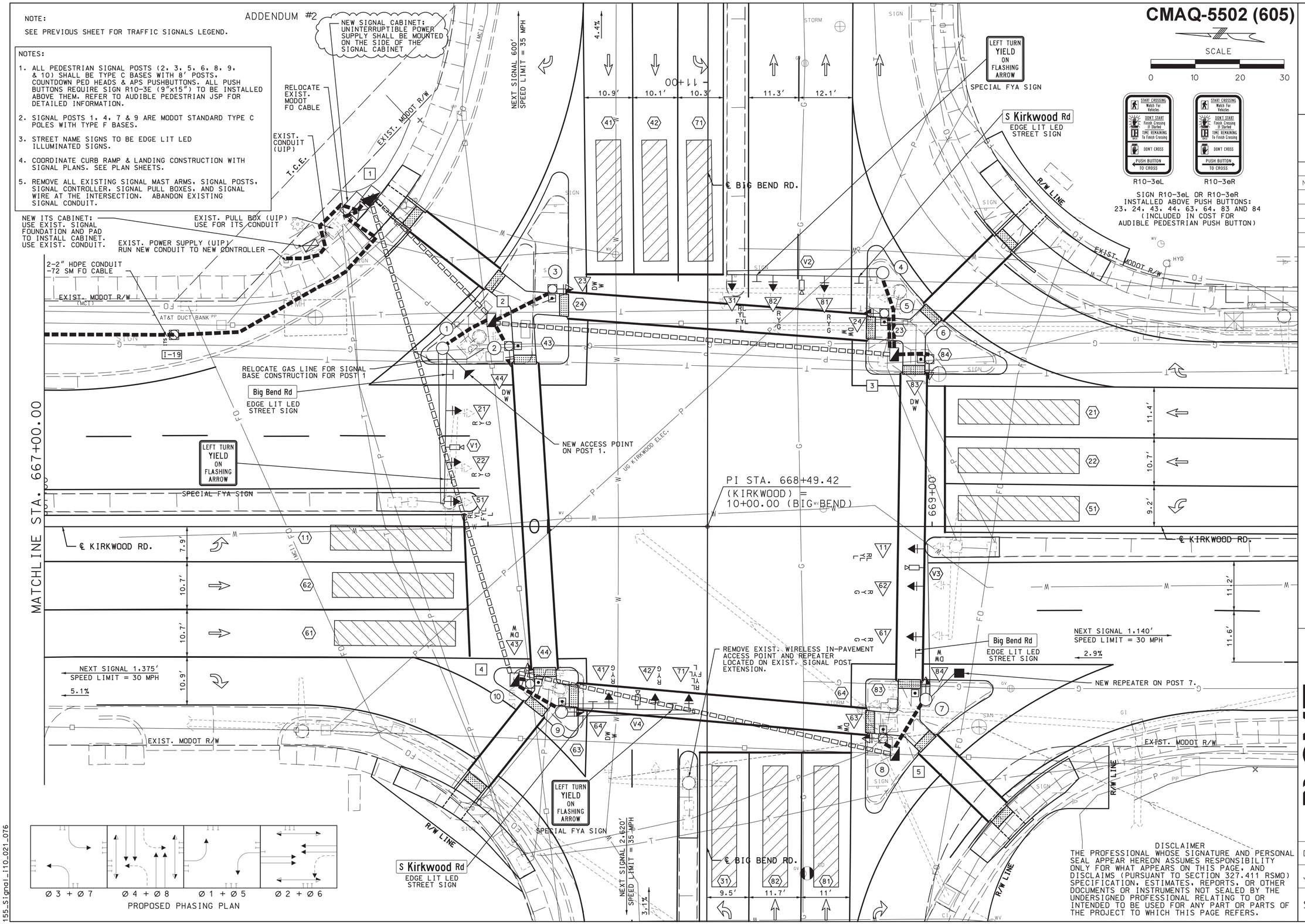
NOTE:

SEE PREVIOUS SHEET FOR TRAFFIC SIGNALS LEGEND.

ADDENDUM #2

NOTES:

1. ALL PEDESTRIAN SIGNAL POSTS (2, 3, 5, 6, 8, 9, & 10) SHALL BE TYPE C BASES WITH 8′ POSTS. COUNTDOWN PED HEADS & APS PUSHBUTTONS. ALL PUSH BUTTONS REQUIRE SIGN R10-3E (9″x15″) TO BE INSTALLED ABOVE THEM. REFER TO AUDIBLE PEDESTRIAN JSP FOR DETAILED INFORMATION.
2. SIGNAL POSTS 1, 4, 7 & 9 ARE MODOT STANDARD TYPE C POLES WITH TYPE F BASES.
3. STREET NAME SIGNS TO BE EDGE LIT LED ILLUMINATED SIGNS.
4. COORDINATE CURB RAMP & LANDING CONSTRUCTION WITH SIGNAL PLANS. SEE PLAN SHEETS.
5. REMOVE ALL EXISTING SIGNAL MAST ARMS, SIGNAL POSTS, SIGNAL CONTROLLER, SIGNAL PULL BOXES, AND SIGNAL WIRE AT THE INTERSECTION. ABANDON EXISTING SIGNAL CONDUIT.



CMAQ-5502 (605)

SCALE

0 10 20 30

R10-3eL R10-3eR

SIGN R10-3eL OR R10-3eR INSTALLED ABOVE PUSH BUTTONS: 23, 24, 43, 44, 63, 64, 83 AND 84 (INCLUDED IN COST FOR AUDIBLE PEDESTRIAN PUSH BUTTON)

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STATE OF MISSOURI — JOHN R. KEEVEN — NUMBER PE-2010000836 — PROFESSIONAL ENGINEER

THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

JOHN R. KEEVEN
PROFESSIONAL ENGINEER
MO. P.E. LICENSE • 2010000836

REVISIONS

NUMBER	BY	DATE
2	CMT	9-5-2018

SIGNAL SHEET

SHEET 76 OF 117

CITY OF KIRKWOOD, MISSOURI
KIRKWOOD ROAD SIGNAL OPTIMIZATION AND INTERCONNECT
CMAQ-5502 (605) &
SOUTH KIRKWOOD ROAD-NIPHER MIDDLE SCHOOL
SAFE ROUTE TO SCHOOL TAP-5502 (607)

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ENGINEERING CORPORATION - 000631

LOCHMUELLER GROUP
411 N. 10th Street, Suite 200
St. Louis, MO 63101
PHONE: 314.621.1355

DATE: 9/5/2018

JOB No: 16401-04-00
16401-13-00

SHEET 155 OF 196

JOB SPECIAL PROVISIONS TABLE OF CONTENTS (ROADWAY)

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

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D. Emergency Provisions And Incident Management JSP-90-11
E. Utilities JSP-93-26F
F. Americans With Disabilities ACT (ADA) Compliance And Final Acceptance Of Constructed Facilities JSP-10-01A
G. Safety Requirements
H. Safety Plan
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J. Add Alternates
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SS. Lighting Cabinet Mounted on Signal Cabinet

TT. Painting of Signal Equipment
UU. Replace Travel Time & Count System (MoDOT Signals)
VV. Disposition of Existing City Equipment
WW. Disposition of Existing MoDOT Equipment
XX. Accessible Pedestrian Pushbuttons And Signing (City Intersections)
YY. Accessible Pedestrian Pushbuttons And Signing (MoDOT Intersections)
ZZ. Pedestrian Signal Heads
AAA. Fiber Optic Cable and Connections
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CCC. Network Connected Signal Monitor
DDD. Uninterruptible Power Supply (City intersections) - Addendum #2
EEE. Video Detection System (City Intersections)
FFF. Video Detection System (MoDOT Intersections)
GGG. ITS Conduit and Pull Boxes
HHH. Flashing Yellow Arrow (FYA) Backpanel
III. 16-Position Back Panel Wiring – Traffic Signal Cabinet
JJJ. Equipment Cabinets
KKK. Closed Circuit Television (CCTV) Camera System
LLL. Install CCTV Assembly (Manchester Road)
MMM. Ethernet Switch
NNN. GPS Unit
OOO. 120 Volt IP Addressable Power Strip
PPP. Network Connected Signal Controller (City Intersections) - Addendum #1
QQQ. Advanced Traffic Controller (MoDOT Intersections)
RRR. Relocate Existing communication Equipment (Manchester Road)
SSS. Coordination With ITS Staff And Utility Locates
TTT. Railroad Wayfinding Sign
UUU. NEMA TS2 Traffic Controller Assemblies JSP-00-04 - Addendum #1 - Addendum #2
VVV. Railroad Coordination, Flagging, and Insurance
WWW. Liquidated Damages Specified for Railroad Wireline Installation - Addendum #1

STATE OF MISSOURI
JOHN R. KEEVEN
NUMBER PE–2010000836
PROFESSIONAL ENGINEER

THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

CITY OF KIRKWOOD
212 S. Taylor Avenue
Kirkwood, MO 63122
Phone 314-822-5850

Crawford, Murphy & Tilly, Inc.
One Memorial Drive, Suite 500
St. Louis, MO 63102
Certificate of Authority: 000631
Consultant Phone: (314) 436-5500

If a seal is present on this sheet, JSP's have been electronically sealed and dated.

PROJECT NO. CMAQ-5502(605) & TAP-5502(607)
CITY OF KIRKWOOD
DATE PREPARED: July 24th, 2018

ADDENDUM:
#1 – August 24th, 2018
#2 – September 6th, 2018

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

A. GENERAL – FEDERAL JSP-09-02C

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 "Bidding". 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 "Business"; "Standards and Specifications". The effective version shall be determined by the letting date of the project.

General Provisions & Supplemental Specifications

Supplemental Plans to July 2017 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. PROJECT CONTACT FOR CONTRACTOR/BIDDER QUESTIONS

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

David Weidler, CPPO, CPPB
Director of Procurement
City of Kirkwood, Missouri
212 S. Taylor Avenue
Kirkwood, MO 63122
314-822-5850
weidledc@kirkwoodmo.org

C. WORK ZONE TRAFFIC MANAGEMENT PLAN (WZTMP) JSP-02-06D

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 Work Zone Specialist (WZS). The Traffic Management Plan shall name an individual, either employed by the contractor or hired by the contractor, to act as the Work Zone Specialist (WZS) throughout the entirety of the project. Any change in personnel for the WZS shall be submitted in written form to the engineer. This individual will be a trained Work Zone Specialist in accordance with Standard Specifications Section 616.3.3 and will be directly involved with daily traffic management and traffic management planning. It will be the responsibility of the WZS to coordinate daily traffic management with the engineer. The WZS shall maintain daily contact with the engineer either on-site or via telecommunication.

1.2 Maintaining Work Zones and Work Zone Reviews. The WZS shall maintain work zones on a daily basis to ensure safety to the traveling public and the workers; this includes long term work zones that have devices and/or roadway conditions that need to be maintained. If the engineer or a designated MoDOT employee (identified at the preconstruction meeting) notifies the WZS of any safety or traffic delay concerns in the work zone, the WZS shall promptly inspect and work to provide a solution to correct the situation. The WZS shall have personnel reviewing traffic control devices daily and any temporary lane drop traffic control devices for initial set up and during the operation. Missing, damaged or over-turned traffic control devices shall typically be corrected without the need for direction by the engineer. The WZS is responsible to assure all traffic control devices are maintained in accordance with EPG standards. The WZS is responsible to ensure 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. The WZS and engineer shall submit one joint weekly technical review of work zone operations identifying any concerns present and the corrective actions taken. Reviews may be subjected to unannounced inspections by the engineer to corroborate the validity of the ratings. The engineer and WZS will be notified of the results.

1.3 Work Zone Conflict Resolution. Any conflict resolution shall be in accordance with Standard Specifications Section 616.4. 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, hours traffic control will be in place, and work hours.

2.2 The contractor shall request permission at least two working days prior to lane closures or shifting traffic onto detours, and 14 calendar days prior to the imposition of height, width or

weight restrictions. This is to ensure closures do not conflict with other work within the zone of influence and the work zone information on the MoDOT's website can remain real-time.

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 10 minutes to prevent congestion from escalating to 15 minutes 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 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 When a traffic queue extends 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 due to non-recurring congestion, the contractor shall deploy a means of providing advance warning of the traffic congestion, as approved by the engineer. The warning location shall be no less than 1000 feet and no more than 0.5 miles in advance of the end of the traffic queue on divided highways and no less than 500 feet and no more than 0.5 miles in advance of the end of the traffic queue on undivided highways.

3.0 Work Hour Restrictions.

3.1 There are six major holiday periods shown below. All lanes shall be scheduled to be open to traffic during these holiday periods, from 12:00 noon on the last working day proceeding the holiday until 9:00 a.m. on the first working day subsequent to the holiday.

Memorial Day
Independence Day
Labor Day

Thanksgiving
Christmas
New Year's Day

3.1.1 The contractor's working hours will be restricted for the Special Events when notified by the City. The City shall notify the Contractor 14 days in advance of Special Events. All lanes shall be scheduled to be open to traffic during these Special Events.

The City will be closing Kirkwood Road between Argonne Dr and Adams Ave for a festival in 2019, exact date to be determined. The Contractor shall have the work completed at these intersections or not start in this area until after the festival is over.

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

3.3 The contractor shall be aware that traffic data indicates construction operations on the roadbed between the hours of 6:30 a.m. and 9:00 a.m. and between 3:45 p.m. and 6:30 p.m. Monday through Friday will likely result in traffic queues greater than 15 minutes. Based on this data the contractors operations will be restricted accordingly unless it can be successfully demonstrated that their operations can be performed without a 15 minute queue in traffic. It shall be the responsibility of the engineer to determine if the above work hours may be modified. Working hours for evenings, weekends and holidays will be determined by the engineer.

3.4 The contractor shall not perform any construction operation between the hours of 6:00 p.m. and 7:00 a.m. Monday thru Friday unless authorized by the City of Kirkwood. The Contractor shall request approval for any nighttime hours. In addition, the contractor shall not perform any construction operation on the weekends, unless approved by the engineer. The contractor must obey all City ordinances with regards to working hours, unless prior approval is granted.

4.1 Detours and Lane Closures

4.2 The contractor shall provide changeable message signs notifying motorists of future traffic disruption and possible traffic delays one week before traffic is shifted to a detour or prior to lane closures. The changeable message sign shall be installed at a location as approved or directed 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 Standard Specifications Section 616.

D. <u>EMERGENCY PROVISIONS AND INCIDENT MANAGEMENT JSP-90-11</u>

1.0 The contractor shall have communication equipment on the construction site or immediate access to other communication systems to request assistance from the police or other emergency agencies for incident management. In case of traffic accidents or the need for

police to direct or restore traffic flow through the job site, the contractor shall notify police or other emergency agencies immediately as needed. The area engineer's office shall also be notified when the contractor requests emergency assistance as well as the City of Kirkwood's Office.

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

Kirkwood Police	(314)822-5858
Kirkwood Fire	(314)822-5883
St. Louis County Police	(314) 889-2341
MoDOT TMC	(314) 275-1500

In emergency or off duty hours dial 911

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

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

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

E. UTILITIES JSP-93-26F

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:

Utility Name	**Known Required Adjustment**
Charter Communications 101 Northwest Plaza Saint Ann, MO 63174 Contact: Ron Williams Telephone: 636-387-6641 Email: ron.williams@charter.com	Yes
Spire Energy (Laclede Gas) 4118 Shrewsbury Ave Shrewsbury, MO 63119 Contact: Brian Langenbacher Telephone: 314-768-7767	Yes

Email: Brian.Langenbacher@spireenergy.com

Missouri American Water
727 Craig Road, Suite 201 — No
St. Louis, MO 63141
Contact: Monte Griffith
Telephone: 314-992-2247
Email: Monte.Griffith@amwater.com

Ameren-Missouri
12121 Dorsett Road Building W — No
Maryland Heights, MO 63043
Contact: Brian Berghoefer
Telephone: 314-344-9527
Email: bberghoefer@ameren.com

MSD
2350 Market Street — Yes (in contract)
St. Louis, MO 63103 — MSD Records # 17MSD-00100
Contact: Sara Kammerer
Telephone: 314-768-6317
Email: skammerer@stlmsd.com

AT&T
12851 Manchester Road — Yes
Des Peres, MO 63131
Contact: Jim Lashley
Telephone: 636-402-7027
Email: jl4728@att.com

City of Kirkwood – Water — Yes
139 South Kirkwood Road
Kirkwood, MO 63112
Contact: Clarence Patterson
Telephone: 314-822-5810
Email: PatterCA@kirwoodmo.org

City of Kirkwood – Electric — Yes
139 South Kirkwood Road
Kirkwood, MO 63112
Contact: Rick McKinley
Telephone: 314-984-5925
Email: mckinlrj@kirkwoodmo.org

Verizon MCI — No
500 Technology Drive
Weldon Spring, MO 63304
Contact: John Garst

Telephone: 636-399-0244
Email: John.Garst@verizon.com

1.0 UTILITY RELOCATION WORK:

1.1 There are several utility valves, meters, manhole lids, signal/lighting pull boxes that need to be adjusted in this contract by the road contractor. Bid items are detailed in the quantity sheet table in the contract plans and the table is labeled "ADJUST TO GRADE".

1.2 There are also other several utility valves, manholes/hand holes, two gas mains and two fire hydrant relocations at various locations in the project limits that the utilities will adjust in coordination with the road contractor's work. A quantity sheet table in the contract plans details all these adjustments to be performed by which utility company. The table is called "UTILITY ADJUSTMENTS BY OTHERS – FOR INFORMATION ONLY". Utility work needs to be coordinated closely with the contractor and each utility company. AT&T, Charter, and Spire Energy advised they need three weeks' notice prior to adjusting facilities.

1.3 Charter and Kirkwood Electric aerial and pole relocations are detailed below. The coordination specifics for each power service connection is also detailed below at each specific location. Contractor to remove all Kirkwood Electric poles. The nine power poles are detailed in the Removal of Improvements items in the contract plans.

2.1 MANCHESTER ROAD INTERSECTION

Charter Communications plans to raise existing overhead facilities on Ameren poles on the west side of South Kirkwood Road soon after the preconstruction meeting.

Power to new signal (UPS)- Kirkwood Electric provides power to the existing power supply. Road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Manchester.

Ameren has aerial facilities on the west side of North Kirkwood Road and **Kirkwood Electric** has aerial facilities on the east side of North Kirkwood Road.

1.2 MID-BLOCK SIGNAL @ HOLLYWOOD LANE

Kirkwood Electric has non-reimbursable work to install a 12' dust to dawn light on new pole on a 12' bracket arm. Kirkwood Electric anticipates installing the new pole and light prior to the preconstruction meeting**.**

Power to new signal (new meter on new Kirkwood Electric pole)- road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Hollywood.

1.3 ESSEX AVE INTERSECTION

Kirkwood Electric will need to install a new pole on the NW & NE quadrant. Kirkwood Electric anticipates installing the new poles prior to the preconstruction meeting**.**

Charter Communications has aerial facilities to transfer to the relocated Kirkwood pole. Charter anticipates completing transfer work three weeks after Kirkwood Electric completes new pole installation.

Power to new signal (new meter on relocated Kirkwood Electric pole)-road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Essex.

1.4 WASHINGTON AVE INTERSECTION

Kirkwood Electric will need to install a new pole on the SE quadrant. Kirkwood Electric anticipates installing the new pole prior to the preconstruction meeting**.**

Charter Communications has aerial facilities to transfer to the relocated Kirkwood pole. Charter anticipates completing transfer work three weeks after Kirkwood Electric completes new pole installation.

Power to new signal (new meter on relocated Kirkwood Electric pole)-road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Washington.

Note: Kirkwood Electric feeds UG power to the existing signal at Adams from the existing traffic signal at Washington Ave. Therefore, the new signal at Adams will need to be replaced prior to the new signal at Washington Ave.

1.5 ADAMS AVE INTERSECTION

Kirkwood Electric will need to install a new pole on the NE quadrant. Kirkwood Electric anticipates installing the new pole prior to the preconstruction meeting**.**

Power to new signal (new meter on existing Kirkwood Electric pole)-road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Adams.

Charter to abandon aerial facilities on the south side Adams on Kirkwood Electric poles soon after the preconstruction meeting.

Note: Kirkwood Electric feeds UG power to the existing signal at Adams from the existing traffic signal at Washington Ave. Therefore, the new signal at Adams will need to be replaced prior to the new signal at Washington Ave.

1.6 JEFFERSON AVE INTERSECTION

Kirkwood Electric will need to install a new pole on the NE quadrant. Kirkwood Electric anticipates installing the new pole prior to the preconstruction meeting**.**

Power to new signal (UIP existing power service on existing Kirkwood Electric pole)

Note: Kirkwood Electric feeds UG power to the existing signal at Jefferson Ave. from the existing traffic signal at Argonne Drive. Therefore, the new signal at Jefferson Ave. will need to be replaced prior to the new signal at Argonne Drive.

1.7 ARGONNE DRIVE INTERSECTION

Power to new signal (new pad mount power supply from new Kirkwood Electric pedestal)-road contractor to contact Rick McKinley with Kirkwood Electric via email two weeks prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Argonne. Kirkwood Electric will need to replace an outdated electric pedestal prior to providing service to contractor.

Kirkwood Electric anticipates installing the new electric pedestal prior to the preconstruction meeting**.**

Note: Kirkwood Electric feeds UG power to the existing signal at Jefferson Ave. from the existing traffic signal at Argonne Ave. Therefore, the new signal at Jefferson Ave. will need to be replaced prior to the new signal at Argonne Drive.

1.8 MADISON AVE INTERSECTION

Power to new signal (new pad mount power supply from existing Kirkwood Electric pad mount transformer)-road contractor to contact Rick McKinley with Kirkwood Electric via email two weeks prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Madison. Kirkwood Electric will coordinate work for contractor to install conduit under pad mount transformer.

1.9 MONROE AVE INTERSECTION

Power to new signal (new pad mount power supply from existing Kirkwood Electric pad mount transformer)-road contractor to contact Rick McKinley with Kirkwood Electric via email two weeks prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Monroe. Kirkwood Electric will coordinate work for contractor to install conduit under pad mount transformer.

2.0 WOODBINE AVE INTERSECTION

Kirkwood Electric will need to install a new pole on the NW & NE quadrant. Kirkwood Electric anticipates installing the new poles prior to the preconstruction meeting**.**

Charter Communications has aerial facilities to transfer to relocated Kirkwood poles. Charter anticipates completing transfer work three weeks after Kirkwood Electric completes new pole installation.

Power to new signal (new meter on relocated Kirkwood Electric pole)-road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Woodbine.

2.1 ROSEHILL AVE INTERSECTION

Kirkwood Electric will need to install a new pole on the SW & SE quadrant. The new pole located on the SW quadrant is located adjacent to an active business parking spots. Kirkwood Electric anticipates installing the new poles prior to the preconstruction meeting**.**

Charter Communications has aerial facilities to transfer to relocated Kirkwood poles. Charter anticipates completing transfer work three weeks after Kirkwood Electric completes new pole installation.

Power to new signal (new meter on relocated Kirkwood Electric pole)-road contractor to contact Rick McKinley with Kirkwood Electric via email one week prior to needing new service work to commence using reference name, CMAQ signal @ Kirkwood/Rosehill.

2.2 BIG BEND ROAD INTERSECTION

Power to new signal (UIP existing power supply)- Ameren Electric provides power to the existing power supply.

3.0 The Contractor is responsible for obtaining the MSD Permit for this job. Any fees necessary for the permit will be the Contractor's responsibility to pay. A copy of the MSD Permit shall be given to the Engineer.

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

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

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

F. AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE AND FINAL ACCEPTANCE OF CONSTRUCTED FACILITIES JSP-10-01A

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:

http://www.modot.mo.gov/business/contractor_resources/forms.htm

2.1 The ADA Checklist is intended to be a helpful tool 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. 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-complaint 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 complaint 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-complaint items that are allowed to remain at the end of the construction project. Specific details of the non-complaint 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.

G. SAFETY REQUIREMENTS

Delete Sec 616.3.1 and substitute the following:

616.3.1 All workers within highway right of way shall wear approved ANSI/ISEA 107 Performance Class 2 or 3 safety apparel and more specifically as follows:

616.3.1.1 Daytime Flagger. During daytime activities, flaggers shall wear a high visibility hard hat, safety glasses, a Performance Class 3 top OR a Performance Class 2 top, and safety footwear. Hard hats other than high visibility orange or green shall be covered with a high visibility covering.

616.3.1.2 Daytime Worker. During daytime activities, workers shall wear a hard hat, safety glasses, a Performance Class 3 top OR a Performance Class 2 top, and safety footwear.

616.3.1.3 Nighttime Flagger. During nighttime activities, flaggers shall wear a high visibility/reflective hard hat, safety glasses, a Performance Class 3 top AND Class E bottoms, OR Performance Class 2 top AND Class E bottoms, and safety footwear. Hard hats shall be reflective or covered with a high visibility covering.

616.3.1.4 Nighttime Worker. During nighttime activities, workers shall wear a hard hat, safety glasses, a Performance Class 3 top OR Performance Class 2 top AND Class E bottoms, and safety footwear.

Note: A graphic representation of the various PPE as described above can be found in the "Additional Information" portion of these provisions. A color representation can be found on the MoDOT website at: http://tinyurl.com/Safe-Apparel.

H. SAFETY PLAN

1.0 Description. This contractor shall submit to the engineer a project Safety Plan (SP) for all work performed by the contractor and all subcontractors. The purpose of the SP is to encourage and enable all work to be performed in the safest possible manner and that all parties involved are aware of their individual responsibility for safety on the jobsite.

1.1 The SP shall be completed by the contractor and provided to the engineer prior to the beginning of any construction activity or phase on the project.

1.2 The contractor shall designate a person to serve as Project Safety Manager (PSM). The PSM shall be responsible for implementing and overseeing the SP. The PSM is not required to be present on the project at all times, but must be available to address safety issues and needs.

1.3 The PSM shall make revisions to the SP as necessary. Any new project activities or phases shall be included in the SP prior to work beginning on that activity or phase.

1.4 An example Safety Plan is available at: www.modot.org/safetyplan

2.0 Emergency Preparedness. The SP shall outline and detail for all workers, the specific procedures and actions necessary to respond to a jobsite emergency and the measures taken to communicate these requirements to all workers.

2.1 The SP shall include a list of local emergency contacts including phone numbers. A copy of the emergency contact list shall be accessible to workers.

2.2 In the case where there is no cellular or land line phone service at the jobsite, the SP shall identify how to reach the nearest available phone service.

3.0 Project Safety Analysis. The SP should contain a basic Project Safety Analysis (PSA) that outlines the actions necessary to complete each activity or phase of the project. The SP shall include a general description of the primary activities or steps required to safely complete the project.

3.1 Each activity should also include a general description of the work involved along with the known risks associated with the activity. In addition, the PSA should outline the controls for those risks, including any Personal Protection Equipment (PPE) requirements for that activity or phase, and whether or not the activity or phase requires a specific safety meeting prior to beginning the activity or phase.

3.2 Submittal of the PSA for all activities or phases is not required with the initial submittal of the SP; however, the PSA for each activity or phase shall be completed prior to the beginning of that activity or phase.

4.0 Safety Meetings. The SP shall include the types of safety meetings that will be required of and conducted by the contractor.

5.0 Safety Training. The SP shall identify the required safety training provided to the contractor's personnel. The contractor shall require that the appropriate safety training for the contractor's personnel is completed prior to the beginning of work on each activity or phase.

5.1 The SP shall identify the recommended safety training needs and PPE for MoDOT employees who will be exposed to the work activities. MoDOT will provide safety training and PPE to MoDOT employees based on MoDOT safety policies.

6.0 Payment. There will be no direct payment for compliance with this Safety Plan provision.

I. FINAL PAYMENT DOCUMENTS

1.0 Description. If the final payment documents are not completed and ready for final payment in accordance with Sec 109.8, within 60 calendar days of final acceptance of the project, the Contractor shall pay to the Contracting Authority the amount of $500 per day as liquidated damages and as a penalty for each Calendar Day until the final payment documents are completed and ready for final payment. The amount of liquidated damages shall be deducted from any payments due or to become due to the Contractor. Final payment documentation shall include but not be limited to the following:

(a) An affidavit, on the form prescribed by the Contracting Authority, to the effect that all payments have been made and all claims have been released for all material, labor and other items covered by the contract bond.
(b) A Certification, on the form prescribed by the Contracting Authority, showing the actual final DBE participation on the project including name of DBE, type of work and amount paid to each DBE firm.
(c) An affidavit, on the form prescribed by the Contracting Authority, to the effect that all workers have been paid in compliance with prevailing wage requirements within the contract.

J. ADD ALTERNATES

1.0 Description. This contract requires bidders to bid on additional contract work that will be considered for award. The award of this project will include one of the add alternate sections. The project will not be awarded with just the base bid, nor will the project be awarded with both add alternates.

Routes	Proposal Section Description
Kirkwood Road CMAQ-5502(605)	Base
Kirkwood Road CMAQ-5502(605)	Add Alternate A (Standard Equipment)
Kirkwood Road CMAQ-5502(605)	Add Alternate B (Decorative Equipment)

Notes: The signal plan sheets show the decorative signal equipment, Add Alternate B (Decorative Equipment). These items have been broken down to corresponding standard MoDOT signal pay items for Add Alternate A (Standard Equipment).

JSP "Painting of Signal Equipment" shall apply to Add Alternate A (Standard Equipment) Pay Items and Add Alternate B (Decorative Equipment) Pay Items.

10' Post Extensions that are set up as varying length mast arm pay items located in Add Alternate B (Decorative Equipment) for CCTV camera mounting height shall be incidental to the pay items shown in Add Alternate A (Standard Equipment).

2.0 Consideration of Bids. The contractor shall submit a bid for each add alternate section. The City reserves the right to award, to the lowest responsible bidder, the combination of base plus the Add Alternate B section (Decorative Equipment). The award of the contract will be selected in accordance with the following:

Base + Add Alternate B (Decorative Equipment)

3.0 Bid Bond Requirements. The contractor shall be required to obtain a bid bond for 5% of the total bid amount for the base bid and Add Alternate B. This bid bond will be considered applicable to the proposed work for any option.

4.0 DBE Goal. The DBE contract goal percentage specified in the Request for Bid applies to work completed for the base bid and Add Alternate B. The DBE contract goal percentage will be considered applicable to the proposed work for any add alternate section that is awarded.

4.1 The bidder shall submit the completed "DBE Identification Submittal" information in accordance with the bid documents for the total DBE participation percentage for the base bid and Add Alternate B.

4.2 If the contract is awarded for less than base bid and Add Alternate B, the awarded bidder shall submit a modified "DBE Identification Submittal" form for the proportionately reduced work with the executed contract documents after award. The modified "DBE Identification Submittal" form shall specify the DBE firm(s) to be used to meet the DBE participation percentage identified in the bid submittal for the proportionately reduced work of the awarded add alternate.

4.2.1 With submittal of the modified "DBE Identification Submittal" form, the awarded bidder is not allowed to eliminate any DBE firm(s) previously identified to complete items of work for the awarded add alternates. The awarded bidder is only allowed to proportionately reduce the participation of previously identified DBE firm(s) on awarded add alternates or eliminate previously identified DBE firms for add alternates that were not awarded.

4.2.2 The failure of the awarded bidder to submit the modified "DBE Identification Submittal", listing actual, committed DBE participation percentage equal to or greater than the DBE participation percentage specified in the bid for the add alternates, may result in the bid being declared non-responsive and may result in forfeiture of the bid surety bond or bid guaranty from the bidder.

5.0 Basis of Payment. The accepted quantities of the chosen combination of base plus add alternate sections will be paid for by the contract unit bid price for item numbers found within the schedule of items for each section.

K. MODIFIED NOTICE TO PROCEED

Addendum #1

1.0 Description. This provision details two different notices to proceed, (1) for the equipment ordering and conduit installation under the railroads and (2) the second Notice to Proceed for the actual start of construction. After the Contract is approved, with the winning bidder, a "Notice To Proceed – Equipment Ordering" will be issued.

The "Notice To Proceed – Equipment Ordering" will state that the Contractor shall begin the ordering process of the necessary signal equipment for this project. This will give the lead time necessary for the manufacturing of the equipment and delivery to the Contractor, before actual work on site begins. No work on site will be allowed during this timeframe.

The Contractor shall first submit the required shop drawings for approval. After shop drawing review and approval, the Contractor shall order the necessary signal equipment. The Contractor shall provide proof to the City that the equipment has been ordered. No ordering of the equipment shall be placed, until the shop drawings are approved.

The initial Notice To Proceed (Notice To Proceed – Equipment Ordering) will also allow the contractor to install the conduits under both railroads. Specifically, the work to be completed includes:

- At the BNSF Railroad:
  - Installation of Pull Boxes I-17 & I-18
  - Installation of Two (2) – 2 inch conduits between Pull Boxes I-17 & I-18
- At the UP Railroad
  - Installation of Pull Boxes I-8 & I-9
  - Installation of One (1) – 6 inch conduit between Pull Boxes I-8 & I-9

The contractor shall have the option to complete all work within both railroad Rights of Way at the same time as the conduit installation, including sidewalk and ADA ramp construction.

The Contractor shall notify the City when they receive a firm date from the manufacturer on the delivery of the signal equipment and are able to figure out a start of work date based upon this. The City will then issue a "Notice To Proceed – Begin Construction". This notice to proceed will begin 30 days before the firm date of delivery, which will allow construction/preparation work to commence. An earlier start date may be allowed with approval from the City.

2.0 Basis of Payment. There will be no direct payment made to the contractor for complying with this provision.

L. DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM REQUIREMENTS

1.0 Description: Insert the following additional program provisions in the Disadvantaged Business Enterprise (DBE) Program Requirements of the General Provisions and Supplemental Specifications to Missouri Standard Specifications for Highway Construction.

13.6 Factors Used to Determine if a DBE Regular Dealer of Liquid Asphalt is Performing a CUF. The DBE must be responsible with respect to materials and supplies used on a contract perform all of the following, pursuant to 49 CFR § 26.55(c)(1) and 7 CSR 10-8.131:

(a) Negotiating price.

(b) Determining quality and quantity.

(c) Ordering the material.

(d) Paying for the material itself.

(e) 30% of the work must be performed by the DBE's permanent employees (which does not include owner-operators or leased employees) or those hired by the DBE firm for the project from an independent source other than the prime contractor, such as a union hall. For at least 30% of the work the DBE's owned (not leased) equipment shall be used and the DBE must provide documentation that this owned equipment was used on the project as required by this provision.

(f) For up to 70% of the remaining work the equipment used by the DBE must be by long term lease (at least one year) with another DBE or non-DBE but not the prime contractor. The DBE must have absolute priority over other businesses or entities to use the long term leased equipment and must display the name and identification number of the DBE.

(g) The Contractor shall require DBE subcontractors to provide documentation in one of the following formats: bills of lading, hauling tickets, shippers manifest, and/or paid invoices. Regardless of the document format, the document(s) shall include the following information: name of the carrier, full name of the driver, driver ID number(s), truck and tanker ID or VIN number, and reflect the contract number, job number, county and route.

The contract number, job number, county and route can be reported through a consignee number or lift number, as long as the DBE Subcontractor has provided the consignee number, or lift number, along with project specific information which shall include contract number, job number, county and route.

The documentation must be submitted and generated by the DBE Subcontractor and be printed on letterhead or other similar documentation outlining the contact information for the DBE Subcontractor. In addition the documentation shall indicate the quantity and amount invoiced to the prime contractor (Such as an invoice). **"MoDOT's DBE Contractor/Subcontractor Project Trucker and Equipment List"** (Form 1) will be provided by MoDOT and shall be completed and submitted to MoDOT by the DBE Subcontractor or Liquid Asphalt Supplier before Asphalt Operations begin. The DBE Subcontractor shall report all trucks and tankers they currently own and all full time drivers that they employ, including all of the drivers numbers for each terminal the drivers pick up from. In addition the DBE Subcontractor shall include a list of "long term" leased equipment, along with drivers and drivers' numbers to the DBE Subcontractor Project Trucker and Equipment List. The DBE Subcontractor shall attach copies of all current long term lease agreements to the DBE Subcontractor Project Trucker and Equipment List.

(h) DBE Trucking/Hauling regulations do not apply to regular dealers of liquid asphalt.

13.7 When a DBE Regular Dealer of Liquid Asphalt is Not Eligible for DBE Credit.

(a) "If its role is limited to that of an extra participant in a transaction, contract or project through which funds are passed in order to obtain the appearance of DBE participation." 49 CFR § 26.55(c)(2)

(b) If the type of transaction does not allow the DBE subcontractor to perform one of the four required functions, such as a prime contractor deciding the price of a commodity to be supplied by the DBE, that transaction is not eligible for DBE credit.

(c) Work that is performed with trucks that are not owned nor under a lease of at least one year by the DBE will not be eligible for DBE credit.

(d) A lack of documentation verifying that at least one DBE owned (not leased) tractor and tanker/ trailer was used to haul liquid asphalt on the project will result in no DBE credit given on that project.

13.8 This form will be completed by the inspector from the project office during the time of the project. MoDOT will use the *MoDOT DBE Job-Site Review CUF Determination Form* to verify CUF was performed on the project, a copy of which is available on the MoDOT Contractor Resource website.

M. LIQUIDATED DAMAGES SPECIFIED FOR ENTRANCE CONSTRUCTION

1.0 Description. The contractor shall be aware of the existing access points along Kirkwood Road and must ensure that appropriate access is available at all times. Traffic must always be able to travel into and out of existing entrances, driveways, and streets within the project limits. The contractor shall notify the property owner at least 2 weeks in advance of when work is to begin on their respective driveways. The contractor shall schedule their operations and work with the property owner to minimize impacts.

1.1 Construction and Closure of Entrances. The contractor shall provide ingress and egress at all times 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. 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. If each entrance or portion of the entrance being constructed, once construction has started, is not completed to plan design and open to traffic within **72 hours** of beginning construction on the entrance, the City, 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 **$1000 per day per entrance for each full day** that the entrance is not fully complete and 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 contractor has the option of using accelerated portland cement concrete pavement (PCCP) for use in paved approaches and other areas of improvements as shown on the plans or as approved by the engineer. All materials, mixture and placement requirements shall be in accordance with all applicable portions of Section 501, 502, and 613, except as specified herein. The concrete mixture shall obtain a compressive strength of 3500 pounds per square inch prior to opening to traffic. An accelerator will be allowed as approved by the engineer.

1.4 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.

N. ADDITIONAL INSURED

1.0 Description. The Contractor shall add Parcel 94, Kirkwood Station Acquisition, LLC to be named as additional insured for the project. The insurance requirements shall conform to Section 107.13, in the Standard Specifications. The Contractor shall submit to the Engineer the insurance certification that names Kirkwood Station Acquisition, LLC as additional insured.

2.0 Basis of Payment. There will be no direct payment to the Contractor to comply with this provision. Failure to furnish evidence of Kirkwood Station Acquisition, LLC as additional insured, will result in temporary suspension of work as provided in Section 108.

O. RELOCATED SIGNS

1.0 Description. This item provides for relocating and mounting existing signs of various sizes to new posts at locations shown on the plans. The Contractor shall be responsible for all existing signs to be relocated. During construction, if any sign to be relocated is lost, stolen, or damaged in any way, the Contractor shall be responsible for all costs.

There is a special downtown Kirkwood Sign that is shown as relocation in the Signing plans. This sign shall be relocated and use its existing posts and then installed to a new foundation similar to the existing.

2.0 Construction Requirements. The contractor shall install new sign support posts at the locations shown and then relocate and mount existing signs to the new posts. All work shall be in accordance with the construction requirements of Section 903.

For the downtown Kirkwood sign, the contractor shall re-use existing posts and then install to a new foundation.

3.0 Method of Measurement. Measurement will be made per square foot for relocating and mounting existing signs to new posts. Measurement for any concrete footings, structural steel posts, pipe posts, perforated square steel tubes and anchor sleeves, and breakaway assemblies will be made in accordance with Section 903.

4.0 Basis of Payment. All costs incurred for relocating and mounting existing signs to new posts at the locations shown, complete in place, will be paid for at the contract unit price for bid item 903-99.02, Remove and Relocate Ground Mount Sign, per each.

All costs incurred for relocating and mounting the downtown Kirkwood sign at the location shown, complete in place, will be paid for at the contract unit price for bid item 903-99.02, Remove and Relocate Special Sign, per each.

Payment for all other labor, equipment, material, and incidental items will be considered completely covered by the bid items included in the contract.

P. DAILY EARTHWORK DUTY

1.0 Description. On a daily basis, the contractor shall be responsible for maintaining drainage patterns that avoids the ponding of drainage water.

2.0 Basis of Payment. There will be no direct payment made to the contractor for complying with this provision.

Q. FIELD VERIFICATION

1.0 Description. Plan details for this contract work are based upon available plans, marked utilities and field surveys performed in conjunction with plan preparation for this proposed work. No warranty is made on either the accuracy or completeness of these available documents. It is the Contractor's (Bidder's) responsibility to assess the actual field conditions and verify the location of all utilities and verify whichever dimensions are required for the performance of the work.

2.0 Basis of Payment. There will be no direct payment made to the contractor for complying with this provision.

R. LOCATION OF EXISTING EDGE OF PAVEMENT

1.0 Description. It shall be the contractor's responsibility to accurately determine the location of the existing edge of pavement at locations where it is necessary to make saw cuts to construct new paved approaches, curbs, and curb ramps. No compensation shall be made for any expenses directly or indirectly incurred, resulting from the contractor's failure to accurately locate the pavement edge.

2.0 Basis of Payment. There will be no direct payment made to the contractor for complying with this provision.

S. ELECTRONIC INFORMATION FOR BIDDER'S AUTOMATION

1.0 Description. Electronic information, consisting of survey and design information including but not limited to cross-section models, alignment data, and plan view geometry, does not constitute part of the bid or contract documents. This electronic information shall be distributed

with the cross-sections or upon the contractor's request. This information, used for project design and quantity estimation purposes, is provided for the bidder's use in automation of bid estimating, grading and contractor staking if provided in the contract. This information shall not be considered a representation of actual conditions to be encountered during construction. Furnishing this information does not relieve a bidder or contractor from the responsibility of making an investigation of conditions to be encountered including, but not limited to site visits, and basing the bid on information obtained from these investigations, and the professional interpretations and judgment of the bidder or contractor. The bidder or contractor shall assume the risk of error if the information is used for any purposes for which the information was not intended. The City makes no representation as to the accuracy or reliability of the information, since the information may not be representative of the sealed contract documents. Any assumptions the bidder or contractor may make from this electronic information is at the bidder or contractor's risk; none are intended by the City. The bidder or contractor assumes the sole risk of liability or loss if the bidder or contractor does rely on this electronic information to its detriment, delay or loss.

2.0 Basis of Payment. There will be no direct payment made to the contractor for complying with this provision.

T. PROJECT COORDINATION

1.0 Description. Overlapping projects may be ongoing at the same time as this project. MoDOT's project J6S1718 – Manchester Project, begins just west of Big Bend Blvd and ends just east of Lindbergh Blvd, J6S1718B – Brentwood Manchester Project, begins west of Hanley Rd to Bremerton Rd, and J6S1718C – Kirkwood Manchester Project, begins at the city limits of Kirkwood (just west of Kenmore Dr) and ends just east of Lindbergh Blvd are planned and may result in being constructed concurrently with this project. The Contractor shall be aware of these projects. The Contractor shall coordinate traffic control, staging, tie-in points and any other items, as determined by the engineer, between the projects.

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 provision.

U. DO NOT DISTURB ITEMS

1.0 Description. The contractor's attention is directed to the fact that there are multiple utility facilities such as manholes, water meters, pull boxes, power poles, light poles, inlets, water valves, gas valves, signs, etc. located in the existing pavement, sidewalks, pavement, grass areas or other areas near the improvements. Care should be taken to avoid damage to the facilities. These items are shown to be used in place (UIP) or do not disturb (DND) on the plans.

1.1 Any damage to existing facilities will be the responsibility of the contractor and shall be repaired and paid for by the contractor.

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

V. SAWCUTS

1.0 Description. Sawcuts will be required for removal of any pavement, driveways, paved approaches, shoulder, median, curb, curb and gutter, sidewalk, curb ramp or other item adjacent to the pavement, shoulder, median, curb, curb and gutter, sidewalk or other item to remain in place or for permanent construction.

2.0 Basis of Payment. All sawcuts required on this job shall be completely covered by the contract unit price for item 202-20.10, Removal of Improvements, per lump sum. The quantities shown in the plans, may not be an all-inclusive list of every sawcut required; there may be additional sawcuts required. Regardless if shown on the quantities, any sawcut required will be included in the contract unit price for item 202-20.10, Removal of Improvements, per lump sum. No additional compensation will be made to the contractor for any additional sawcuts required.

W. STORMWATER COMPLIANCE REQUIREMENTS NJSP-15-38

1.0 The land disturbance necessary to complete this project is not anticipated to exceed one (1) acre. Should the contractor disturb more than one (1) acre to complete the work, or for any other reason, all terms of this Job Special Provision will apply.

1.1 Description. The Contractor shall comply with the terms of the United States of America v. Missouri Highways and Transportation Commission Consent Decree (Consent Decree) that are identified as the responsibility of the Contractor or subcontractor, and with the terms of this provision. Viewing of the Consent Decree is available on the MoDOT Land Disturbance webpage under Contractor Resources, or by going to the web address www.modot.org/LD.

1.2 Applicability. The Consent Decree and this provision apply to any project that includes land disturbance of areas totaling greater than one (1) acre on the project site. The project site consists of all areas designated on the plans, including temporary and permanent easements. The Consent Decree and this provision do not apply to Contractor staging, plant, or borrow areas that are not located on MoDOT right of way (Off-site). The Contractor is responsible for obtaining its own separate land disturbance permit for Off-site areas. This provision is in addition to any other stormwater, environmental, and land disturbance requirements specified elsewhere in the contract.

2.0 Stormwater Training for Contractor Employees. The Contractor's on-site project manager, designated Water Pollution Control Manager (WPCM), as defined in Section 3.0, and WPCM delegate, shall complete MoDOT Stormwater Training prior to serving in those roles. If someone other than the Contractor's project manager is given the authority to manage the grading or erosion control operations, the project manager(s) for those operations shall also complete MoDOT Stormwater Training. MoDOT Stormwater Training is also required for any other person who the Contractor gives authority to take measures to prevent or minimize the consequences of non-compliance with the Stormwater requirements, as defined in Section 3.1(a) of this provision.

2.1 The Commission will provide MoDOT Stormwater Training to the Contractor employees specified in Section 2.0 at a location and time determined by MoDOT. There will be no fee for attending the training; however, the Contractor shall be responsible for all other cost related to

the training, such as travel expenses, if necessary, and wages for its employees. The time to complete the training is anticipated to be no more than 6 hours. As long as the Consent Decree is in effect, MoDOT will provide periodic trainings at various locations around the state, as needed, to ensure contractors and bidders have the opportunity to maintain the number of WPCMs they need to comply with this provision.

2.2 Those who require MoDOT Stormwater Training per Section 2.0 shall complete the training prior to beginning any land disturbance work. Thereafter, training shall occur at least once every two (2) years. The training is not project-specific. Any Contractor employee who receives the training will be qualified to perform the WPCM duties on any MoDOT project for a period of two (2) years.

2.3 MoDOT will document the names and dates that contractor employees attend MoDOT Stormwater Training and will retain those records for the period of time specified in the Consent Decree. Duplicate record keeping by the contractor is not required.

3.0 Water Pollution Control Manager (WPCM). Prior to the Pre-Activity meeting for Grading/ Land Disturbance, the Contractor shall designate a Water Pollution Control Manager (WPCM) to fulfill the duties and responsibilities listed in Section 3.1 until final stabilization occurs. The Contractor's on-site project manager may also serve as the WPCM or that role may be assigned to another manager employed by the contractor or a subcontractor. The Contractor shall also maintain a WPCM delegate to temporarily fulfill the WPCM duties in the absence of the primary WPCM (e.g. illness, vacation, other leave).

3.1 Duties of the WPCM:

(a) Be familiar with Stormwater Requirements including the National Pollutant Discharge Elimination System (NPDES), the current MoDOT State Operating Permit for construction stormwater discharges/ land disturbance activities, the Project-specific Stormwater Pollution Prevention Plan (Project SWPPP), the Corps of Engineers Section 404 Permit, when applicable, the Consent Decree, and this provision. The Project SWPPP includes: a title page with project-specific information, the general SWPPP posted on the MoDOT land disturbance website, the Project Erosion & Sediment Control Plan, all applicable special provisions, and all applicable specifications and standard drawings;

(b) Complete the stormwater training set forth in Section 2.0;

(c) Attend the Pre-Activity for Grading/ Land Disturbance Meeting or, if hired after the meeting has occurred, be familiar with the conference decisions;

(d) Review and sign the Project-specific SWPPP and all updates thereto within time periods set out in the Consent Decree;

(e) Visit and review the project site for compliance with Stormwater Requirements at least once per week from the start of any grading operations until final stabilization is achieved and permit is closed;

(f) Be authorized by the Contractor to supervise all work performed by the Contractor and subcontractors that involves compliance with Stormwater Requirements, including the authority to order work be stopped on a Project, implement MoDOT-directed changes in work related to Stormwater Requirements, and order the taking of, measures to cease, correct, prevent, or minimize the consequences of non-compliance with Stormwater Requirements;

(g) Review and certify electronically each MoDOT inspection report for the Project within three (3) days of receiving each report to ensure it conforms with report requirements in the National Pollution Discharge Elimination System Stormwater (NPDES SW) Permit, Project SWPPP and the Consent Decree and ensure that all Stormwater Deficiencies noted on the report are corrected within the time required;

(h) Recommend in writing within three (3) days of discovering any changes in site conditions and Best Management Practices (BMPs) that require an update to the Project-specific SWPPP; and

(i) Be the point of contact relating to Stormwater Requirements and the Consent Decree between the Contractor, Subcontractors and MoDOT.

4.0 Pre-Activity Meeting for Grading/Land Disturbance and Required Hold Point. At each Project, a Pre-Activity Meeting for Grading/Land Disturbance shall be held prior to the start of any land disturbance and shall include a physical visit and review of the project site. 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.

4.1 Contractor employees who shall attend the Pre-Activity Meeting for Grading/Land Disturbance include the WPCM for the Project and the person(s) designated the authority to manage the grading and erosion control operations.

4.2 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.

5.0 Compliance with the NPDES SW Permit and Project SWPPP. On all projects, the Contractor shall comply with all applicable Stormwater Requirements which are defined as, but are not limited to:

(a) Consulting with the engineer on recommended design revisions to the Project SWPPP to accommodate the Contractor's staging plan, implementation, managing, and maintaining BMPs or other control measures to prevent or minimize sediment and other pollutants in stormwater runoff in accordance with contract specifications or any relevant manufacturer specifications and good engineering practices, including but not limited to

the manuals (*Note: two manuals cited in the MoDOT permit are "Developing your stormwater pollution prevention plan: A guide for construction activities" and "Protecting Water Quality: A Field Guide to erosion, sediment and stormwater best management practices for development sites in Missouri"*) and any other applicable standards for sedimentation basins, stabilization, rock dams, brush checks, construction entrances, and other BMPs;

(b) Installing all BMPs at the locations and relative times specified in the Project SWPPP; and

(c) Complying with the Missouri Water Quality Standards and with effluent limitations in Section E.1 of the NPDES SW Permit. Measurement of effluent is not required except as specified in E.2.

5.1 Stormwater Deficiency Corrections. Per terms of the Consent Decree, Stormwater Deficiencies identified on the MoDOT Land Disturbance Inspection Report shall be corrected within 7 days of the inspection date to avoid stipulated penalties, except that more time might be 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.

6.0 Inspection Protocol. The Contractor and all subcontractors shall review and adhere to MoDOT's written Stormwater Inspection Protocol, found on the MoDOT Land Disturbance webpage (www.modot.org/LD). The Inspection Protocol is applicable to all Projects under the consent decree. The MoDOT Resident Engineer will serve the role of Stormwater Resident Engineer, or a delegate will be named in their absence.

6.1 Inspection Reports. MoDOT will provide one or more Environmental Construction Inspectors (ECI) to perform the weekly and post run-off inspections and other duties described in paragraph 17 of the Consent Decree. The ECI will enter the inspection reports into a web-based Stormwater Compliance database. The WPCM will have access to this database to view all report information, including any noted deficiencies, and to certify the report as required in Section 3.1 (g.). Automated email reminders of pending reports that need to be certified and for deficiencies that need to be corrected will be sent to the WPCM. The Contractor may designate other employees or subcontractor employees to have viewing access to this database and to receive the email reminders. Completion of MoDOT Stormwater Training is necessary in order to receive the email reminders. The WPCM and other users shall be equipped with an electronic device (desktop computer, laptop, tablet, smartphone, etc.) with a browser and internet access to connect to the database. The contractor shall be responsible for providing the electronic devices.

7.0 Stipulated Penalties. If the Contractor fails to comply fully and timely with the requirements of the Consent Decree, stipulated penalties will be assessed to the Commission. For matters under the Contractor's responsibility and control the following stipulated penalties will be assessed to the Contractor and MoDOT will withhold payment pursuant to the following:

Violation	Stipulated Penalty Amount
Failure to Designate or Maintain WPCM at each Project in Accordance with Section 3.0.	$750 for the initial violation (each person not designated) and then $750 for each fourteen (14) day period that person is not designated.
Failure to complete MoDOT Stormwater Training by an Individual Required to be Trained in Accordance with Section 2.0, such as the WPCM or Project Manager.	$750 per person for each missed training. This $750.00 per person violation shall continue to accrue for each fourteen (14) day period that the person fails to timely receive the applicable training
Failure of WPCM to Review and Certify an Inspection Report in Accordance with Inspection Protocol as set forth in Section 6.	$250 per inspection report not reviewed or signed.
Failure to Comply with Any NPDES SW Permit or SWPPP Requirement.	$1000 per violation for the first ten (10) days of the violation; $2500 per violation for days 11-20; $3500 per violation for days 21 and beyond.
Failure to Correct a Stormwater Deficiency Identified in a MoDOT Inspection Report, or Otherwise Discovered by the WPCM, within the Time Required by the NPDES SW Permit or SWPPP.	$1000 per deficiency for the first ten (10) days after correction was required; $2500 per deficiency for days 11-20 after correction was required; $3500 per deficiency for days 21 and beyond after correction was required.

8.0 Information Collection and Retention. The EPA, its representatives and its agents shall have the right of entry into any facility covered by this Consent Decree, at all reasonable times, upon presentation of credential, to:

(a) monitor the progress of activities required under the Consent Decree;

(b) verify any data or information submitted to the United States in accordance with the terms of the Consent Decree;

(c) obtain samples and, upon request, splits of any samples taken by MoDOT or its representatives, contractors, or consultants;

(d) obtain documentary evidence, including photographs and similar data; and

(e) assess MoDOT's compliance with the Consent Decree.

8.1 Until three (3) years after the termination of the Consent Decree, Contractors and the agents of the Contractors shall preserve all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) in its or its Contractors' or agents' possession or control, or that come into the Contractor's or agent's possession or control, and that relate to MoDOT's performance of its obligations under the Consent Decree or to the Contractor's performance of its obligations under the Consent Decree. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures.

9.0 Basis of Payment. Should the contractor disturb more than one (1) acre due to its method of operations, or for any other reason, no direct payment will be made for compliance with this provision, including the cost to provide a WPCM. Should the engineer direct the contractor to exceed one (1) acre of land disturbance, payment will be made only for the actual cost of the weekly duties of the WPCM. Separate payment will be made for erosion and sediment control devices, and for permanent and temporary seeding and mulching, when payment for those items are provided elsewhere in the contract.

X. 36 INCH SIDEWALK TRENCH DRAIN

1.0 Description. The plans call for 1 - 36" wide sidewalk trench drain. This work is to allow the water from the parking lot to drain under the sidewalk to the road. Details of this work are shown on the plans.

2.0 Materials. The lid of the trench shall be ADA compliant and must be approved by the Engineer prior to construction. The thickened sidewalk and reinforcement as shown in the plans is incidental to the cost of the drain.

3.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "36" Sidewalk Trench Drain" and be paid at the contract unit price per each.

Pay Item No. 604-99.02, 36" Sidewalk Trench Drain, per each

Y. SIDEWALK, CURB RAMPS, AND MEDIANS

1.0 Description. This work shall consist of constructing regular concrete sidewalk and curb ramps, exposed aggregate concrete sidewalk and curb ramps, decorative pavers sidewalk, and exposed aggregate medians as shown in the plans.

2.0 Construction Requirements. As shown on the plans, there are various types of sidewalk/curb ramps surfacing.

Concrete sidewalk and curb ramp, 7" thick locations are shown on the plans. These shall have regular concrete surfacing. Sidewalk and curb ramp were combined into one pay item for clarity between the two.

Exposed aggregate concrete sidewalk and curb ramp, 7" thick locations are shown on the plans. These shall have exposed aggregate concrete surfacing, that shall match the adjacent areas. Exposed aggregate sidewalk and curb ramp were combined into one pay item for clarity between the two.

Decorative pavers sidewalk locations are shown on the plans. The pavers shall be brought to the final sidewalk surface and shall match adjacent paver areas. Existing pavers shall be excavated carefully and stored to the side for re-use. The concrete curb ramp/sidewalk shall be constructed and then the pavers shall butt up against the concrete curb ramp/sidewalk. The Contractor shall submit a plan to the Engineer for the concrete paver work; which shall include

materials needed (rock, sand) and construction methods. Additional pavers may be required, and they shall match the existing pavers.

Exposed aggregate concrete median locations are shown on the plans. These shall have exposed aggregate concrete surfacing, that shall match the adjacent areas.

Work for concrete sidewalk and curb ramp, exposed aggregate concrete sidewalk and curb ramp, and exposed aggregate concrete median shall be in accordance with Section 608.

3.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "Decorative Pavers Sidewalk" and be paid at the contract unit price per square yard. There will be no additional payment made for any additional pavers needed.

All costs for materials, equipment, labor and installation shall be included in the cost for "Concrete Sidewalk and Curb Ramp, 7 IN. Thick", and be paid at the contract unit price per square yard

All costs for materials, equipment, labor and installation shall be included in the cost for "Exposed Aggregate Concrete Sidewalk and Curb Ramp, 7 IN. Thick", and be paid at the contract unit price per square yard

All costs for materials, equipment, labor and installation shall be included in the cost for "Exposed Aggregate Concrete Median" and be paid at the contract unit price per square yard.

The associated type 5 aggregate base as shown in the plans is paid for at its contract unit price.

Pay Item No. 608-99.05, Concrete Sidewalk and Curb Ramp, 7 IN. Thick, per square yard
Pay Item No. 608-99.05, Exposed Aggregate Concrete Sidewalk and Curb Ramp, 7 IN. Thick, per square yard
Pay Item No. 608-99.05, Decorative Pavers Sidewalk, per square yard
Pay Item No. 608-99.05, Exposed Aggregate Concrete Median, per square yard

Z. TRUNCATED DOMES COLOR

1.0 Description. The new truncated domes for all the curb ramps and landings throughout the project shall be Red in color.

2.0 Basis of Payment. There will be no additional payment for the color of the truncated domes to be Red. All costs for materials, equipment, labor and installation shall be included in the cost for 608-10.12, "Truncated Domes", and be paid at the contract unit price per square foot.

AA. ADJUST TO GRADE ITEMS

1.0 Description. This work shall consist of adjusting water valves, water meters, water vaults, basins/inlets, manholes, landscaping lights, and pull boxes that are within areas where either new sidewalks/ramps/approaches/pavement are to be constructed as shown on the plans. The adjustments shall be made to match the final proposed grade.

2.0 Construction Requirements. 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 shall be completed to ensure the finished sidewalk, ramp, approach, or pavement will meet current ADA standards.

3.0 Basis of Payment.

3.1 All costs for materials, equipment, labor and installation shall be included in the cost for adjusting the water valves, water meters, basins/inlets, manholes, and pull boxes.

Pay Item No. 603-99.02, Adjust to Grade Water Valve, per each
Pay Item No. 603-99.02, Adjust to Grade Water Meter, per each
Pay Item No. 603-99.02, Adjust to Grade Water Vault, per each
Pay Item No. 604-20.20, Adjusting Basin or Inlet, per each
Pay Item No. 604-20.10, Adjusting Manhole, per each
Pay Item No. 902-99.02, Adjust to Grade Signal Pull Box, per each
Pay Item No. 901-99.02, Adjust to Grade Lighting Pull Box, per each
Pay Item No. 901-99.02, Remove and Relocate Lighting Pull Box, per each

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

BB. <u>SPRINKLER SYSTEMS</u>

1.0 Description. This work shall consist of removing and relocating sprinkler heads to the final proposed grade and adding a future conduit for the irrigation system as shown on the plans.

2.0 Construction Requirements. As shown on the plans, sprinkler heads that are in conflict with proposed sidewalk shall be removed and relocated to the back of the sidewalk at a mutually agreed upon location with the property owner and the City. They shall be aimed and then tested for the correct watering application. At the location shown on the plans, a 1-1/2" PVC conduit is to be installed at a mutually agreeable location with the property owner.

3.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "Remove and Relocation of Sprinkler Head" and be paid at the contract unit price per each.

All costs for materials, equipment, labor and installation shall be included in the cost for "1 ½" PVC Conduit for Irrigation System" and be paid at the contract unit price per linear foot.

Pay Item No. 806-99.02, Remove and Relocation of Sprinkler Head, per each
Pay Item No. 902-99.03, 1 ½" PVC Conduit for Irrigation System, per linear foot

CC. PAVEMENT MARKING PAINT

1.0 Description. This work shall consist of placing:

6 IN. White Standard Waterborne Pavement Marking Paint, Type P Beads
24 IN. White Standard Waterborne Pavement Marking Paint, Type P Beads
White Standard Waterborne Pavement Marking Paint, Straight Arrow
White Standard Waterborne Pavement Marking Paint, Left/Right Arrow
White Standard Waterborne Pavement Marking Paint, Combination STR/RT/LT Arrow
White Standard Waterborne Pavement Marking Paint, 12 IN. White Line Yield Triangles
White Standard Waterborne Pavement Marking Paint, Word (Only)
White Standard Waterborne Pavement Marking Paint, Bicycle Symbol
White Standard Waterborne Pavement Marking Paint, Handicap Symbol

as shown on the plans.

2.0 Construction Requirements. Work shall be in accordance with Section 620.

3.0 Method of Measurement. This work shall be measured for payment per linear foot of 6 in. white waterborne pavement marking paint. This work shall be measured for payment per each for arrows, yield triangles, word symbol, bicycle symbol, and handicap symbol.

4.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for “6 IN. White Standard Waterborne Pavement Marking Paint, Type P Beads”, and be paid at the contract unit price per linear foot, Pay Item No. 620-99.03.

All costs for materials, equipment, labor and installation shall be included in the cost for “24 IN. White Standard Waterborne Pavement Marking Paint, Type P Beads”, and be paid at the contract unit price per linear foot, Pay Item No. 620-99.03.

All costs for materials, equipment, labor and installation shall be included in the cost for “White Standard Waterborne Pavement Marking Paint, Straight Arrow”, and be paid at the contract unit price per each, Pay Item No. 620-99.02.

All costs for materials, equipment, labor and installation shall be included in the cost for “White Standard Waterborne Pavement Marking Paint, Left/Right Arrow”, and be paid at the contract unit price per each, Pay Item No. 620-99.02.

All costs for materials, equipment, labor and installation shall be included in the cost for “White Standard Waterborne Pavement Marking Paint, Combination STR/RT/LT Arrow”, and be paid at the contract unit price per each, Pay Item No. 620-99.02.

All costs for materials, equipment, labor and installation shall be included in the cost for “White Standard Waterborne Pavement Marking Paint, 12 IN White Line Yield Triangles”, and be paid at the contract unit price per each, Pay Item No. 620-99.02.

All costs for materials, equipment, labor and installation shall be included in the cost for "White Standard Waterborne Pavement Marking Paint, Word (Only)", and be paid at the contract unit price per each, Pay Item No. 620-99.02.

All costs for materials, equipment, labor and installation shall be included in the cost for "White Standard Waterborne Pavement Marking Paint, Bicycle Symbol", and be paid at the contract unit price per each, Pay Item No. 620-99.02.

All costs for materials, equipment, labor and installation shall be included in the cost for "White Standard Waterborne Pavement Marking Paint, Handicap Symbol", and be paid at the contract unit price per each, Pay Item No. 620-99.02.

DD. REMOVE AND RELOCATE MAILBOX

1.0 Description. This work will consist of removing a USPS mailbox and relocating to an approved location by the City. Existing posts and supports shall be reused if in good condition, and the posts and supports can be relocated without damaging the mailbox or the existing support system.

2.0 Method of Measurement. The quantity of Remove and Relocate Mailbox will be measure per each.

3.0 Basis of Payment. The removal and relocation of the USPS mailbox will be paid for at the contract unit price per each, which shall include all materials, labor, equipment, and tools necessary for the work.

Pay Item No. 607-99.02, Remove and Relocate Mailbox, per each

EE. TREE TRIMMING

1.0 Description. This work will consist of trimming back all existing tree branches at the location of the new mid-block signal mast arm. The clearing limits shall provide 6" clear distance horizontally from the back of the sidewalk edges and 10' vertically from the top of the sidewalk. This is to provide visibility to the new signal heads located here. In addition to the tree trimming at the mid-block signal, there may be minor tree trimming located at other areas as designated by the engineer. These areas will be included in the total work for this pay item.

2.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "Tree Trimming" and be paid at the contract unit price per lump sum, Pay Item No. 808-99.01.

FF. MODOT VS. CITY INTERSECTIONS

1.0 Description. MoDOT and the City of Kirkwood own different intersections through the project limits. MoDOT and the City have different requirements for the type of equipment warranted at their respective intersections. The Contractor shall carefully read each Specification that applies to either the MoDOT or City intersection and abide by that particular

specification. The following is a list of intersections and which entity owns them:

MoDOT Intersections:

1. Manchester Road
2. Big Bend Road

City of Kirkwood Intersections:

1. Mid-Block Crossing
2. Essex Avenue
3. Washington Avenue
4. Adams Avenue
5. Jefferson Avenue
6. Argonne Drive
7. Madison Avenue
8. Monroe Avenue
9. Woodbine Avenue
10. Rosehill Avenue

GG. PROPERTY OWNER AGREEMENTS

1.0 Description. CMAQ-5502(605). During the negotiations of easements and rights of way, the City has entered into agreements with certain property owners. The Contractor must assure that the following are adhered to:

A) Parcel 19 *(505 S. Kirkwood Rd.)*

1) That should the existing junction box, underground conduit or wiring serving the church's ground sign need to be relocated the Contractor shall do so solely at the City's expense.

2) That should the existing sprinkler system located on the TCE or ROW need to be relocated the Contractor shall do so solely at the City's expense.

B) Parcel 21 *(407 S. Kirkwood Rd.)*

1) That the Contractor will not be allowed to store equipment or material on the TCE except when working on parcel 21.

C) Parcel 22 *(111 E. Woodbine)*

1) The Contractor shall not disturb or damage the burning bushes located along the eastern curb line of E. Woodbine within the limits of the TCE.

2) The Contractor shall stake out the perimeter of the TCE with orange construction fencing.

D) Parcel 26 *(710 S. Kirkwood Rd)*

1) The Contractor shall repair all disturbed grassy areas with sod.

2) Should any bushes or other improvements be damaged by the Contractor during construction, they will be repaired or replaced in-kind at the Contractor's expense.

3) The concrete for the driveway approach shall be reconstructed as follows:
   a) placed in one day on a Friday
   b) concrete placed will be batched with Type III, high early strength cement
   c) forms shall be stripped and the approach be open to traffic on the following Monday

E) Parcel 27 *(712 S. Kirkwood Rd.)*

1) The Contractor shall repair all disturbed grassy areas with sod.

2) Should any bushes or other improvements be damaged by the Contractor during construction, they will be repaired or replaced in-kind at the Contractor's expense.

3) The concrete for the driveway approach shall be reconstructed using the following sequence:

   a) placed in one day on a Friday
   b) concrete placed will be batched with Type III, high early strength cement
   c) forms shall be stripped and the approach be open to traffic on the following Monday

F) Parcel 31 *(800 S. Kirkwood Rd.)*

1) The Contractor shall repair all disturbed grassy areas with sod.

2) Should any bushes or other improvements be damaged by the Contractor during construction, they will be repaired or replaced in-kind at the Contractor's expense.

G) Parcel 36 (*906 S. Kirkwood Rd.)*

1) The concrete for the driveway approach shall be reconstructed using the following sequence:

   a) replaced one-half (½) at a time
   b) placed in one day on a Friday
   c) concrete placed will be batched with Type III, high early strength cement
   d) forms shall be stripped and the approach open to traffic on the following Monday

2) Tenants shall have access to the driveway approach at all times

H) Parcel 38 *(930 S. Kirkwood Rd.)*

1) That the Contractor will not be allowed to store equipment or material on the

TCE except when working on parcel 38.

I) Parcel 48 *(217 S. Kirkwood Rd.)*

1) The Contractor shall excavate the concrete flatwork along the Kirkwood Rd and E. Monroe frontage of **Spencer's Grill** only on Monday in any given week. The concrete for the reconstructed flatwork shall then be placed immediately in order that the sidewalk can be reopened to pedestrian foot traffic on the following Thursday of that same given week. There shall be no construction activity undertaken on any Friday that will prevent **Spencer's Grill's** customers from having access to the front door of **Spencer's Grill** over the following weekend.

2) In the event the Contractor determines that its construction operations will deny the second-floor tenants of 223 S. Kirkwood Rd. access to their first floor entrance door; the Contractor shall immediately notify the City Engineer to discuss and identify alternative access options for the second floor tenant.

J) Parcel 69 *(301 N. Kirkwood Rd.)*

1) That the Contractor shall replace the concrete flatwork adjacent to the Adams Ave./Kirkwood Rd. intersection ½ at a time in order to maintain customer access to Royal Bank.

2) That the Contractor saw cut the concrete flatwork at the nearest joint adjacent to the Royal Bank door nearest the Kirkwood Rd/Adams Ave. intersection.

3) That the Contractor shall place a 1 ½" PVC conduit under the concrete flatwork during reconstruction in order to facilitate the reinstallation of Royal Bank's sprinkler system at a later date.

K) Parcel 70 *(325 N. Kirkwood Rd.)*

1) That the Contractor shall not disturb or damage the existing landscaping. Should any landscaping be damaged by the Contractor or their subcontractors during construction, they will be replaced in-kind solely at the Contractor's expense.

2) That the property owner is responsible for relocating their irrigation system upon project mobilization by the Contractor. Once the project is substantially complete the property owner is responsible for permanently reinstalling their irrigation system.

L) Parcel 71 *(401 N. Kirkwood Rd.)*

1) That the Contractor will not be allowed to store equipment or material on the TCE except when working on parcel 71.

N) Parcel 74 *(400 N. Kirkwood Rd.)*

1) That the island adjacent to the intersection be replaced in its entirety rather than piece meal as shown on the construction plans.

2) That the Contractor not be allowed to store equipment or material on the TCE except when working on parcel 74.

M) Parcel 76 *(100 E Adams Ave)*

1) That the Contractor will shall place a snow fence along the limits of the T.C.E. line.

O) Parcel 102 *(601 N. Kirkwood Rd.)*

1) That the stone wall adjacent to the sidewalk along Kirkwood Rd. shall not be disturbed in any way. Should the stone wall be damaged by the Contractor or their subcontractors during construction, the wall will be replaced or repaired in-kind solely at the Contractor's expense.

P) Parcel 104 *(526 N. Kirkwood Rd.)*

1) That the stone wall adjacent to the sidewalk along Kirkwood Rd. shall not be disturbed in any way. Should the stone wall be damaged by the Contractor or their subcontractors during construction, the wall will be replaced or repaired in-kind solely at the Contractor's expense.

Q) Parcel 122 *(10764 Manchester Rd.)*

1) The Contractor shall saw cut along the property line/right-of-way line, remove the existing asphalt pavement and reconstruct, in-kind the portion of this parcel's parking lot area (where conduit is installed) that is located on the right-of-way. Selective patching of excavated areas will not be allowed.

2) The Contractor shall mill areas according to the construction drawings then overlay the entire parking lot as well as restripe the parking spaces. Prior to the overlay the Contractor shall remove steel stairway in southeastern corner of parking lot and reinstall after overlay completion.

2.0 Basis of Payment: CMAQ-5502(605). Payment for the above-mentioned items are to be completely paid for under the unit bid prices. If there are no bid items for the above-mentioned work, the work will be considered incidental and there will be no direct payment.

1.0 Description. TAP-5502(607). During the negotiations of easements and rights of way, the City has entered into agreements with certain property owners. The Contractor must assure that the following are adhered to:

A) Parcel 26 *(710 S. Kirkwood Holdings)*

1) The Contractor shall repair all disturbed grassy areas with sod. Should any bushes or other improvements be damaged by the Contractor during

construction, they will be repaired or replaced in-kind at the Contractor's expense.

2) The concrete for the driveway approach shall be constructed as follows:
   a) placed in one day on a Friday
   b) concrete placed will be batched with Type III, high early strength cement
   c) forms shall be stripped and the approach be open to traffic on the following Monday

B) Parcel 26 *(710 S. Kirkwood Holdings)*

1) The Contractor shall repair all disturbed grassy areas with sod. Should any bushes or other improvements be damaged by the Contractor during construction, they will be repaired or replaced in-kind at the Contractor's expense.

2) The concrete for the driveway approach shall be constructed as follows:
   a) placed in one day on a Friday
   b) concrete placed will be batched with Type III, high early strength cement
   c) forms shall be stripped and the approach be open to traffic on the following Monday

C) Parcel 31 *(HRWCJW Realty LLC)*

1) The Contractor shall repair all disturbed grassy areas with sod. Should any bushes or other improvements be damaged by the Contractor during construction, they will be repaired or replaced in-kind at the Contractor's expense.

D) Parcel 36 (*KOP, LLC)*

1) The concrete for the driveway approach shall be constructed as follows:
   a) replaced one-half (½) at a time
   b) placed in one day on a Friday
   c) concrete placed will be batched with Type III, high early strength cement
   d) forms shall be stripped and the approach be open to traffic on the following Monday
   e) Tenants shall have access at all times to the driveway approach

2.0 Basis of Payment: TAP-5502(607). Payment for the above-mentioned items are to be completely paid for under the unit bid prices. If there are no bid items for the above-mentioned work, the work will be considered incidental and there will be no direct payment.

HH. DECORATIVE CROSSWALKS

1.0 Description. This work shall consist of stamping a colored red pattern into the asphalt surface for a decorative final surface of the street crosswalks at locations shown on the plans. The following intersections require decorative crosswalks:

Washington Avenue
Adams Avenue
Jefferson Avenue
Argonne Drive
Madison Avenue
Monroe Avenue
Woodbine Avenue

The pattern of the stamped asphalt shall be a pattern as selected by the City from the installer's selection of choices.

Madison Avenue East Approach and Woodbine Avenue West Approach are existing concrete pavement structures. The Contractor shall sawcut as shown on the plan sheets and special sheets, remove 2" of existing concrete, and then installed the stamped and colored asphalt crosswalk.

2.0 Construction Requirements. Work for decorative crosswalks shall be in accordance with Section 400 and the manufacturers recommendations.

2.1 Hot Mix Asphalt

New asphalt must be placed to meet Section 400. Compaction density must be met prior applying the asphalt stamps.

2.2 Stamping the Asphalt

Using flexible templates, (3/8" cable or 1/4" plastic) stamp the pattern into the asphalt using a vibratory plate compactor. Stamping can be performed on a freshly placed asphalt surface when the asphalt is still pliable or into an existing asphalt surface. An existing asphalt surface must be heated using an infrared heating apparatus insuring not to heat the surface above 325ºF (163ºC)

Use slow cycled heat to ensure the surface does not burn. The surface should be heated to a depth of at least ¾" to ensure compaction (not crushing of the aggregate) below the stamping tool.

3.1 Coating Composition and Performance Characteristics

This section covers the composition, handling and application characteristics for the Stamped Asphalt Coating System. Coatings used with this surfacing system must meet the minimum characteristic and performance properties described below.

3.2 Asphalt Coating (Tint Base)

Material Composition and Application Characteristics

Table 1:

Characteristics	Requirement
ASTM D2369 % Solids by weight	> 76%
ASTM D26297 % Solids by volume	> 55.5%
Weight per gallon	13.9 lbs/gal
% non-reactive fillers	< 40%
Boiling Range	147° - 477°F
Vapor Density	Heavier than air
Flashpoint ASTM D 3278	>201°F
Flashpoint ASTM D 3278	>201°F
Hazardous Ingredients	none
Mix Ratio (Coating : LiquidTint) gal/pints	5gal : 1pint
Dry mil thickness per coat	10 to 15 mils

Performance Requirements

Table 2:

Test	Requirement
Dry Time (to re-coat) @ 50°F (10°C).....	120 min
Dry Time (to re-coat) @ 90°F (32°C).....	30 min
85% Cure (to permit traffic) @ 50°F (10°C).....	8 to 10 hours
85% Cure (to permit traffic) @ 90°F (32°C).....	4 to 6 hours
Gloss: ASTM D523 (60° Gardner).....	2.5
Hardness: ASTM D3363	3H pencil
ASTM 2486 Gasoline Scrub Resistance..... To 50% of coating thickness (30 mils).....	>5000 cycles to max loss of 50% coating thickness
ASTM 2486 Motor Oil Scrub Resistance..... To 50% of coating thickness (30 mils).....	>5000 cycles to max loss of 50% coating thickness
Temp. limits for service (of cured material)	-35°F to 145°F
ASTM G-155 Color Stability..... QUV 2,000 hrs (CIE units).....	Old Brick Color ΔE < .5
Pedestrian Friction ASTM E303 British Pendulum.....	88 BPN Dry 72 BPN Wet
Mandrel Bend Test ASTM D522.....	>3/16" Pass
Water Absorption ASTM D570 7day.....	<9%
VOC Content ASTM D3960.....	<19 grams/liter
Taber Abrasion Dry H-10 ASTM D4060 1day cure.....	.17g/1000 cycles
Taber Abrasion Wet H-10 ASTM D4060 7day cure.....	.43g/1000 cycles
Adhesion to Asphalt ASTM D4541 >245 lb./sq.in.....	Asphalt Cohesive Failure

3.3 Liquid Tint (coloring system)

The coloring system "Liquid Tint" shall consist of no less than 95% pure inorganic iron oxide pigments in a water base liquid carrier. Pigment particle size (fineness) must pass 95% minus 325 mesh. Liquid Tint must be alkali resistant, water insoluble, inert, light resistant, inorganic, and lime-proof.

4.0 Delivery, Storage, and Handling

4.1 Packaging and Labeling

All coating products shall be packed in standard closed containers. Each container of separately packaged component shall be clearly and durably labeled to indicate the date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name or formula specification number together with special instructions**.**

4.2 Delivery, Storage, and Handling

Coating products shall be delivered to the site in sealed containers that plainly show the designated name, batch number, color, date of manufacturer, and name of the manufacturer. Store the material on site in enclosures, out of direct sunlight in a warm, ventilated and dry area at room temperature; do not allow coating to freeze. Care shall be taken in handling of coating containers to prevent puncture, inappropriate opening or other action, which may lead to product contamination. No materials that are past the coating manufacturer's recommended shelf life shall be used without the approval of the coating manufacturer.

5.0 Surface Preparation

5.1 Cleaning

Broom using mechanical brooming device, or stiff bristle hand broom. Scrape and blow fine sand and debris off of surface. Pressure washing may be necessary to remove bonded debris. Use a non-solvent based degreaser to remove stains. Spray degreaser on stained area and let stand for 15 minutes. Using a stiff broom or brush, agitate the stained area to remove stain and rinse with water. Repeat this procedure on severe stains. Thoroughly rinse the area and let dry for 24 hours.

5.2 Repair Damaged Asphalt

Damaged and cracked asphalt shall be repaired by heating damaged area until the asphalt cement is in a liquid state (ensuring asphalt does not exceed 375° F), turning over and mixing in new fresh asphalt if necessary to ensure repair is level with adjacent area. Infrared type heating mechanisms are the recommended tool for this procedure.

5.3 Preparation of New Asphalt

New asphalt surfaces shall be allowed to traffic for 30 days prior to heating and stamping. This allows the surface oils to be removed. Asphalt mix design shall specified by a qualified Pavement Engineer and shall be designed for the purpose of the application.

6.0 Coating Application

6.1 Environmental Conditions

Surfaces should be dry for at least 24 hours prior to applying Stamped Asphalt coatings. 50°F and rising, is the recommended minimum air and surface temperature. The temperature of the asphalt surface must be at least 5°F above the dew point temperature during and after applying coating. Coating application must be complete at least two hours before sunset to allow for proper cure.

6.2 Masking

Mask all adjacent areas using paint-grade masking tape. Use duct taped on concrete and asphalt surfaces. Building paper extended a minimum of 48 inches beyond the edge of coated area is required to prevent over-spray of coatings onto adjacent areas.

6.3 Spray Equipment

Spray texture gun (Graco RTX1500 TexSpayer). or Benron “EZ-TEX DX” sprayers.

The coating manufacturer shall approve spray gun settings and alternative spray equipment.

6.3 Mixing Base Coat

Contractor to follow latest mixing techniques provided by the manufacturer.

7.0 Coating Thickness

The applied thickness of the coating shall be determined according to the application as noted in table 3. The City may specify a greater thickness if so desired.

<u>Required Film Thickness for Vehicular Traffic</u>

Table 3:

Application	Film Thickness
Prime Coat where applicable	5 wet mils (1 dry mil)
First coat	22 wet mils (15 dry mils)
Second coat	22 wet mils (15 dry mils)
Third coat	22 wet mils (15 dry mils)
Fourth coat were necessary.....	22 wet mils (15 dry mil)

8.0 Applicator Training

The Applicator shall be approved by the manufacture for the application being applied. The Applicator shall have lead personnel on the project that have been trained by the manufacturer within the past 12 months of starting the project. At least one of these trained personnel shall be on site at all times during the application.

9.0 Samples, Mockups, and Submittals

Samples shall be provided to the City for approval prior to tender closing.

Samples shall display the following:

1. Brick or stone Pattern
2. Brick or stone color
3. Variations of the above if requested

Coating samples and mockups, are to be applied to an asphalt surface covering a 96” x 96” area.

Approval of color and pattern to be provided in writing to the Contractor.

Approved samples and mockups to be held by the City for future onsite verification.

Submittals required:

1. At least 3 reference sites and written references from 3 previous customers for asphalt stamping work performed by the Contractor, his subcontractor or his installer.

2. A list of the major equipment to be used in the execution of the work. This list shall include asphalt heating equipment when texturing is being applied to existing asphalt, compactors and wire rope or cable stamping templates and any other necessary equipment.

10.0 Field Quality Control

10.1
The contractor for work under this section shall maintain a quality control program specifically to verify compliance with this specification. A daily log shall be kept to record actions in the field.

10.2
This log shall include the following information;

1. Surface preparation start date and time
2. Photos of surface prior to start of preparation
3. Close up photos of crack repair (before and after) if applicable
4. Ambient temperature start and end of each day
5. Relative humidity start and end of each day
6. Substrate surface temperature start and end of each day

7. Photos of surface after application of each coat

Note:
On projects larger than 1,000 square feet, break project into areas of approximately 1,000 square feet for the purpose of photo taking and record keeping. Number these areas and record the respective numbers on scaled drawing.

10.3
Dry film thickness shall be confirmed by the City on site, during the application process.

Method:
2" x 4" lengths of duct-tape (or 2" x 4" thin plastic, glass or metal plates) shall be secured to the substrate that will receive coating. The tape will be randomly placed averaging one tape per 300 sq ft. These tapes shall be pre-marked (on the adhesive side) with location matching a marked, scaled drawing. The tape shall be removed within 1 hour after the final coat has been applied. These samples shall be kept by the City for future verification of dry film thickness (if verification becomes necessary).

11.0 Method of Measurement. The quantity of decorative crosswalks will be measured per square yard.

The area of stamped asphalt will be the area that has received the asphalt pavement texturing. No deduction will be made for the area occupied by manhole castings or other utility appurtenances within the area.

12.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "Decorative Crosswalk" and be paid at the contract unit price per square yard, Pay Item No. 608-99.05.

Separate payment will be made for the 6" white pavement marking crosswalk lines.

No separate payment will be made for sawcutting, milling, and removal of concrete surfacing needed at Madison Avenue and Woodbine Avenue for installation of the stamped asphalt concrete.

II. PARKING SIGNS

1.0 Description. This work shall consist of installing parking signs on the signal posts at locations shown on the plans. The following intersections require parking street signs:

Jefferson Ave
Argonne Dr
Madison Ave

2.0 Construction Requirements. Work for street parking signs shall be in accordance with Sections 902 and 903 and the manufacturers recommendations.

3.0 Parking Signs Requirements.

The signs shall be 30" in width by 36" in height. The general required look of the parking signs are shown on the plans. There are 4 different types of signs depending on the location that the sign is to be installed (different arrow configurations).

The Contractor shall submit shop drawings to the City for their review and approval prior to ordering of the parking signs. The shop drawings shall include the sizes of the font and symbols/arrows and the colors to be used.

4.0 Method of Measurement. The quantity of street parking signs will be measure per each.

5.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "Parking Sign" and be paid at the contract unit price per each, Pay Item No. 902-99.02.

The signal sign mounting hardware will be paid for separately.

JJ. EDGE LIT LED STREET SIGNS

1.0 Description. This work shall consist of installing edge lit LED street signs on the signal mast arms as shown on the plans. The following intersections require edge lit LED street signs:

Manchester Road
Essex Avenue
Washington Avenue
Adams Avenue
Jefferson Avenue
Argonne Drive
Madison Avenue
Monroe Avenue
Woodbine Avenue
Rose Hill Avenue
Big Bend Road

Addendum #1

The sizes (widths and lengths) and details required are shown on the plans. Products partially meeting requirements herein may be accepted for installation with prior approval from the Engineer.

2.0 Construction Requirements. Work for edge lit LED street signs shall be in accordance with Sections 902 and 903 and the manufacturers recommendations.

3.0 Sign Requirements.

3.1 Mechanical Specifications.

The outer dimensions of the sign assembly shall be standard nominal heights of 15, 18, 20, 22,

24, 28, and 30 inches (required sizes are shown in the plans), and standard nominal widths of 4, 5, 6, 7, 8, 9, or 10 feet.
The Sign's length shall also be fabricated to allow for 6" inch interval length increments to best fit the Sign's legend. Required lengths are show in in the plans.

The maximum thickness of the sign shall be 1.60 inches, as measured front-to-back, to include the end cap. End caps shall be used to secure both ends of the signs and all internal components, and each end cap shall be fabricated using a single sheet of 0.090" thick Type 5052-H32 grade aluminum.

The maximum weight of each sign shall be determined by the total width and height of the sign's outside finished dimensions. Individual sign weights, including their outside finished edges, shall be calculated as NOT TO EXCEED (NTE):

4' x 18": NTE 38 lbs
6' x 18": NTE 50 lbs
8' x 18": NTE 65 lbs

4' x 24": NTE 45 lbs
6' x 24": NTE 63 lbs
8' x 24": NTE 79 lbs

8' x 30": NTE 90 lbs
8.5' x 30": NTE 95 lbs
9' x 30": NTE 100 lbs

The long edges of the sign shall be made from a single section of 6000 series aluminum extrusion. The ends caps shall be made from a single section of aluminum and shall be affixed to the frame with stainless steel screws. The power supply shall be mounted internally in one of the end caps. The non-electrical end cap shall be removable to enable replacing panels and components.

The sign shall have a front panel that is UV, weather, abrasion and impact resistant. The front panel shall be replaceable so that maintaining agencies have the option to supply their own sheeting and film for the sign faces.

3.2 Exterior Finish

All exterior surfaces of the sign assembly shall be powder-coat painted in accordance with Military Standard MIL-C-24712. Finish will meet the requirements of ASTM D3359, ASTM D3363, and ASTM D552.

The sign enclosure shall have a weatherproof design that ensures water does not reach internal components and shall be able to do so in its design, without the use of silicone.

No silicone will be used in the weather resistant seal of the sign.

3.3 Sign Face and Material

Sign faces shall be designed using only current MUTCD approved fonts and font sizes, in addition to the requesting Agency's own preferences and specifications. The font color shall be black and the background color shall be white. See details in the plans for further information regarding sign layout.

The Sign shall have a 3mm or 4mm acrylic front panel that is UV, weather, abrasion and impact resistant. The front panel shall be replaceable so that maintaining agencies have the option to supply their own sheeting and 3M 1170 Series Electrocut™ film or approved equal for the Sign faces.

The Sign shall utilize ONLY 3M 4090 Series ASTM Type IX (Type 9) Diamond Grade™ Sheeting or approved equal for the Sign legend and Sign background, when specified, to meet minimum levels of the retro-reflectivity of the Sign face, as recommended by the MUTCD, if the Sign's LED's should fail.

The light transmission factor of the Sign panel must provide a letter to background ratio of a minimum of 4:1.

The Sign shall utilize impact resistant, match-grade component acrylics (in both 3mm and 4mm variants) with the above-specified 3M Electrocut™ or approved equal to prevent out-gassing, bubbling, peeling, and cracking of the Sign face film, ensuring Sign face durability over the life of the Sign.

3.4 Mounting System (Rigid Back Brace Mounting)

The Sign must be supplied with rigid back brace mounting brackets on two positions on the back of the sign. The rigid back brace mounting brackets will be powder-coat painted to an exact match of the sign extrusions and signal mast arms and shall be in accordance with Military Standard MIL-C-24712. Finish will meet the requirements of ASTM D3359, ASTM D3363, and ASTM D552. The rigid back brace mounting brackets used to affix the sign to the mast arm pole shall not extend more than 3/16" inch above the top horizontal surface, and the opposite end of that same bracket shall not extend more then 3/16" inch below the bottom horizontal surface of the sign, as viewed from the front. Approved brackets, such as Pelco AS-3004 or AS-3009 or an approved equal shall be used for this installation.

3.5 Environmental Specifications

The sign shall be designed and constructed to withstand 241 Km/h (150 mph) wind loads in conformance with the requirements of the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaries and Traffic Signals," 6th Edition 20013.

The sign and power supply should be able to withstand and operate at temperature extremes of -22 deg F to +140 deg F.

Signs shall be tested and certified for the following environmental conditions:

- Exclusion of Water Test
- Strain Relief Test
- Temperature Test

- Dielectric Voltage-Withstand Test

A representative sample of the product shall be tested in accordance with the Standards for Electric Signs (UL 48).

3.6 Luminance

The entire surface of the sign panel must be evenly illuminated with a minimum average brightness reading at the letters of 580 Lux and a variation of no more than 15% for any reading from the average (minimum of 50 readings). Each background reading measured must not vary by more than 10% (minimum of 50 readings) from the average of the background brightness readings. The light transmission factor of the sign panel must provide a letter to background ratio of a minimum of 4:1.

3.7 Light Source

The light source for the sign shall be LEDs (light emitting diodes). LEDs shall be mounted along both the top and bottom edges of the sign. The LEDs shall evenly illuminate a light panel that is the same dimensions of the sign face. The LEDs shall have a minimum rated lumen maintenance of 70% at 60,000 hours (an L70 of 60,000 hours). A maximum of four LEDs per square foot shall be used. NOTE: 50,000 hour LEDs (until degradation to L70) will not be submitted to the City for use, and OEM documentation shall be made available to prove out the manufacturer's use of a 60,000 LED at the City's request.

3.8 LED Single Output Switching Power Supply

LED Single Output Switching Power Supply shall be a fully-encapsulated, constant- current design built to withstand 300VAC surge input for 5 seconds, with inherent short circuit/over current/over voltage protection. The Power Supply shall be a UL 1310 Class 2 power unit and will be housed in a fully isolated plastic case to prevent water intrusion.

The Sign's LED Single Output Switching Power Supply shall be rated for a 1450 mA (milli-Amps) Rated Current, a DC Voltage Range of 9-34V, a Power Rating of 59.5W, a Voltage Tolerance of +/- 5.0%, an AC Current of 0.7A/230VAC, and Voltage Range of 127-370VDC with 87% Operating Efficiency Rating, plus a working temperature of -30 to +70 degrees Celsius.

Safety Standards shall meet the following criteria: UL1310 Class 2, CAN/CSA C22.2 No. 223-M91 (for LPC-60-1750 only), IP67 approved; design refer to TUV EN60950-1, EN61347-2-13.

3.9 Energy Requirements

The average power consumption of the sign shall not exceed:

4ft = 30 Watts
6ft = 48 Watts
8ft = 55 Watts

3.10 Quality Assurance

Manufacturer shall have a demonstrable Quality Assurance Program in place, with proof of regular re-certification by an independent auditing agency. Reports shall be made available upon request.

3.11 Electrical Standards

The Sign shall be listed and approved to UL 48 Standards by a Nationally Recognized Testing Laboratory. The outside of the sign shall be marked with a certification mark for Electric Signs UL 48.

3.12 Product Guarantee

Sign must be guaranteed for a minimum of five years.

4.0 Method of Measurement. The quantity of edge Lit LED street signs will be measured per each.

5.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for "Edge Lit LED Street Sign" and be paid at the contract unit price per each, Pay Item No. 902-99.02.

The required cable from the lighting control to each individual sign, will not be paid for separately, and is included in the cost for the Edge Lit LED Street Sign.

The required mounting brackets for the sign to the mast arm and post will not be paid for separately and are included in the unit cost for "Edge Lit LED Street Signs".

KK. CONTRACTOR VERIFICATION OF SIGNAL BASE LOCATIONS

1.0 Description. 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 directly contact the utility companies to verify the location of facilities, 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.

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 document.

LL. TRAFFIC SIGNAL MAINTENANCE AND PROGRAMMING

1.0 Description. Traffic signal maintenance and timing for this project shall be in accordance with Section 902 of the Standard Specifications, and specifically as follows.

2.0 Existing Traffic Signals.

2.1 Once any part of an existing traffic signal or its controller within the limits of this project has been modified or adjusted by the contractor, or the contractor makes any roadway changes to reduce the traffic capacity through a signalized intersection within the limits of the project, or the contractor begins work at an intersection with signals already in operation, the contractor shall then be solely responsible for that signal's controller programming and all signal maintenance as specified in 902.2 and 902.3, except for power costs, until Final Acceptance of the project.

2.2 The engineer shall provide to the contractor at the start of the project a detailed report on the existing phasing and timing of each traffic signal, which may be the contractor's responsibility to program. The engineer shall be available to the contractor before any changes are made to a signal or controller to answer any questions about the report. Once the contractor has modified a signal or controller for any reason, the contractor shall be solely responsible for the existing timing plans and all subsequent timing changes.

2.3 The contractor will notify the engineer of the changes no later than 1 working day after changes are programmed if unable to provide advance notice as specified in 902.2.

2.4 Once the communication lines which carry information necessary for these or any other signal controllers outside the limits of this project to maintain coordination is removed by the contractor, the contractor shall be solely responsible for maintaining the coordination at any affected signal to the satisfaction of the engineer until Final Acceptance of the project. 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 engineer. 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.

3.0 Existing Traffic Signal Maintenance and Response. The contractor shall respond to any signal timing complaints or malfunction complaints for those locations referenced in paragraph 2.0 as specified in 902.21.1. Response time shall be 1 hour for complaints received by the engineer between 6 AM and 6 PM on non-holiday weekdays, and 2 hours for all other times. For some cases (due to travel times or other extenuating circumstances) additional time may be acceptable within reason, but must be approved by the engineer. These timeframes will replace the '24 hour' response time in Section 105.14 for any 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 Sec 108.9 and deducted from the payments due the contractor.

4.0 New Signal Controller Programming. In order to satisfy the provisions of 902.2, the contractor shall reference the reports provided by paragraph 2.2 to program the new controllers with timings and settings. The contractor shall account for possible changes made in phase numbers from the existing to new signals when programming the new controllers. All flashing yellow arrow displays shall be activated at turn on for the appropriate yielding left turn as part of the new programming of the controllers and MMU's, but no time of day omission of the flashing yellow arrow will be required. The contractor may use all or part of these reports when

programming the signal, but providing this report in no way waives the contractor's responsibility for the programming.

4.0 Method of Measurement. No measurement for separate payment.

5.0 Basis of Payment. No direct payment for compliance to this section.

MM. DECORATIVE SIGNAL MAST ARMS AND POSTS

1.0 Description. This work shall consist of constructing decorative mast arms at various lengths and 8' decorative top mount posts as shown on the plans. The following intersections require decorative mast arms and 8' decorative top mount posts:

Essex Avenue
Washington Avenue
Adams Avenue
Jefferson Avenue
Argonne Drive
Madison Avenue
Monroe Avenue
Woodbine Avenue
Rose Hill Avenue

Details of these decorative mast arms and 8 FT. decorative top mount posts are shown in the plans.

2.0 Construction Requirements. Work for decorative mast arms and 8' decorative top mount posts shall be in accordance with Sections 902 and the manufacturers recommendations.

3.0 Decorative Mast Arms and 8' Decorative Top Mount Posts Requirement.

3.1 General

Decorative mast arms and 8' decorative top mount posts shall be manufactured to the appearance as shown on the plans.

The Contractor shall submit shop drawings to the City for their review and approval prior to ordering the decorative mast arms and posts. The Contractor shall furnish the City the manufacturer's certification as to the type, use, and engineering qualities of the decorative mast arms and posts. The shop drawings must be signed and sealed by a registered professional engineer in the state of Missouri.

3.2 Design

All pole units and all materials used in its manufacture shall meet the requirements of the 1994 American Association of State Highway and Transportation Officials (AASHTO), specifically the Standard Specifications of Structural Supports for Highway Signs, Luminaires and Traffic Signals.

3.3 Anchorage

Included for each pole shall be a minimum of four steel anchor bolts, complete with double hex nuts and washers. Nuts, washers and threaded areas of anchor bolts shall be hot-dip galvanized to ASTM - A153. Anchor bolts shall have a 55,000 psi minimum yield strength.

3.4 Packaging

Each pole shall be wrapped in ripple kraft paper and padded at points of contact..

3.5 Wind Resistance

Entire luminaire, pole and arm assembly to be rated to withstand AASHTO requirements for 90 mile an hour wind load with a 30% gust factor.

3.6 Welds

All welds shall meet the requirements of AWS D1.1 for Steel & AWS D1.2 for aluminum.

3.7 Material Certification

Material certifications shall be provided for all ASTM numbers referred to in this specification.

3.8 Factory Certification

In order to insure proper procedures are followed in the manufacture of all structural members, the fabrication of the traffic mast arm and pole assemblies shall be done in a plant certified to the American Institute of Steel Construction (AISC) category 1.

3.9 Material Availability

Manufacturer shall certify to the City that the accepted pole, arm, luminaire and decorative shroud is or will become a stock item, readily available with replacement parts for a minimum ten year period.

3.10 Warranty

All materials supplied shall be warranted by the manufacturer for one year after delivery against faulty materials and workmanship.

3.11 One Manufacturer

Fluted pole, fluted mast arm, decorative base and decorative luminaire arms must all be provided from one manufacturer, no substitutions will be allowed from other OEM manufacturers.

3.12 Luminaire Arm

3.12.1

Twin luminaire arm assembly shall be as the appearance shown on the plans and shall be furnished complete with connection hardware.

3.12.2

The luminaire arm shall be welded cast aluminum with tenon to fil luminaire.

3.13 Traffic Pole

3.13.1

The pole shaft shall be fabricated from a minimum of 7-gauge (.179 inch) hot rolled commercial steel. The shaft shall have only one (1) longitudinal, automatically, electrically welded joint, and shall have no intermediate horizontal joints nor welds. Only one (1) length of steel sheet shall be used, which shall be formed into a continuously tapered shaft, having a taper of approximately 14" per foot.

After forming and welding, the tapered shaft shall be longitudinally cold rolled over a hardened steel mandrel under sufficient hydraulic pressure to flatten the weld and increase the physical characteristics of the shaft. The shaft shall meet the chemical and physical properties of ASTM-A595 grade A, having a minimum yield strength of 55,000 psi. The cold rolling process shall also form a 16-flute shaft. The 16-flute shaft shall have sixteen (16) equally spaced Doric flutes, sharp and clear-cut throughout the entire length of the shaft. **NO ROUND PORTION OF THE SHAFT WILL BE ALLOWED, SHAFT MUST BE FLUTED OVER ENTIRE LENGTH of the pole.** The radius of the flutes crest shall not exceed the thickness of the metal in the shaft.

* Individually rolled flutes or round poles with a separate fluted sheathing will not be acceptable.

3.13.2

The base plate shall conform to ASTM-A36. It shall telescope the shaft and be attached by means of two continuous welds, one on the inside of the base at the end of the shaft, the other one the outside at the top of base. The base plate shall be arranged to accept (4) 1 ½" or 1 ¾" diameter anchor bolts on the required bolt circle.

3.13.3

The pole shaft shall be furnished with a 4" x 8" reinforcing handhole frame and a 1/2" - 13 UNC grounding provision. A 3" x 5" shall handhole shall be provided opposite the mast arm.

3.13.4

Each pole shall be provided with an ornamental pole top. The ball shaped pole top shall be mechanically attached to the top of the shaft. Material shall conform to the requirements of AA-319-0.F aluminum.

3.14 Mast Arm

3.14.1

The mast arm shall be fabricated from a minimum 7-gauge (.179 inch) hot rolled commercial steel. It shall be fabricated and formed into a 16 sharp flute shape using the same cold rolling process as the pole shaft.

3.14.2

Mast arm shall be monocurve flange plate mounted style and shall include a steel arm plate w/(4) connecting bolts. Arm plates shall conform to the requirements of ASTM-A36 steel. Bolts shall be internally mounted to pole plate and meet the requirements of ASTM-A325. 16 Flute mast arm must be FLUTED over entire length of the arm and have no round portions.

3.15 Ornamental Base

3.15.1

The base shall be have the appearance as shown on the plans and shall conform to the requirements of ASTM B26 (356.0F) aluminum. The decorative bases must be sized per pole with a FLUTED opening in the top to match the shape of the pole, no round openings will be accepted for the fluted poles. The gap between the pole and base opening shall be approx. 1/4" or 1/8" on each side. The Decorative base shall have a hairline consistent seam from the top of the base to the bottom of the base. Seam preferred to be 1/32" but no more than 1/16". No machining of the seam to obtain fit during manufacturing will be allowed.

3.15.2

The base shall be 45" high and 30" or 34" diameter at the base bottom depending on pole size.

3.15.3

The foundation surface must be level in order to accept the base assembly. It must be at least as large as the bottom dimension of the ornamental base casting.

4.0 Method of Measurement. The quantity of decorative mast arms will be measured per each. The quantity of 8 FT. decorative top mount posts will be measured per each.

5.0 Basis of Payment. All costs for materials, equipment, labor and installation shall be included in the cost for the following items, and be paid at the contract unit price per each:

Pay Item No. 902-99.02, Decorative 8 FT. Top Mounted Post, per each
Pay Item No. 902-99.02, Decorative Post, 10 FT. Arm, per each
Pay Item No. 902-99.02, Decorative Post, 15 FT. Arm, per each
Pay Item No. 902-99.02, Decorative Post, 20 FT. Arm, per each
Pay Item No. 902-99.02, Decorative Post, 20 FT. Arm With 10' Post Extension, per each
Pay Item No. 902-99.02, Decorative Post, 25 FT. Arm, per each

Pay Item No. 902-99.02, Decorative Post, 25 FT. Arm With 10' Post Extension, per each
Pay Item No. 902-99.02, Decorative Post, 30 FT. Arm, per each
Pay Item No. 902-99.02, Decorative Post, 30 FT. Arm With 10' Post Extension, per each
Pay Item No. 902-99.02, Decorative Post, 35 FT. Arm, per each
Pay Item No. 902-99.02, Decorative Post, 35 FT. Arm With 10' Post Extension, per each

5.1

One decorative post at each intersection requires a CCTV to be mounted on the posts. These mast arms shall have a 10' extension of the post to get the required height. The pay items associated with these are designated as "With 10' Extension".

5.2

The Base Concrete for the signal mast arms shown on the plans are based on MoDOT Standard Plans. The manufacturer may require additional depth or width or reinforcement, resulting in a higher total amount of concrete than what is shown. No additional payment will be made for additional concrete or reinforcing steel required for the signal foundations.

NN. DECORATIVE LUMINAIRES

1.0 Description. This work shall consist of furnishing and installing decorative luminaires as shown on the plans. Each decorative mast arm requires two decorative luminaires to be installed on the posts. The luminaires shall be 175 Watt Metal Halide and shall be as the appearance as shown on the plans. The finished color of the luminaire housing shall match the decorative signal mast arm color.

2.0 Material Requirements. Decorative luminaires shall conform to all specifications in Sec. 1091 and the manufacturer's recommendations.

3.0 Construction Requirements. All construction requirements shall conform to Sec 901 and 902 and the manufacturer's recommendations.

4.0 Basis of Payment. Payment for furnishing and installing decorative luminaires shall include all materials, equipment, tools, labor, and work incidental thereto, and shall be considered to be completely covered by the contract unit price for Item Number 902-99.02, "175 WATT 120 VOLT METAL HALIDE DECORATIVE LUMINAIRE," per each as indicated in the plans.

Separate payment will be made for 2c #12 wire from the lighting control to the decorative luminaire.

OO. LUMINAIRE CONTROL CABLE

1.0 Description. This work shall consist of furnishing and installing 2 conductor #12 cable for luminaire control from the lighting control box to the luminaires on the signal posts.

2.0 Material Requirements. 2 conductor #12 cable shall conform to all specifications in Sec. 1060.

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

4.0 Basis of Payment. Payment for furnishing and installing 2 conductor #12 cable shall include all excavation, materials, equipment, tools, labor, and work incidental thereto, and shall be considered to be completely covered by the contract unit price for Item Number 902-99.03, "2 CONDUCTOR 12 AWG LUMINAIRE CONTROL CABLE," per linear foot as indicated in the plans.

PP. 6 IN. PUSHED CONDUIT

1.0 Description. This work shall consist of furnishing and installing conduit, 6 inch rigid, pushed for the conduit required under the Union Pacific Railroad tracks as shown on the plans. The 6 inch conduit shall carry signal wire and fiber underneath the railroad tracks. The depth required under the railroad tracks is shown on the plans.

2.0 Material Requirements. 6 inch conduit shall conform to all specifications in Sec. 1060.

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

4.0 Basis of Payment. Payment for furnishing and installing conduit, 6 inch rigid, pushed shall include all excavation, materials, equipment, tools, labor, and work incidental thereto, and shall be considered to be completely covered by the contract unit price for Item Number 902-99.03, "CONDUIT, 6 IN., PUSHED WITH TRACER WIRE," per linear foot as indicated in the plans.

QQ. PAD MOUNTED 120 VOLT POWER SUPPLY

1.0 Description. At the City-owned locations designated on the plans, this work shall consist of furnishing and installing 120 Volt signal power supplies as shown on the plans. Available units are listed in the lighting section of the MoDOT approved products list.
Other signal controllers shall have a Type 1 Power Supply installed that will feed the signal controller at the locations shown on the plans.

2.0 Construction Requirements. Construction requirements shall conform to Sec 902 and 1092.

3.0 Basis of Payment. Payment for furnishing and installing pad mounted power supply unit shall include all excavation, materials, equipment, tools, labor, and work incidental thereto, and shall be considered to be completely covered by the contract unit price for Item Number 902-99.02, "Pad Mounted 120 Volt Power Supply," per each.

RR. COMBINATION PAD MOUNTED 120/240 VOLT SIGNAL POWER SUPPLY W/2 CIRCUIT LIGHTING CONTROL AND UNINTERRUPTIBLE POWER SUPPLY SYSTEM

1.0 Description. This work shall consist of furnishing and installing a single meter combination 120/240 Volt signal & lighting power supply, uninterruptible power supply system (UPS), and two-circuit type lighting control station. Service pedestals available with lighting control, UPS distribution module, inverter, and component assembly as illustrated on the plan sheets are listed in the Signal Meter Pedestal section of the MoDOT approved products list under Meter

Service Pedestals. Control stations shall be installed in accordance with the plans and by direction of the engineer.

2.0 UPS Location and Cabling. UPS system shall be installed separate from the signal cabinet and shall be installed in the same cabinet as the power supply and two-circuit lighting control station. In addition to the power cables from the UPS to the signal cabinet, the contractor will route but not connect a CAT-5 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 connections from the UPS to the D-plug panel in the 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 pin 17 on the D- Panel 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 (set at 40 %). The normally open contact should be wired to provide logic ground to pin 18 on the D Panel when the UPS is in Low Battery mode. This should indicate a Special Status 3 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 3 hours. The normally closed contact should be wired in series with CVM to allow for the circuit to open after 3 hours and bring the signal to flash. The CAT-5 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.

2.1 UPS Components and System Assembly. The approved aluminum combination service pedestal shall be specified by the contractor to include a pre-assembled and pre-wired UPS component assembly from the service pedestal manufacture in accordance with the wiring diagram and lay out provided in the plans. This assembly shall include an approved pre-wired rack mounted 120 V Inverter w/ Ethernet port and an approved rack mounted accessory shelf w/ 120V 30A Universal Automatic Transfer Switch w/Bypass & 120V 30A Universal Automatic Generator Switch. The contractor shall additionally furnish and install a 48v battery charge management system, 48V Battery harness kit, Gel Cell Batteries, Battery Heater Mat Kit, auxiliary breakers, wiring, and any additional hardware necessary to bring the unit to its intended operation as indicated in the plans and by the direction of the engineer. All shall be fully compatible and fully supported by the UPS inverter manufacturer's warranty. A NEMA L14- 30R generator plug shall be externally accessible by a separate lockable door.

2.2 Gel Cell Batteries. The batteries for the UPS system shall meet the following requirements:

The batteries shall be Gel Cell Valve Regulated Lead Acid (VRLA) type specifically designed for outdoor use. The batteries shall be designed for "Float Service" to provide 100% out-of-box runtime capacity. Each battery shall be rated to provide a typical run time of 196 minutes. The batteries shall have Silver Alloy positive plates. The batteries shall have a five (5) year full replacement, non-prorated warranty. The battery capacity rating at 20hr shall be 100Ah.
The battery shall be 12VDC. The number of batteries in the system shall be four (4) or eight (8). The batteries shall be connected to provide 48VDC. 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.

2.3 Battery Heater Mats. The battery heater mats shall meet the following requirements:

The battery heater mats shall be available in four (4) battery and single (1) battery sizes. The single battery heater mat shall allow for a Master-Slave configuration so two (2) or more mats can be ganged together. The battery heater mats shall plug into a 120VAC/5-15 receptacle. The battery mats shall be thematically controlled, turning ON at 5°C and turning OFF at 15°C. The battery mats shall be thermally fused for 82°C to prevent thermal runaway.

3.0 Construction Requirements. Construction requirements shall conform to Sec 902. Any exceptions to these requirements will be approved by the engineer before system installation.

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

5.0 Basis of Payment. Payment for furnishing and installing pad mounted combination units shall include all excavation, materials, equipment, tools, labor, and work incidental thereto, and shall be considered to be completely covered by the contract unit price for 902-99.02, "Pad Mounted Power Supply/UPS/Controller (MoDOT)," per each.

SS. <u>LIGHTING CABINET MOUNTED ON SIGNAL CABINET</u>

1.0 Description. At the locations designated on the plans, signal controller cabinets shall have a lighting control cabinet installed on the side of the signal cabinet or at an approved location by the engineer. The lighting control cabinet shall be in accordance with MoDOT standard plan 902.15. The lighting control cabinet shall control dusk to dawn operations for the decorative luminaires and edge lit LED street signs.

2.0 Construction Requirements. Construction requirements shall conform to Sec 902 and 1092.

3.0 Basis of Payment. Payment for furnishing and mounting a lighting control cabinet on the signal cabinet will not be paid for separately but included in the Pay Item Number 902-42.81, "Controller Assembly Housing, Keyboard Entry, 8 Phase NEMA Controller," per each.

TT. <u>PAINTING OF SIGNAL EQUIPMENT</u>

1.0 Description. New decorative and MoDOT standard steel signal posts, decorative and MoDOT standard mast arms, pipe extensions for video detector cameras, pipe extensions for CCTV cameras, pipe extensions for wireless in-pavement access points, signal controller cabinets (City intersections only), uninterruptible power supply cabinets (City intersections only), and lighting control cabinets (City intersections only) shall be galvanized after fabrication in accordance with AASHTO M111.

MoDOT's Manchester Rd. and Big Bend Rd. signal control cabinets, power supply cabinets, uninterruptible power supply cabinets, and lighting control cabinets shall NOT be painted black.

They shall then be painted in accordance with the following provision:

1.1

Precautions shall be taken with the galvanizer to ensure that the galvanized materials are not water or chromate after galvanizing. Surfaces to be painted shall be prepared in accordance with ASTM D-6386 "Standard Practice for Preparation for Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and hardware Surface for Painting" using the method for "partially weathered galvanized steel". This includes checking for the presence of a chromate conversion coating or wet storage stain and removing if necessary, smoothing the surface, removing any oil or grease, and priming with one coat (1-2 mils) of a penetrating epoxy sealer meeting the requirements of MSP-96-07C. Surfaces shall then be given two coats (2 mils minimum each) of a System G (black) matching Federal Standard 595B 17038 polyurethane finish coat. Primer and finish coat shall be products from the same manufacturer and used in accordance with the manufacturer's instructions.

1.2

The contractor shall submit to the engineer a detailed painting plan, including product data sheets and finish color sample, prior to the work.

2.0 Basis of Payment. Payment for painting new decorative and MoDOT standard steel signal posts, decorative and MoDOT standard mast arms, signal controller cabinets, battery backup cabinets, lighting control cabinets, and appurtenances above the base plate including the exposed bolts, completely in place, including all materials, equipment, tools, labor and work incidental thereto, shall be considered to be completely covered by the contract unit bid price for the respective pay items in the contract, no additional payment will be made.

UU. <u>REPLACE TRAVEL TIME & COUNT SYSTEM (MODOT SIGNALS)</u>

1.0 Description. This work shall consist of relocating a travel time and count system at Big Bend Road. The existing system is in operation and shall be removed and replaced to the new post and relocated to the new signal cabinet as shown in the plans. The existing wireless in-pavement detectors located in the southbound and northbound lanes of Kirkwood Road at Big Bend Rd, shall be left in place and not disturbed.

1.1

Requirements:

- Big Bend Road
    - Remove access point mounted on existing median post extension and install new access point (FlexAP-ES) to proposed post #1, facing west
    - Remove repeater mounted on existing median post extension and install on a new repeater (LL-Repeater) on proposed post #7, facing east
    - Provide new mounting kits for each new repeater and access point
    - Provide a new pipe extension, the same color as the new mast arms for proposed post #1 and post #7
    - Install new cat5E cable from the proposed MoDOT signal cabinet to the new access point
    - Relocate the access point cards in the existing signal cabinet to the new signal cabinet

  - Configure new hardware and test system for a fully functional wireless-in pavement system
- Manchester Road
  - Remove each existing access point and repeater from existing signal structures and install 2 new access points (FlexAP-ES) on proposed posts #1 and #4
  - Install 2 new repeaters (LL-Repeater) on proposed posts #7 and #10
  - Provide new mounting kits for each new repeater and access point
  - Install new cat5E cable form the proposed MoDOT signal cabinet to the new access points
  - Relocate the access point cards in the existing signal cabinet to the new signal cabinet
  - Replace the existing in-pavement magenetometers with new sensors (MAG2-F) for the northbound and southbound receiving lanes on Kirkwood Rd./Lindbergh Blvd. (10 total new magnetometers)
  - Remove disused magnetometers and fill void with material acceptable to MoDOT's representative.
  - Configure new hardware and test system for a fully functional wireless-in pavement system

2.0 Construction Requirements. Construction requirements shall conform to Sec 902 and the manufacturer's recommendations. Coordinate all work with the manufacturer to ensure a fully operational system after relocation.

3.0 Basis of Payment. Payment for all labor, tools, any necessary materials, and equipment for adjusting relocating the travel time and count system shall be completely covered at the contract unit price for Item No. 902-99.02, "Remove and Replace Travel Time System", per each.

Any requirements or materials needed that are not specifically listed shall be incidental and included in the cost for Relocate Travel Time & Count System, for a fully functional system.

VV. DISPOSITION OF EXISTING CITY EQUIPMENT

1.0 Description. The existing City signing / signal / lighting equipment located within the project limits, including the 2 neon railroad overpass signs at Madison and Argonne, shall be removed by the contractor and transported to the City's electric department at 212 S. Taylor Ave, Kirkwood, MO 63122. The contractor shall notify the City's representative 24 hours prior to each delivery by calling Mr. Rick McKinley at 314-984-5925. The contractor may call Mr. Rick McKinley in advance of the removal of City equipment, as a decision to what the City wants to keep, might be made in the field prior to transporting to the electric department. The contractor shall exercise reasonable care in the handling of the equipment during removal and transportation. Should any of the equipment be damaged by the contractor's negligence, it shall be replaced at the contractor's expense. Delivery of the listed items shall be within two (2) working days of removal. All items returned shall be tagged with the date removed, project number and location/intersection.

2.0 Basis of Payment. This work shall be considered included in the contract unit price for Removal of Improvements, per lump sum.

WW. DISPOSITION OF EXISTING MODOT EQUIPMENT

1.0 Description. The existing MoDOT signing / signal / lighting / ITS equipment located within the project limits shall be removed by the contractor 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 signal shop 24 hours prior to each delivery by calling Mr. Jim Collier at 314-301-1466 (office) or 314-565-6729 (cell). The contractor shall exercise reasonable care in the handling of the equipment during removal and transportation. Should any of the equipment be damaged by the contractor's negligence, it shall be replaced at the contractor's expense. Delivery of the listed items shall be within two (2) working days of removal. All items returned shall be tagged with the date removed, project number and location/intersection.

2.0 Basis of Payment. This work shall be considered included in the contract unit price for Removal of Improvements, per lump sum.

XX. ACCESSIBLE PEDESTRIAN PUSHBUTTONS AND SIGNING (CITY INTERSECTIONS)

1.0 Description. Accessible Pedestrian Signal (APS) units with pushbuttons and signing will be required at all intersections where pedestrian pushbutton locations are shown on the plans and shall meet the requirements of the current editions for the Manual on Uniform Traffic Control Devices (MUTCD) and Public Rights-of-Way Accessibility Guidelines (PROWAG).

2.0 Equipment.

2.1 APS Unit Housing. All APS unit components shall be weatherproof and of sturdy design, and in complete accordance with manufacturer specifications. The entire assembly shall be weather tight, secure against electrical shock, and able to withstand continuous frequent usage.

2.2 Electrical Requirements. The APS shall operate with systems providing 95 to 130 VAC, 60 Hz and throughout an ambient air temperature range of -29 to +160 °F (-34 to +70 °C).

2.3 Walk Indications. Accessible pedestrian signals shall have both audible and vibrotactile walk indications.

2.4 Vibrotactile. Vibrotactile walk indications shall be provided by a tactile arrow on the pushbutton that vibrates during the walk interval. Tactile arrow shall be located on the pushbutton that vibrates during the walk interval. Tactile arrow shall be located on the pushbutton, 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.

2.5 Audible. Accessible pedestrian signals 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.

2.6 Pushbutton Signage. In addition to standard pedestrian sign requirements, all pushbuttons for the locations mentioned in 1.0 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.

2.6.1 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 50 mm (2 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.

2.6.2 Street Name. Accessible pedestrian signals (APS) shall include street name information aligned parallel to the crosswalk direction and shall comply with Revised Draft Guidelines for Accessible Public Rights-of-Way R409.3 or shall provide street name information in audible format.

3.0 Performance.

3.1 Audible Locator Tone. Locator tone that 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. 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.

3.2 Verbal Wait Message. Acknowledge tone that tells the pedestrian that they have placed a call and informational message that tells the pedestrian to “Wait to cross” street name at intersecting street name.

3.3 Verbal Walk Message. The verbal messages shall provide a clear message that the walk interval is in effect, as well as to which crossing it applies. If available, the audio tone feature will not be used. The verbal message that is provided at regular intervals throughout the timing of the walk interval shall be the term “walk sign,” which will be followed by the name of the street to be crossed.

3.4 Volume. Automatic volume adjustment in response to ambient traffic sound level will 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.

4.0 Documentation and Support.

4.1 Two copies of the operation and maintenance manuals for each station shall be included.

4.2 The City of Kirkwood shall be furnished with a certification from the equipment manufacturer stating that the equipment furnished under this specification complies with all

provisions of this specification. If there are any items that do not comply with this specification, then a list of those exceptions must be detailed on the certification.

4.3 If needed for programming elements such as volume, the Contractor shall provide the City with a total of two handheld units as part of this project for future maintenance needs.

5.0 Construction Requirements.

5.1 Construction requirements shall conform to Sec 902, 1061, and 1092.

5.2 Each pedestrian pushbutton shall be mounted 42" above the adjacent pedestrian path and be accessible within a maximum unobstructed side-reach distance of 10". If the 10" side-reach distance cannot be met, the Contractor shall either install an extension for the pushbutton or re-construct the landing/curb area to meet this. The exact solution will be determined by the Engineer. There will be no direct payment for installing an extension or re-construction.

5.3 The Contractor shall be responsible for programming each APS unit to the satisfaction of the City of Kirkwood and the Engineer.

5.4 The City of Kirkwood reserves the right to modify any and all volume settings based upon field conditions, within specified limitations outlined in the MUTCD and PROWAG. During the programming and installation of the proposed APS units, the Contractor shall ensure that a representative of the City of Kirkwood is present to approve the volume settings of each APS unit.

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

7.0 Payment. Payment for the accessible pedestrian pushbutton will be for each unit per bid item "902-99.02, Accessible Pedestrian Pushbutton". This work shall include the provision of all labor and materials necessary to provide a complete APS unit for each pushbutton location, including but not limited to: miscellaneous wiring (excluding the pushbutton cables), adaptors, installation/mounting hardware), pedestrian information signs, APS pushbutton assemblies, and APS programming.

YY. <u>ACCESSIBLE PEDESTRIAN PUSHBUTTONS AND SIGNING (MODOT INTERSECTIONS)</u>

1.0 Description. Audible pedestrian pushbuttons and signing will be required for all pedestrian indications at all the MoDOT intersections (Manchester and Big Bend).

2.0 Installation. Audible signals should be installed as part of a pushbutton assembly.

3.0 Equipment.

3.1 Walk Indications. Accessible pedestrian signals shall have both audible and vibrotactile walk indications.

3.2 Vibrotactile. Vibrotactile walk indications shall be provided by a tactile arrow on the pushbutton that vibrates during the walk interval. Tactile arrow shall be located on the pushbutton that vibrates during the walk interval. Tactile arrow shall be located on the

pushbutton, 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.

3.3 Audible. Accessible pedestrian signals 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.

3.4 Pushbutton signage. In addition to standard pedestrian sign requirements, all pushbuttons for the locations mentioned in 1.0 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. Accessible pedestrian signals (APS) shall include street name information aligned parallel to the crosswalk direction and shall comply with Revised Draft Guidelines for Accessible Public Rights-of-Way R409.3 or shall provide street name information in audible format.

4.0 Performance.

4.1 Audible Locator Tone. Locator tone that 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. 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. Acknowledge tone that tells the pedestrian that they have placed a call and informational message that tells the pedestrian to “Wait to cross” street name at intersecting street name.

4.3 Verbal Walk Message. The verbal messages shall provide a clear message that the walk interval is in effect, as well as to which crossing it applies. If available, the audio tone feature will not be used. The verbal message that is provided at regular intervals throughout the timing of the walk interval 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 will 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. Two copies of the operation and maintenance manuals for each station shall be included.

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 Payment. Payment for the audible signals will be for each unit per bid item, 902-99.02, "Accessible Pedestrian Pushbutton", per each. This will include all wiring, power adaptors, and installation hardware needed. Payment for signing will be included in the pay item for audible pedestrian pushbutton.

ZZ. PEDESTRIAN SIGNAL HEADS

1.0 Description. This work shall consist of furnishing, installing and placing into operation any pedestrian signal heads.

2.0 System Requirements. Delete Sec. 1092.1.9 in its entirety and substitute the following:

1092.1.9 Pedestrian Signal Heads. Pedestrian signal heads shall be in accordance with ITE specifications and standards for pedestrian traffic control signal indications and the following:

(a) Pedestrian signal head housings shall be constructed of a one-piece, 0.250-inch (6 mm) thick, polycarbonate material as shown on the plans. The housing shall include an integral mounting bracket designed for side-of-pole mounting on all makes of signal poles with a terminal compartment and minimum 5-position, double-row terminal block.

(b) The door, lens and any openings in the housing shall have gaskets or seals to exclude dust and moisture from the inside of the compartment.

(c) Lenses shall be constructed of polycarbonate material.

(d) Pedestrian signal head units shall be provided with a manufactured preformed rectangular visor or screen-type louver.

(e) All plastic material shall be ultraviolet stabilized.

(f) Indications shall be ITE Class 3 symbol messages. The "UPRAISED HAND" symbol shall be illuminated with a filled, Portland orange LED module. The "WALKING PERSON" symbol shall be illuminated with a filled, white LED module. The "Countdown" display numbers shall be illuminated with a Portland orange LED module. The LED modules shall be in accordance with applicable portions of Sec 1092.1.

(g) Pedestrian traffic control signal faces shall be constructed such that all messages are displayed from the same message-bearing surface having a black opaque background.

The "Countdown" display shall be located to the right of the "UPRAISED HAND" and "WALKING PERSON" symbols, which will be overlaid.

(h) Pedestrian signal heads require "Countdown" displays and shall have the following features:

(1) Display numbers must be two digits at least 9 inches in height.

(2) Shall only display the "Countdown" time during the pedestrian change interval. Time displayed shall be in seconds and begin only at the beginning of the pedestrian change interval. The flashing "UPRAISED HAND" symbol shall be concurrently displayed during the pedestrian change interval. The total time displayed at the start of the pedestrian change interval shall be automatically adjusted by the pedestrian signal head and not require any manual settings or additional wiring to the signal cabinet.

(3) Once the "Countdown" display reaches "0", the "Countdown" display shall blank-out until the next pedestrian change interval begins.

(4) If the pedestrian change interval is interrupted or shortened as part of a transition into a preemption sequence, the "Countdown" display shall go dark immediately upon activation of the preemption transition.

(5) A test switch shall be provided in order to test the "Countdown" display.

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

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

5.0 Basis of Payment. Accepted pedestrian signal heads will be paid at the contract unit price per each. Payment will be considered full compensation for all labor, equipment and material to complete the described work.

AAA. <u>FIBER OPTIC CABLE AND CONNECTIONS</u>

1.0 Description. This work shall consist of installing, splicing and terminating fiber optic cables. All work and materials shall comply with Section 902.12.6 of standard specs as modified by the following.

2.0 Materials.

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

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

2.1.2 The cables shall be constructed with 12 fibers per tube, 6 tubes per cable (72 SMFO).

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

2.3 Pigtail. Pigtails shall be factory-made, buffered, and strengthened with aramid yarn to reduce the possibility that accidental mishandling will damage the fiber or connection. Pigtails shall be yellow. They must use the type of connector specified in Sec 2.2 of this provision. Each must contain one fiber. Length shall suffice to provide two feet of slack after installation. No direct payment for pigtails will be made and will be subsidiary to cabinet and fiber bid items.

2.4 Jumper. Jumpers shall meet the requirements for pigtails, but shall have a connector on each end. The second connector shall be as specified in Sec 2.2 of this provision except where a different connector is required for compatibility with the equipment to which the jumper connects. Length shall suffice to provide approximately five feet of slack after installation. Jumper cables contain a pair of fibers.

2.5 Splice Tray. Splice trays shall be 11.7” long, 3.9” wide, and 0.2” tall. They shall be aluminum, 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. No direct payment will be made for splice trays and will be subsidiary to cabinet and fiber bid items.

2.6 Rack-Mounted Interconnect Center. An interconnect center is an 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. Other fibers may be coiled, unterminated.

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

The interconnect center may be installed with bracketing on the underside of signal cabinet shelves, in lieu of 19-in. rack mounting.

The enclosure shall hold at least six splice trays meeting the requirements of Sec 2.5 of this provision. Provide enough trays for all splices made in the interconnect center. The enclosure’s patch panel shall have at least 24 or 48 positions as indicated on the plans, compatible with the connectors specified in Sec 2.2 of this provision. It shall have provisions for cable strain relief and for connector labeling. No direct payment for rack mounted interconnects centers will be made and will be subsidiary to cabinet and fiber bid items.

2.7 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 be made of powder coated aluminum and have a gasketed, hinged door. It shall have provisions for cable strain relief and for connector labeling. It shall have a patch panel with at least 24 positions compatible

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

2.8 Underground Splice Enclosure. Splice enclosures, if needed, shall provide capacity for 72 fiber splices. Enclosure shall be: suitable for outdoor applications with a temperature range of -30 to 60 degrees Celsius, protect splices from moisture and damage, non-reactive and not support galvanic cell action, waterproof, re-enterable, sealed with a gasket, permit selective splicing to allow one or more fiber strands to be cut and spliced without disrupting other fibers, equipped with a basket to accommodate the slack from all fibers routed into the enclosure, capable of holding splice trays from various manufacturers, input/output capacity of four 18 mm cables, equipped with a termination block to terminate the central strength members of the fiber optic cables.

Splice trays shall be: compatible with fiber splices and splice enclosure, equipped with polyethylene tubes to protect exposed individual fibers within the enclosure, stackable within the splice enclosure. Vinyl markers shall be supplied to identify each fiber to be spliced. Each splice shall be individually mounted and mechanically protected on the splice tray. Loose tube buffers shall be secured with a tube guide or channel snap. Slack fiber shall be placed in an oval shape along an inside wall of the tray.

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

2.10 Documentation. Provide MoDOT and City of Kirkwood with a copy of the final plans in Visio and/or Microstation formats and any relevant notes that would aid in the understanding of the fiber configuration.

3.0 Construction Requirements.

3.1 Cable Installation. Prior to installation, perform such tests as indicated in Sec 3.6 of this provision to confirm that the cable is in good condition and complies with the specifications. Any defects found after installation will be deemed the fault of the contractor.

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

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

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

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

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

3.1.6 In every intermediate pull box, store 30 feet of slack fiber optic cable for every cable that passes through the pull box. Store slack cable neatly on the walls of the pull box using racking hardware acceptable to the Engineer. Additional slack cable that is included in the pay quantity includes 60' at the splice point within the MoDOT or City of Kirkwood fiber pullbox.

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

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

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

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

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

3.2.3 Prior to splicing to a fiber installed by others, measure and record the optical loss over that fiber. See Sec 3.6 of this provision.

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

3.3 Terminations. Terminate fibers by splicing them to factory-made pigtails. Cap all connectors that are not connected to a mating connector. If the existing termination panel does not have the capacity to conform to the project documents and specifications, it is the contractor's responsibility to replace the termination panel at no additional cost to the project. Pigtails are subsidiary to this bid item.

3.4 Jumper Management. Use spiral wrap to guide and protect bundles of jumpers between the patch panel and equipment. Affix the spiral wrap to the wall of the field terminal cabinet or vertical member of the rack. Label the jumpers at each end, numbering them sequentially.

3.5 Acceptance Testing

3.5.1 General. Test the fiber after installation, including all splicing and terminations. For each fiber optic link terminated at the field terminal cabinet patch panels, 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).

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

(a) Calculate the maximum allowable losses for the contractor installed fiber link, both at 1310 nm and at 1550 nm. Use the following formula:

Maximum link loss = (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.

(b) Provide the engineer documentation that the optical time domain reflectometer to be used in testing has been calibrated and is working properly.

(c) Use an optical time domain reflectometer to assess the losses along the contractor furnished and installed fiber paths. Record the result at both 1310 nm and 1550 nm. Arrange for the engineer or his representative to witness these tests.

(d) 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.

3.5.3 Test Result Documentation. Prepare a diagram showing all of the links tested in this project. For the portions installed in this project, show the field terminal 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 this diagram to the Engineer, along with the calculations for the maximum allowable loss. Submit the diagrams and calculations in an electronic format acceptable to the Engineer.

4.0 Basis of Payment. Measurement and payment for items covered by this specification include the documentation and acceptance testing, in addition to all materials and equipment necessary for a fully operational system.

Payment for the following bid items will be made as follows:

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

BBB. MODOT ITS EQUIPMENT WITHIN PROJECT LIMITS

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

2.0 Construction Requirements. The contractor shall exercise reasonable care while completing work near these facilities and shall take steps necessary to protect these facilities from damage for all items that are not specifically identified as being removed and/or relocated in the plans. Should any of the existing wiring or conduit be damaged by the Contractor, it shall be replaced at the Contractor's expense and the system in full operation within 4 hours of when the damage occurred. If it is mutually agreed upon between MoDOT, the City of Kirkwood, 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 Contactor 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. The ITS Maintenance contractor will then bill the contractor causing the damage directly.

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

CCC. NETWORK CONNECTED SIGNAL MONITOR

1.0 Description. The signal cabinets within the project limits shall have a flashing yellow arrow compatible monitor installed with an internal RJ-45 plug for 10/100 Ethernet communication that is connected to the MoDOT or City computer network through Ethernet switches and allow a remote user running the monitor's software to interface with any specific monitor.

2.0 Performance.

2.1 Inputs. If video detection is used, inputs into controller shall be via SDLC port. Signal cabinet to be TS2 Type 1 setup and the monitor is to be a Malfunction Management Unit (MMU) for MODOT cabinet. Signal cabinet to be TS2 Type 1 setup for all City of Kirkwood cabinets.

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

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

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

3.0 Construction Requirements.

3.1 Requirements. Construction requirements shall conform to Sections 902 and 1092.

3.2 Setup and Training. A minimum of one half-day of training shall be provided in the operation, setup communication and maintenance of the monitors to both MoDOT and City of Kirkwood staff.

3.3 Acceptance Testing. Contractor shall demonstrate that all network-connected monitors are remotely communicating and individually addressable via supplied software either MoDOT's TMC or City of Kirkwood's facilities, where applicable. No direct payment will be made for this testing.

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

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

Item No.	Type	Description
910-99.02	Each	Network Connected Signal Malfunction Management Unit

DDD. UNINTERRUPTIBLE POWER SUPPLY (CITY INTERSECTIONS)

1.0 Description. This specification establishes the minimum requirements for a complete emergency battery back-up system for use at traffic signals utilizing Light Emitting Diodes (LED) signals and pedestrian heads.

Addendum #2

NOTE: This specification also applies to the intersection of Big Bend Road (MoDOT Intersection).

The Uninterruptible Power Supply (UPS)) shall include, but not be limited to the following:

- UPS with Inverter, Charger, Tap Switching Transformer and Internal Power Transfer Switch.
- Automatic / Manual Bypass Transfer Switch unit.
- Batteries
- Cabinet
- Mounting hardware
- Wiring

The UPS shall provide reliable emergency power to a traffic signal in the event of a power failure or interruption.

2.0 Operation.

2.1 General. The UPS shall provide the following operational modes when operating on battery power:

- Full operation of all traffic signal devices
- Flash operation
- Combination of full and flash operation

2.2 Run Time. The UPS shall provide a minimum of 8.0 hours of full time operation with a 450 watt load. The minimum battery size requirement is listed in section 7.0, Battery Type.

2.3 Compatibility. The UPS shall be compatible with Model 332, 336, and 337 cabinets; an ITS cabinet; model 170 and 2070 controllers and any NEMA style cabinet and enclosures; an advanced transportation controller; and all cabinet components for full time operation.

2.4 Output Capacity. The UPS shall provide a minimum of 1100W/1100VA@25°C active output capacity with 83 percent minimum inverter efficiency with 30% minimum loading.

2.5 Output Voltage. When operating in backup mode, The UPS output shall be 120VAC ± 2%, pure sine wave output, ≤3%THD, 60Hz ± 0.3 Hz.

2.6 DC System Voltage. The UPS DC system voltage shall be 48VDC nominal.

2.7 Transfer Time. The maximum transfer time allowed, from disruption of normal utility line voltage to stabilized inverter line voltage from batteries, shall be 5 milliseconds (ms). The same maximum allowable time shall also apply when switching from the inverter line voltage to utility-

line voltage. Transfers to and from battery operation shall not interfere with the operation of the other equipment in the intersection.

2.8 Operating Temperature. The UPS and all components shall operate without performance degradation over a temperature range of -40°C to +74°C with a maximum load of 70% of rated output of the UPS inverter.

2.9 Feedback Level. The UPS shall be tested and certified to Electrical Standards UL 1778 and CSA 107.3.

2.10 Surge Protection. The UPS shall have surge protection compliant with IEEE/ANSI C.62.41 Cat. A & B.

2.11 Reliability. The UPS system shall have a minimum Mean-Time-Before-Failure (MTBF) of 150,000 hours at a temperature of 25 degree C (77 degree F) and 100,000 hours at a temperature of 50 degree C (122 degree F).

2.12 Power and Control Connections. The UPS shall be easily installed, replaced, or removed by using easily removable cables for AC input, AC output, DC input, external transfer control/alarm and battery temperature sense.

2.12.1 AC Connection. The AC input and output shall be hard wired connections.

2.12.2 DC Connection. The DC connection shall be a recessed one piece connector rated to handle the maximum DC current required by the inverter while running on batteries.

2.12.3 Temperature Probe Connections. The battery temperature sensor inputs shall be panel-mounted connector.

2.13 Unit Failure. In the event of inverter/charger failure, battery failure or complete battery discharge, the automatic bypass transfer switch shall revert to Normally Closed (NC) (de-energized) state, where utility line power is connected to the cabinet.

2.14 Overload. The UPS Inverter Module must be able to shut down in order to protect against internal damage in the event of an overload at the output. The Inverter shall support an overload up to 115% for 2 minutes and then turn off the inverter output. The fault recovers when the overload is removed and line power returns.

2.15 Schedule.

2.15.1 The UPS shall provide a (2) time-of-day schedule settings programmable by the user.

2.15.2 The time-of-day schedule shall allow the user to program schedule operational modes as required, per intersection.

2.15.3 The UPS time-of-day function when programmed shall automatically change operational modes based on the time-of-day schedule. Operational modes shall be Red Flash or Full Operation.

2.15.4 The UPS shall not switch from Flash Operation to Full Operation mode when the remaining battery capacity is ≤40 percent.

2.16 AC Feedback. The UPS shall prevent a malfunction feedback to the cabinet or from feeding back to the utility service.

2.17 UPS Failure Mode. In the event of UPS failure (inverter/charger or battery) or complete battery discharge, the internal power transfer relay shall revert to Normally Closed (de-energized) state and provide utility power to the intersection when utility line power is available to the cabinet.

2.18 Automatic Shutdown. The UPS shall initiate an automatic shutdown when battery output reaches 42.5VDC.

2.19 Destructive Discharge or Overcharge. The UPS shall be equipped with an integral system to prevent the battery from destructive discharge or overcharge.

3.0 Automatic Bypass Transfer Switch.

3.1 Rating. The UPS shall include an Automatic/Manual Transfer Switch rated at 120VAC/30 amps.

3.2 Automatic & Manual Bypass Switch. The Automatic Bypass Transfer Switch shall be a combination automatic/manual bypass switch. Placing the bypass switch in the “Bypass” mode shall transfer the intersection load from the UPS output directly to utility power. AC utility power must still be available to the UPS input, allowing the UPS to keep the batteries charged. An Inverter Input breaker shall be provided and located on the Bypass Switch so to shut off utility power to the UPS input, allowing safely disconnecting and removing the inverter. With the inverter turned off, the batteries can be safely disconnected from the system.

3.3 Indicator Light. The Automatic Bypass Transfer Switch shall include a bypass indicator light that automatically notifies the user when the Manual bypass switch is in Bypass position. The indicator light shall be illuminated when in UPS mode.

3.4 Status Relay. The Automatic Transfer Switch shall have an optional bypass status relay with normally open, dry contacts that automatically close when the Manual bypass switch is in Bypass position.

3.5 Integrated Switch. The manual bypass switch and the automatic transfer relay shall be integrated together within the Automatic Bypass Transfer Switch allowing the manual bypass switch to be rated at 15 Amp and to be integrated with the bypass indicator light.

3.6 Terminal Blocks. The Automatic Bypass Transfer Switch shall have terminal blocks capable of accepting #6 AWG wiring for the AC input and output with #10 AWG from the Automatic Bypass Transfer Switch to inverter/charger module.

4.0 Functionality.

4.1 Output Voltage Regulation Mode.

4.1.1 The UPS shall include AVR (Auto Voltage Regulation) Functionality.

4.1.2 AC Input Voltage Range for Output Regulation. The Buck/Boost mode shall have a minimum range of 88 - 175 VAC

4.1.3 Transfer Set Points. There shall not be any user definable transfer set points for the buck boost mode.

4.1.4 Regulated Voltage. Whenever AVR mode is selected the output of the system shall be regulated between 108-130VAC. When the output of the system can no longer be maintained with this range, the UPS shall transfer to Backup Mode.

4.2 Circuit Breakers.

4.2.1 The UPS shall be equipped with an AC Input circuit breaker that protects both the UPS and the loads connected to the output.

4.2.2 Should the AC Input breaker on the UPS trip, it shall allow the UPS to go to inverter mode to power the intersection off of batteries.

4.2.3 Should an overload condition still exist when the inverter is energized the inverter will revert to its internal electronic protection, preventing damage to the inverter due to the overload or short circuit condition, on the output. Once this overload condition is cleared the inverter will energize and power the intersection utilizing the available battery power. If the condition does not clear itself, the inverter will stay in the standby mode until manually cleared by a technician.

4.2.4 The UPS shall have a flush mounted Battery circuit breaker installed on the front panel of the UPS inverter module.

4.3 Line Qualify Time. The UPS shall have a user definable line qualify time. The user shall be able to select a minimum of six (6) possible settings. The settings shall be 3, 10, 20, 30, 40 and 50 seconds. The default line qualify time shall be 3 seconds.

4.4 Battery Charger.

4.4.1 The UPS shall have an integral charger that is compatible with Gel and AGM battery topology. The charger shall be an intelligent charger with control systems that automatically incorporates bulk, absorption and float charging modes.

4.4.2 Battery Temperature Compensation. The integral Intelligent Charger shall use temperature compensation. The charging system shall compensate over a range of 2.5 - 6.0mV/°C per cell, user adjustable when required.

4.4.3 Battery Temperature Sensor. A temperature probe which plugs into the front panel of the UPS shall be used to monitor the internal temperature of the batteries. The Temperature sensor shall be 2 meter in length, external to the inverter/charger module and taped to the side of a center battery within the battery string.

4.4.4 Battery Temperature Charging. The batteries shall not be recharged whenever the battery temperature exceeds 50°C.

4.4.5 Recharge Time. The recharge time for the batteries from "protective low-cutoff" to 90 percent or more of full charge capacity shall not exceed 12 hours. The UPS charger shall be capable of providing 15 amps at 54VDC.

5.0 User Interfaces and Displays.

5.1 Inverter/Charger Display. The UPS inverter/charger unit shall include a backlit LCD display for viewing all status and configuration information. The screen shall be easily viewable in both bright sunlight and in darkness.

5.1.1 Screen Size. The screen shall be large enough to display the following information with the use of menu scrolling buttons to read required information. All active readings shall be real time.

- Operating Mode (Line, Standby, Backup, Buck / Boost)
- Utility input voltage
- UPS output voltage and current
- Battery Temperature
- Input Frequency
- Output Power
- Battery Voltage
- Charger Current
- Shed Timer Relays time to activation
- Ethernet MAC Address and IP Address
- Accumulated output power in kW hours
- Battery Runtime Remaining
- Unit Serial number
- Unit Firmware Version
- Any alarms and faults

5.1.2 Keypad. The UPS inverter/charger unit shall include a keypad for navigating system information.

5.2 Web-based Interface. The UPS shall be provided with a web-based-interface for user configuration and management through a web browser.

5.2.1 Minimum Capabilities. The UPS shall allow the user to do the following through the web browser

- View Logs
- Change modes of operation
- Configure email alarms
- Adjust line qualify time
- Program relay contacts
- Configure network parameters.
- Inverter/charger firmware to be upgradeable remotely via Ethernet.
- Communication module firmware upgradeable remotely.

5.2.2 Status LEDs. The UPS shall have discrete status LED indications on the front of the inverter/charger.

5.2.3 Green Output LED. This LED will be ON any time that the output of the UPS is in normal mode. When the UPS output is either in Backup Mode or AVR Modes the LED will flash On and Off.

5.2.4 Red Fault LED. This LED will be Solid On any time that there are any faults in the system

5.2.5 Red Flashing Alarm LED. This LED will Flash On and Off any time that there are any alarms in the system.

5.2.6 Event Log. The UPS shall maintain an event log containing a minimum of 200 of the most recent events recorded by the UPS. These events shall be down loadable remotely via Ethernet and automatically reported to the central monitoring software. The Events Log shall be date and time stamped.

5.2.7 Events, Alarms and Faults. The UPS shall display and log the following events, alarms and faults.

- Operating Mode
- Weak Battery
- Overload
- High and Low Temperatures
- User Input,
- Line Frequency out of specifications
- No temperature probe
- Low Battery
- Battery Breaker Open
- UPS is performing a Self-Test
- Fan Fail
- Incorrect Firmware
- AC Input Breaker Open
- Short Circuit
- Output Voltage High
- Output Voltage Low
- Battery Voltage High
- Battery Voltage Low
- Isolation Relay Fail
- Temperature High

5.2.8 Counters. The UPS shall keep track of the following:

- The number of times that the unit was in Backup Mode
- The accumulated number of hours and minutes that the unit has operated in Backup mode since the last reset.

5.3 Programmable Relay Contacts. The UPS shall provide the user six (5) programmable dry relay contacts and one (1) 48VDC relay contact. As a minimum, the programmable options shall be On Battery, Low Battery, Timer, Alarm, Fault, and Off. The UPS shall also have three (3) input dry relay contacts. UPS Self Test, User Alarm, and UPS Shutdown.

5.3.1 Relay Contact Terminals. The relay contacts shall be made available on the front panel of the UPS via 6, 3 position plug-in terminal blocks with screw down wiring connections.

5.3.2 Contacts. Each relay (1 through 5), shall have their own common and their own set of normally open (NO) and normally closed (NC) terminals. The terminals for each relay shall be oriented as NO-C-NC on the terminal block. Contact 6 shall provide continuous 48 VDC voltage for powering of enclosure DC fan.

5.3.3 Labeling. The contacts on the terminal block shall be labeled 1-18, left to right. Additionally, each set of contact shall be labeled with the NO-C-NC designation, as well as C1…C6 from left to right. Printed labels noting all alarms and faults shall be provided with the UPS Inverter/Charger to be installed when required.

5.3.4 Rating. The relay contacts shall be rated at a minimum of 1 amp @ 250 VAC.

5.3.5 On Battery Relay Contact. The dry relay contacts that are configured for “on battery” shall only energize when the Inverter is operating in Backup Mode

5.3.6 Timer Relay Contacts. The UPS shall include a timer that will energize the “timer” configured dry relay contact after the user configured time has elapsed. The timer is started when the UPS enters Backup Mode. The user shall be able to configure the timer to the required time. The format shall be Hours, Minutes, Seconds.

5.3.7 Low Battery Relay Contact. The UPS shall have an adjustable low battery relay setting. This setting shall be adjustable so that the user can set the point at which the low battery relay contact is energized.

6.0 Communications

6.1 Serial Interface. The UPS shall be equipped with an industry standard RS-232 serial connection for user configuration and management. The serial port shall be an EIA-232 (DB9-Female) connector.

6.2 Ethernet Interface. The UPS shall have an internal Ethernet communication interface for user configuration and management. The Ethernet Port shall be an RJ-45, EIA 568B Pin Out Connector.

6.3 Remote Monitoring. The UPS shall include remote monitoring & alarms transmission capabilities through the Ethernet RJ-45 IP Addressable Port, using SNMP protocol.

6.4 Notification. System shall have the capability of notifying Operations, Maintenance or Engineering personnel via e-mail of any alarms, faults or events, user selectable. E-mail set up must allow for different levels of notifications based on the criticalness of the alarms.

6.5 User Configuration Menus. All UPS configuration and System menus shall be accessible and programmable from the RS-232 and Ethernet Port.

6.6 Communication Protocols. The UPS shall support TCP and UDP over IP protocol communications.

6.7 Application Layer Protocols. The UPS shall support FTP, Telnet, and HTTP.

6.8 Simple Network Management Protocol (SNMP). The UPS shall be SNMP compliant.

7.0 Batteries

7.1 Battery Type. The battery shall be comprised of extreme temperature, float cycle, GEL VRLA (Valve Regulated Lead Acid) or AGM components.

7.1.1 Individual batteries shall meet the following specifications:

- Voltage Rating: 12V
- Amp-hour rating: 109 AH, at the 20 hour rate, to 1.75 Volts per cell, minimum battery rating.

7.1.2 Larger AH batteries are acceptable providing they do not exceed the group size listed below (Case 31):

- Group size: Case 31
- Batteries shall be easily replaced and commercially available off the shelf
- Batteries shall provide 100% runtime capacity out-of-box. Each battery must meet its specification without the requirement of cycling upon initial installation and after the initial 24 hour top off charge.

7.2 Battery String. Batteries used for the UPS shall consist of 4 batteries configured for a 48 VDC battery buss system.

7.3 Operating Temperature. The battery system shall consist of one or more strings of extreme temperature; float cycle GEL VRLA or AGM batteries. Batteries shall be certified to operate at extreme temperatures from –40°C to +71°C.

7.4 Construction.

7.4.1 Terminals. The batteries shall have maintenance-free threaded insert terminals eliminating annual torqueing. Battery terminals that require annual torqueing of each post connection shall not permitted.

7.4.2 Ability to Function. An integral lifting handle should be provided on the batteries for ease of removal/installation.

8.0 Cabinet.

8.1 General.

8.1.1 UPS Cabinet Dimensions. The dimensions for the UPS cabinet shall not exceed 50 inches in height, 17 inches in width and 17 inches in depth.

8.1.2 Inverter/Charger Mounting. The Inverter/Charger Unit shall be shelf or rack mounted on a standard EIA19" rack.

8.1.3 Automatic Transfer Switch Mounting. The Automatic Transfer switch shall be mounted on EIA 19" Rail.

8.1.4 Interconnect Wiring. All interconnect wiring shall be provided and shall be UL Style 1015 CSA TEW.

8.2 UPS Replacement. The UPS equipment and batteries shall be easily replaced and shall not require any special tools for installation.

8.3 Hot Swappable. The UPS inverter and batteries shall be hot swappable. There shall be no disruption to the Traffic Signal when removing the inverter or batteries for maintenance.

8.4 Quick Disconnects. All inverter and battery connections shall be of the quick disconnect type for ease of maintenance

8.5 Ancillary Installation Hardware. All necessary installation hardware (bolts, fasteners, washers, shelves, racks, etc.) shall be included.

8.6 Cabinet Sizing. The external cabinet shall be capable of housing batteries up to a group 31 size, inverter/charger power module, automatic transfer switch, control panels, wiring, wiring harnesses, and all other ancillary equipment.

8.7 Cabinet Type. The UPS shall be installed as side-mounted to a Traffic Controller cabinet with no mounting brackets required.

8.8 Rating. All external cabinets shall be NEMA 3R rated. The enclosure shall be made of 0.125 (5052-H32) aluminum.

8.9 Ventilation.

8.9.1 The external cabinet shall be ventilated through the use of louvered vents, filter, and one thermostatically controlled fan. The filter shall be the re-usable type and matching the dimensions of the louver with both located on the bottom half of the door.

8.9.2 The cabinet fan shall be DC operated for longer reliability.

8.10 Ancillary Hardware. The UPS cabinet shall come with all bolts, washers, nuts required to mount it to a Controller cabinet.

8.11 Accessibility. All components, terminations, terminal blocks, relays, etc. shall be fully accessible.

8.12 Shelves. Battery shelves shall be located in the bottom half of the enclosure. Air must be allowed for flow from the bottom of the cabinet and up the back internal wall. Neither the top battery shelf nor the Power Module shelf shall inhibit the airflow to the top of the cabinet.

8.13 Locking. The cabinet shall include a 3 point locking system, including a Type 2 Corbin lock and utilize a handle with pad locking capability.

8.14 Cabinet Options. The following options shall be available for the cabinet:

- On-Battery lamp mounted externally on the top of the cabinet that illuminates when the UPS is operating in inverter mode.
- Battery Heater Mats to increase battery capacity in cold climates.
- Receptacle plate assembly that mounts on the transfer switch panel to provide utility power to the battery heater mats.
- Automatic Generator Transfer switch that senses a generator is connected and automatically switches to the generator source.
- Internal lamp with door push-button switch to illuminate the interior of the cabinet.
- Status monitoring dry contacts for the Automatic Transfer Switch and the Generator Transfer Switch.

9.0 Maintenance.

9.1 Probe Jacks. The UPS shall provide voltmeter standard probe input-jacks (+) and (-) to read the exact battery voltage drop at the inverter input.

9.2 Self-Testing. The UPS Inverter Module shall be programmable to perform automatic self-testing, programmed in weekly intervals and programmed by the user to meet their specific requirements or manufacturer's recommendation. During self-test the UPS Inverter Module shall identify a weak battery or multiple batteries in the string that have reached a weak state and notify maintenance by initiating a Weak Battery Alarm.

9.3 Remote Battery Monitoring Specifications.

9.3.1 Provide a remote battery monitor system (RBMS) to be permanently installed into the UPS/Battery cabinet to monitor the four UPS batteries (4-12V battery blocks).

9.3.2 The RBMS shall have the ability to monitor, read and record both the battery string and individual battery voltages, admittance (internal battery resistance), individual battery temperatures and to provide a real-time evaluation of the battery bank health.

9.3.3 The RBMS shall have a built in web interface for communications over Ethernet. The device shall be hardened and operate at a temperature range of -40C to +65C. The device shall include individual 12 volt battery sensors and operate in the range of -40C to +80C. Communications shall be SNMP via TCP/IP.

9.3.4 The RBMS shall include software to automatically poll each intersection, up to 100 per software program, reading individual battery voltage, admittance and temperature, confirming each is within its user programmable parameters.

9.3.5 The system shall have the ability to program the intervals as to when each reading is taken, by days, weeks or months. The software shall be provided as part of the system cost.

9.3.6 The RBMS shall also perform as a battery balancer, continuously monitoring all batteries in the string and to interface with the UPSs charger voltage/current so to keep the batteries equal with all batteries within the battery string.

9.3.7 The RBMS shall allow for any single 12V battery within the battery string to be replaced without replacing all batteries in the string during the battery warranty period.

10.0 Warranty.

10.1 Battery Backup System.

10.1.1 The UPS System shall include a five-year warranty on parts and labor on the entire UPS System, including batteries, to the Agency when utilizing the UPS Manufacturers own designed enclosure, meeting the above cabinet specifications.

10.1.2 Should the agency decide not to use the enclosure provided by the UPS Manufacturer, the manufacturer must provide a three-year warranty on parts and labor on the UPS Inverter Module only.

10.2 Batteries. The UPS Manufacturer must provide a 5 year unconditional full replacement warranty for every battery sold to the City with the UPS under this specification. Under the warranty time period, the battery must provide a minimum of 70% of its original capacity; otherwise it will be considered to be non-compliant to the warranty and replaced at no cost to the City or MoDOT by the UPS manufacturer.

11.0 Vendor Support

11.1 Technical Support. The UPS manufacturer shall provide a toll-free technical support phone number. The toll-free phone number shall be included in the UPS manual.

11.2 Documentation. Equipment manuals must be provided for each UPS cabinet. Equipment manuals shall include installation, operation, programming, maintenance and troubleshooting.

12.0 Quality Assurance.

12.1 Design and Production. Each UPS shall be manufactured in accordance with a written manufacturer's Quality Assurance program. The QA program shall include, as a minimum, specific design and production QA procedures.

12.2 ISO Certified. The UPS Power Module manufacturer shall be ISO 9001or ISO 9002 certified.

12.3 Design Qualification Testing. The manufacturer shall be certified to carry out the CSA and UL standards testing on the UPS system.

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

14.0 Basis of Payment. Payment will be for 1 unit per bid item "902-99.02 – Uninterruptible Power Supply". Payment will be considered full compensation for all labor, equipment and material to complete the described work.

EEE. VIDEO DETECTION SYSTEM (CITY INTERSECTIONS)

1.0 Description. This specification sets forth the minimum requirements for a video detection system that detects vehicles, bicycles, and motorcycles on a roadway by processing video images and that provides vehicle presence, traffic flow data, event alarms, and full-motion video for real-time traffic control and management systems.

2.0 System Hardware. The video detection system shall be comprised of two major hardware components: a video sensor and a communications interface panel. An optional wired input/output card shall be available for certain cabinet types.

2.1 Video Sensor. The video detection system shall include a video sensor that integrates a high-definition (HD) camera with an embedded processor for analyzing the video and performing detection.

2.1.1 Camera and Processor

2.1.1.1 The camera shall be a color CMOS imaging array.

2.1.1.2 The camera shall have HD resolution of at least 720p (1280x720 pixels).

2.1.1.3 The camera shall include a minimum 10X optical zoom.

2.1.1.3.1 It shall be possible to zoom the lens as required to satisfy across-the-intersection detection objectives, including stop line and advance detection.

2.1.1.3.2 It shall be possible to zoom the lens remotely from a City facility for temporary traffic surveillance operations or to inspect the cleanliness of the faceplate.

2.1.1.4 The camera shall have direct, real-time iris and shutter speed control by the integrated processor.

2.1.1.5 The processor shall support H.264 video compression for streaming output.

2.1.2 Video Sensor Enclosure Assembly

2.1.2.1 The camera and processor shall be housed in a sealed IP-67 enclosure. The enclosure and all associated hardware, including elements needed for mounting to a signal structure, shall be black in color.

2.1.2.1.1 The faceplate of the enclosure shall be glass and shall have hydrophilic coating on the exterior surface to reduce debris accumulation and maintenance.

2.1.2.1.2 The faceplate shall have a thermostatically-controlled indium tin oxide (ITO) heater applied directly on the interior surface to keep the faceplate clear of condensation, snow, ice and frost.

2.1.2.2 An adjustable aluminum visor shall shield the faceplate from the sun and extraneous light sources.

2.1.2.3 An integral aiming sight shall assist in aiming the camera for the detection objectives.

2.1.2.4 A removable rear cap and cable strain relief shall seal the power connection.

2.1.2.4.1 The rear cap shall be tethered to the enclosure to avoid dropping the cap during installation.

2.1.2.4.2 The rear cap shall be fastened to the body of the video sensor with a single, captive bolt.

2.1.2.5 The rear cap and enclosure shall include Gore breathers to equalize internal and external pressure.

2.1.2.6 The sensor shall be self-supporting on manufacturer's mounting brackets for easier fastening during installation.

2.1.2.6.1 It shall be possible to rotate the field-of-view 360° without changing the angle of the visor.

2.1.3 Power and Communications

2.1.3.1 Power and communications for the video sensor shall be carried over a single three-conductor cable.

2.1.3.1.1 Termination of the three-conductor cable shall be inside the rear cap of the enclosure on a three-position, removable terminal block. Each conductor shall be attached to the plug via a screw connection.

2.1.3.2 The video sensor shall operate normally over an input voltage range of 89 to 265 VAC at 50 or 60 Hz.

2.1.3.3 Power consumption shall be no more than 16 watts during typical operation.

2.1.3.4 No supplemental surge suppression shall be required outside the cabinet.

2.1.3.5 All communications to the video sensor shall be broadband-over-power via the same three-conductor cable that powers the unit. Coaxial cable shall not be required.

2.2 Communications Interface Panel. The video detection system shall include an interface panel in the signal cabinet that manages communications between the video sensors, the City facilities or MoDOT TMC, a maintenance technician, and the traffic cabinet itself.

2.2.1 Video Sensor Connection

2.2.1.1 The communications interface panel shall provide connection points for four video sensors.

2.2.1.1.1 Each sensor connection shall be a 3-pole terminal block, which supplies power and broadband-over-power communications to the sensor.

2.2.1.1.2 The broadband-over-power communications shall provide a throughput of 70 to 90 Mbps.

2.2.1.1.3 The broadband-over-power connection shall support at least 1,000 feet of cabling to the video sensor.

2.2.1.1.4 Each video sensor connection shall include a power switch.

2.2.1.1.5 There shall be an LED for each video sensor to indicate the state of the power to the sensor and an LED for each video sensor to indicate the status of communications.

2.2.1.1.6 Each video sensor connection shall contain a resettable fuse.

2.2.1.1.7 Each video sensor connection shall provide high-energy transient protection.

2.2.2 Communications

2.2.2.1 An Ethernet port shall be provided within the video detection hardware in the signal cabinet to connect to the City facilities or MoDOT's TMC.

2.2.2.1.1 The remote connection shall support 10/100/1000 Mbps Ethernet communication.

2.2.2.1.2 The communications interface panel shall proxy all network requests that arrive on the remote connection to avoid unwanted network traffic from reaching the broadband-over-power network between the communications interface panel and the video sensors.

2.2.2.1.3 All communications to the video detection system through the remote connection shall be to a single IP address.

2.2.3 Local User Communications

2.2.3.1 A wired Ethernet port shall be provided to connect the technician at the cabinet to the video detection system for setup and maintenance purposes.

2.2.3.1.1 The maintenance port shall support 10/100/1000 Mbps Ethernet communication.

2.2.3.1.2 All communications to the video detection system through the maintenance port shall be to a single IP address.

2.2.3.1.3 The maintenance port shall support DHCP to automatically assign an IP address to the user's computer, if desired.

2.2.3.2 An 802.11g Wi-Fi access point shall allow wireless connection to the video detection system at the cabinet for setup and maintenance purposes.

2.2.3.2.1. All communications to the video detection system through the Wi-Fi access point shall be to a single IP Address.

2.2.3.2.2 The Wi-Fi access point shall support DHCP to automatically assign an IP Address to the user's computer.

2.2.3.2.3 The Wi-Fi access point shall include a dipole, omnidirectional antenna.

2.2.3.2.4 A momentary pushbutton shall allow the user to turn the Wi-Fi access point on or off.

2.2.3.2.5 The Wi-Fi access point shall turn itself off automatically after a period of inactivity from connected devices of 30 minutes.

2.2.3.2.6 An LED shall indicate when the Wi-Fi access point is enabled.

2.2.3.2.7 The Wi-Fi access point shall operate simultaneously with the wired maintenance port and with the remote connection.

2.2.4 Traffic Controller Connection. The communications interface panel shall provide one connection to communicate to the traffic controller through the cabinet.

2.2.4.1 The traffic controller connection shall support a TS2 Type 1 or TS2 Type 2 cabinet configuration.

2.2.4.1.1 The traffic controller connector shall be a 15-pin female metal shell D sub-miniature type connector to support a standard NEMA TS2 or TEES SDLC cable.

2.2.4.1.2 The traffic controller connection shall support a protocol interface to SDLC-capable traffic controllers (NEMA or TEES).

2.2.4.1.3 The traffic controller connection shall support the NEMA TS2 SDLC protocol to include up to 64 detector outputs and 32 inputs.

2.2.4.2 The traffic controller connection shall be able to connect to a wired input/output card, which supports wired I/O in cabinets without a SDLC-capable controller.

2.2.4.2.1 The wired I/O data communications link shall support at least 24 outputs and 16 inputs.

2.2.4.3 It shall be possible to connect and use both SDLC communications and communication to the wired input/output card simultaneously.

2.2.5 USB Ports

2.2.5.1 The communications interface panel shall include two USB 2.0 ports.

2.2.5.1.1 If a communications interface panel fails to start and run due to a software or operating system failure, it shall be possible to reinstall all system and application software from a USB memory stick without necessitating removal of the communications interface panel from the cabinet.

2.2.6 Power

2.2.6.1 The communications interface panel shall accept input voltage in the range of 89-265 VAC, 50/60 Hz power from the transient-protected side of the cabinet.

2.2.6.2 The communications interface panel shall be protected by two slow blow fuses. Two (2) spares shall be attached to the panel.

2.3 Wired Input/Output Card. The video detection system shall support an optional wired input/output card that communicates with the communications interface panel for real-time detection states and other I/O to the traffic controller. The card may reside in a standard detector rack or shelf-mount enclosure with power module.

2.3.1 The optional wired input/output card shall comply with the form factor and electrical characteristics to plug directly into a NEMA type C or D detector rack.

2.3.1.1 The card shall occupy two slots of the detector rack.

2.3.1.2 The card shall provide four detector outputs on its rear-edge connector.

2.3.1.3 A front connector shall provide communication to the communications interface panel.

2.3.1.4 A front connector shall allow 16 inputs and 24 contact-closure detector outputs for wiring into the cabinet.

2.3.1.4.1 A front panel LED for each of the 16 inputs and 24 outputs shall indicate the state of the input or output.

2.3.1.5 The wired input/output card shall support optional expansion cards in other slots. Each expansion card shall support 4 outputs to the back edge of the card.

2.3.1.6 The wired input/output card shall support optional harnesses for connection to Input Files or C1, C4, C11, and C12 ports to support Type 170 or Type 2070 controllers.

3.0 System Software. The Contractor shall provide management software for configuration, monitoring and data collection purposes with the video detection system. Configuration software shall be provided to the City of Kirkwood .

3.1 Management Software

3.1.1 Management software shall be a Windows-based application.

3.1.1.1 The software shall be compatible with Windows 7 and Windows 10 operating systems.

3.1.1.2 The software shall communicate with the video detection system via Ethernet.

3.1.2 The management software shall automatically determine all video sensors and communications interface panels available on the local network and populate a list of all devices.

3.1.3 The management software shall provide the user a means to name individual video sensors and communications interface panels.

3.1.4 The management software shall provide a means for the user to zoom the camera optics while viewing a live video stream.

3.1.5 The management software shall provide a means for the user to calibrate distances in the field of view.

3.1.6 The management software shall provide the user a means to create 4-sided detection zones in the field of view using either a still snapshot or live video.

3.1.6.1 The management software will overlay an outline of each detection zone over the background image.

3.1.6.2 It shall be possible for the user to place detection zones anywhere in the field of view for stop line detection and/or advance detection.

3.1.6.3 It shall be possible for the user to set the desired color of both the on and off states of the detection zone overlay.

3.1.6.4 It shall be possible for the user to alter the size and shape of any previously created zone.

3.1.6.5 It shall be possible for the user to overlap zones, either partially or fully.

3.1.6.6 It shall be possible for the user to name each zone uniquely.

3.1.6.7 It shall be possible for the user to assign each zone to detect vehicles, to detect bicycles, or to detect both, and to specify different outputs for each type.

3.1.6.8 It shall be possible for the user to assign the same output to multiple zones such that the output will be on if any of the zones are detecting a vehicle or bicycle.

3.1.6.9 It shall be possible for the user to assign a single zone to more than one output such that if a vehicle or bicycle is detected, all the assigned outputs shall be turned on.

3.1.6.10 The management software shall be capable of creating at least 99 detection zones per video sensor.

3.1.7 It shall be possible for the management software to retrieve all configuration parameters from video sensors or communications interface panels.

3.1.7.1 It shall be possible for the user to save all the settings for a video sensor or a communications interface panel to a laptop file.

3.1.7.2 The management software shall provide a means to read or import all the settings from a previously saved configuration file for a video sensor or a communications interface panel.

3.1.8 The management software shall be able to download a new version of the application software into a communications interface panel and its attached video sensors.

3.1.9 The management software shall provide a video image module to monitor operation of a video sensor.

3.1.9.1 The monitoring screen shall include a live video stream from the video sensor with at least HD 1280x720 pixel resolution.

3.1.9.2 The video monitoring screen shall show indications of detection in real time by changing the color of the detection zone.

3.1.9.3 It shall be possible for the user to configure different indications for vehicle detections vs. bicycle detections when both are configured for the same zone.

3.1.9.4 The monitoring screen shall include the following optional, configurable objects:

- It shall be possible for the user to size and position them anywhere on the screen and to change the color and size of text.
- An indication of when an output is on or off, along with a user-configurable name for that indicator.
- The current time in the video sensor.
- A user-configurable title or name.
- The version number of the video sensor software.

3.1.9.4.1 An indication of when an output is on or off, along with a user-configurable name for that indicator.

3.1.9.4.2 The current time in the video sensor.

3.1.9.4.3 A user-configurable title or name.

3.1.9.4.4 The version number of the video sensor software.

3.1.10 The management software shall provide a screen to monitor operation of the intersection with a quad-view video stream from the communications interface panel.

3.1.10.1 The quad-view video stream shall have a resolution of at least HD 1280x720 pixels, where each of the sensor videos comprising the quad-view shall be at least 640x360 pixels.

3.1.10.2 It shall be possible for the user to configure the order that the sensor videos appear in the quad-view.

3.1.10.3 The real-time quad-view video stream shall be capable of displaying the overlay graphics for all four sensors simultaneously.

3.1.11 While monitoring the video of a single video sensor or of the quad-view, it shall be possible for the user to request a “snapshot” or single-frame image to save to a named file on a laptop.

3.1.12 While monitoring the video of a single video sensor or of the quad-view, it shall be possible for the user to record a period of the video to save to a named file on a laptop.

4.0 System Functionality. The video detection system shall provide the following features and functionality.

4.1 Detection Performance

4.1.2 For detection zones placed at the stop line, the probability of not detecting the presence of a vehicle shall be 1% or less under all operating conditions when the video sensor is installed and configured per manufacturer recommendations.

4.1.3 It shall be possible to place advance detector zones such that the farthest point of the zone is up to 600 feet from the video sensor. Advance detector zone placement shall include 2-3 car lengths of field-of-view beyond the farthest point of the zone.

4.1.4 The video detection system shall be configured by the Contractor or their vendor to collect continuous turning movement counts for each approach to the intersection. The turning movement counts shall be accurate to a +/- 5% level.

4.1.5 To ensure statistical significance for the above detection performance specifications, the data shall be collected over two separate 2-hour time intervals with at one of those intervals occurring during low-light conditions (so as to avoid a single lighting condition) and shall contain a minimum of one hundred (50) detected vehicles per lane. The calculations of detection performance will not include turning movements where vehicles do not pass through the detectors, vehicle lane-change anomalies, or where they stop short or stop beyond the combined detection zones.

4.1.6 The Contractor shall propose a testing method to prove accuracy levels required above, to be performed by the Contractor or their vendor and approved by the Engineer.

4.1.7 If the required performance measures are not met, the Contractor shall make adjustments to the system configuration until required levels of accuracy are met.

4.2 Failsafe Mode

4.2.1 The video detection system shall provide three (3) failsafe options during optical contrast loss. The default shall be maximum recall. The end-user may choose to use minimum recall or fixed recall in which a user-defined number of seconds may be implemented to hold call during green.

4.2.2 The video sensor shall continuously monitor the overall contrast in the video. If the overall contrast falls below a preset level (such as caused by dirty faceplate, severe glare, extreme fog, or temporary ice/snow on the faceplate), the sensor shall enable the chosen failsafe mode. When sufficient contrast is restored in the video, the sensor will exit the failsafe mode.

4.2.3 The communications interface panel shall continuously monitor the connectivity status of the attached video sensors. If any video sensor goes offline due to either electrical failure or

internal software failure, the communications interface panel shall enable the failsafe mode for that video sensor. If the video sensor comes back online, failsafe mode shall end.

4.3 Data Collection

4.3.1 The video detection system shall automatically collect and store traffic flow data in non-volatile memory for later retrieval and analysis. A minimum of 7 days of traffic data shall be stored in each camera, at which time the oldest data stored may be overwritten by the most recent data collected. No additional hardware or software outside of the camera housing shall be necessary to store traffic data. The data shall include:

4.3.1.1 Vehicle counts, including turning movement counts per approach.

4.3.1.2 Vehicle average speeds.

4.3.2 The management software shall be able to retrieve collected data for a specified period of time or for all currently stored data and save into a standard CSV file.

4.4 Operations Log

4.4.1 The communications interface panel and each video sensor shall maintain a time-stamped operations log of routine and special events in non-volatile memory for later retrieval and analysis.

4.5 Time Synchronization

4.5.1 The video detection system and management software shall provide three methods to synchronize the time of day clocks in the communication interface panel and the video sensors, as follows:

4.5.1.1 Manual time synchronization operation by the user, which sets the time to the current time on the laptop where the management software is running.

4.5.1.2 A configuration setting to allow the communications interface panel to automatically obtain time from the NEMA TS2 protocol on the SDLC channel and broadcast it to the video sensors.

4.5.1.3 A configuration setting to allow the communications interface panel to automatically obtain time from up to five Network Time Protocol (NTP) sources and broadcast it to the video sensors.

4.6 Video Streaming

4.6.1 In addition to the ability to view video streams in the management software, it shall be possible to view video from individual sensors or to view the quad-view from the communications interface panel using a third-party video player application on a tablet, smartphone or laptop computer.

4.6.2 Video bitrate shall be user-definable between 100 Kbps-5000 Kbps. The default shall be 2048 Kbps. All bitrates shall provide 30 fps.

5.0 Installation and Setup. The video detection system hardware shall be designed for flexible, fast and easy installation and setup.

5.1 It shall be possible to mount the video sensor on a post extension pipe, mast arm, or luminaire arm.

5.2 No special tools or extra equipment, other than a laptop for configuration, will be required.

5.3 Once all hardware is installed, connected and functional, it shall be possible to configure the video detection system for a typical 4-approach, 8-phase intersection in 15 minutes or less.

5.4 The camera shall be mounted as close as possible to the top of the mast arm, with any unneeded extension pipe to be cut and removed prior to final acceptance.

6.0 Warranty, Service and Support. The video detection system shall be provided with the following warranty, service and support options.

6.1 Warranty

6.1.1 The manufacturer shall warrant the video detection system for a minimum of three (3) years.

6.2. Service

6.2.1 Ongoing software support by the manufacturer will include software updates of the video sensor, communications interface panel, and management software. These updates will be provided free of charge during the warranty period. The manufacturer will maintain a program for technical support and software updates following expiration of the warranty period. This program will be available to the City in the form of a separate agreement for continuing support.

6.3 Support

6.3.1 A quick-start guide, installation guide, application notes, and other materials shall be available from the manufacturer to assist the Contractor in product installation and setup for various applications.

6.3.2 Training shall be provided to the City of Kirkwood and MoDOT staff in application design, operation, setup, and maintenance of the video detection system.

6.3.3 Manufacturer shall provide a tech support website and a toll-free phone number for technical support.

7.0 Basis of Payment. Measurement and payment for items covered by this specification include the documentation and acceptance testing, in addition to all materials, including mounting hardware, cables, and miscellaneous equipment needed for a fully functional cabinet. Payment will be made as follows:

Item No.	Type	Description
902-49.75	Each	Video Detection System

FFF. VIDEO DETECTION SYSTEM (MODOT INTERSECTIONS)

1.0 Description. If video is provided by the Contractor to enable any needed detection, this work shall consist of furnishing, installing and placing into operation a vehicle detection system that detects vehicles by processing video images and providing detection outputs to a traffic signal controller. MoDOT intersections are located at Manchester and Big Bend.

2.0 System Requirements. Delete Secs. 902.13.4 and 1092.4.7.7 in their entirety and substitute the following:

902.13.4 Video Detection System. The system shall include all equipment shown on the plans and described in these specifications, plus any incidental items necessary for the satisfactory operation and maintenance of the system. All original identifying information from the packaging of each installed camera shall be placed in the signal cabinet. Up to date reference manuals or user guides are required in pdf format. 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 coaxial 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.

902.13.4.1 Camera. The bottom of the video camera shall be mounted a minimum of 30 feet (9.0 m) above the pavement**,** unless otherwise indicated on the plans or approved by the Engineer.

902.13.4.2 Extra Service Outlet. 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.

1092.4.7.7.1 System Requirements. The video detection system shall provide flexible detection zone placement at any location and at any orientation within the combined field of view of the image processors. Preferred presence detector zone configurations shall be a box, lines or similar placed across lanes of traffic or lines placed parallel with lanes of traffic. Detection zones shall be capable of overlapping **and** be configurable to be directional in order to prevent vehicles that approach from all but 1 direction from activating the detection zone.

1092.4.7.7.1.1 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.

1092.4.7.7.1.2 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.

1092.4.7.7.1.3 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.

1092.4.7.7.1.4 The video detection system shall be capable of being programmed via remote communication through the Commission's Ethernet network via serial connection or Ethernet connection. It shall provide at a minimum 2 frames per second moving image and real time detection displays to a remote computer using supplied video detection system software through the Commission's network for all cameras. All components, existing cabinet wiring changes, and/or modules needed to communicate through the Commission's network other than Commission furnished communication gear shall be included as part of the video detection system. If provided with an IP address by the Commission, the contractor will program and connect the video detection system into the Commission supplied communication gear before project acceptance.

10924.7.7.1.5 The video system must integrate/be compatible with an Advanced Transportation Signal Controller (ATC). This applies not only to the existing controller brand but any other signal controller that meets ATC requirements.

1092.4.7.7.1.6 The system must be able to be accessed and configured remotely by users with a rudimentary understanding of video systems/signal controllers. Any and all software to interface the video system is to be included.

1092.4.7.7.1.7 In addition to presence detection, the video detection system shall be capable of performing at a minimum the following calculations in real time and store all values for each camera view for any visible lane without the addition of another device:

a) Speed
b) Volume
c) Lane Occupancy
d) Vehicle Classification
e) Other available performance measures

1092.4.7.7.1.8 For speed calculations thru movements are required. Turning movement measurements are desired but not required. 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.
If this requirement cannot be met all values must be able to be exported thru an excel spreadsheet. Other performance measures must be clearly defined. In all cases all performances measures must be ultimately available in an easily usable, exportable format.

1092.4.7.7.2 Video Detection System Components. 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. All camera views shall be obtainable without requiring the disconnection and reconnection of cables within the system.

1092.4.7.7.2.1 Video Detection System Software. The video detection system shall include software that detects vehicles in multiple lanes using only the video image. Detection zones shall be defined using a video monitor and control device to place the zones on a video image, which may include a laptop computer. A minimum of 12 detection zones per camera shall be available.

1092.4.7.7.2.2 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.

1092.4.7.7.2.2.1 The equipment shall be provided with either a NEMA TS1 or NEMA TS2 interface as shown on the plans.

1092.4.7.7.2.2.1.1 For TS1 systems, the video detection system shall be equipped with a TS1 detector interface for a minimum of 16 detector outputs, or 32 detector outputs if required by Job Special Provisions. Logic output levels shall be compatible with the TS1. A subminiature "D" connector on the video detection system shall be used for interfacing to these outputs.

1092.4.7.7.2.2.1.2 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 16 detector outputs is required, with the capability of expansion to 32 outputs if required by Job Special Provisions.

1092.4.7.7.2.2.1.3 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, a 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.

1092.4.7.7.2.2.2 The video detection system shall be provided for either single camera or multiple camera installations as shown on the plans. Multiple camera installations shall be configured so that failure of 1 camera or control module shall not affect the operation of the remaining cameras or control modules.

1092.4.7.7.2.2.2.1 All video detection systems shall have a RS-170 (NTSC) video input to process another synchronous video source in real-time. The video detection system shall have at least 1 RS-170 (NTSC) video output.

1092.4.7.7.2.2.2.2 The video detection system shall be capable of providing the connection of a local surveillance camera or other non-detection video source. The video from the auxiliary input shall not be processed for video detection. The video detection system shall have an RS-170 (NTSC) composite video output, which may correspond to any of the video inputs, as selected

remotely via RS-232 or locally by front panel switch. Multiple video inputs shall be routed into external video switchers (mounted to the monitor if provided).

1092.4.7.7.2.2.2.3 The video detection system shall be able to turn any detection zone in the default detector pattern on or off by internal time base control. The video detection system shall also be capable of switching to any detector pattern at the request of the user by either a menu selection with the control device or through a computer.

1092.4.7.7.2.3 Monitor. The monitor shall be a 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. If the video detection system is installed in a 332 or 336 cabinet or NEMA cabinet housing a master controller or in one that does not have shelf space, the screen size will be 5” diagonal with all other noted provisions unchanged.

1092.4.7.7.2.4 Video Camera and Housing. The video detection system supplier shall furnish the video camera for traffic detection. 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).

1092.4.7.7.2.4.1 The camera shall provide a minimum resolution of 430 lines horizontal (TVL) and 350 lines vertical under NTSC operation.

1092.4.7.7.2.4.2 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.

1092.4.7.7.2.4.3 The camera shall have a variable focal length. The maximum aperture of the lens shall not be smaller than f1.8 and the minimum aperture shall not be larger than f300. The camera shall have a horizontal field of view ranging from a minimum angle of view between 5 degrees and 10 degrees wide to a maximum angle of at least 45 degrees. The adjustments for focus and focal length shall be made without opening up the camera housing.

1092.4.7.7.2.4.4 The camera shall be contained in an enclosure that is waterproof and dust-tight to NEMA-4 specifications. A minimum 5W heater shall be incorporated in the camera to prevent the formation of condensation and to assure proper operation of the lens' iris mechanism. The heater shall not interfere with the operation of the image sensor electronics, and it shall not cause interference with the video signal. The enclosure shall allow the camera to be rotated in the field during installation.

1092.4.7.7.2.4.5 The housing shall be equipped with a 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.

1092.4.7.7.2.4.6 The total weight of the enclosure, camera, lens, housing, sun shield and mounting bracket shall be less than 10 pounds (4.5 kg).

1092.4.7.7.2.5 Cable. Coaxial cable, if used, shall be a 75 ohm, precision video cable with 20 AWG (0.50 mm2) solid bare copper conductor, maximum of 10.1 ohms/m Nom. D.C.R., solid polyethylene insulating dielectric, 96% minimum tinned copper double-braided shield with a black polyethylene outer covering. The signal attenuation shall not exceed 0.8 dB per 100 feet (30 m) at 10 MHz. Nominal outside diameter shall be 0.305 inches (7.7 mm). The cable shall be in accordance with Belden Type 8281, West Penn P806 or approved equal.

1092.4.7.7.2.5.1 Seventy-five ohm BNC plug connectors shall be used with coaxial cable, if used. The supplier of the video detection system shall approve the coaxial cable, BNC connectors and crimping tool, and provide a 10% extra quantity of the needed BNC connectors with the system. The manufacturer's instructions shall be followed.

1092.4.7.7.2.5.2 Multi-conductor cable shall be per the manufacturer's recommendation and in accordance with Sec 1061.

1092.4.7.7.2.5.3 Twisted pair cable shall meet recommendations of the video detection system manufacturer. Pairs shall be untinned, with an overall shield. Individually shielded pairs will not be allowed.

1092.4.7.7.2.6 Maintenance and Support. The supplier shall maintain an ongoing program of technical support and software updates for the video detection system following expiration of the warranty period. The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the video detection system.

1092.4.7.7.2.7 Warranty of Video Detection System. The video detection system shall be warranted to be free of defects in material and workmanship for a minimum of two years, with the cameras being warranted for the same for two years. During the warranty period, 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 the warranty period. The update of the processor unit software to be National Transportation Communications for ITS Protocol (NTCIP) compliant shall be included.

1092.4.7.7.2.8 Training of Video Detection System. A minimum of one day (6 hours) of training shall be provided in the operation, setup and maintenance of the video detection system. Please contact the engineer to set up said training.

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

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

6.0 Basis of Payment. Accepted video detection systems will be made at the contract unit price per each. Payment will be considered full compensation for all labor, equipment and material to complete the described work.

6.1 No direct payment will be made for programming the video detection system and its local intersection controller.

GGG. ITS CONDUIT AND PULL BOXES

1.0 Description.

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

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

2.0 Materials.

2.1 Conduits shall meet the requirements of current MoDOT Standard Specifications Sec 1060.

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

2.3 Pull ropes or tapes shall be polypropylene with a minimum tensile strength of 600 pounds. Pull ropes or tapes are incidental the cost of the conduit.

2.4 Locator wire shall be solid copper wire, AWG 10, type THHN, with blue insulation, and is incidental to the cost of the conduit.

3.0 Construction Requirements.

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

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

3.1.2 Pull ropes shall be furnished and installed in all conduit cells, both empty and filled, for future maintenance needs.

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

3.1.4 Non-metallic duct shall not be spliced. All runs shall be continuous except for locations where the conduit reel has been expended or where otherwise shown in the plans.

3.2 Directional Drilling.

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

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

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

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

3.2.4 Drilling Control. Use a digital walkover locating system to track the drill head during the bore. At minimum, the locating system shall be capable of determining the pitch, roll, heading, depth, and horizontal position of the drill head at any point along the bore. During each drilling operation, locate the drill head every 10 feet along the bore and prior to crossing any underground utility or structure. Mark approximate depth at 50 foot intervals for recording by the Contractor and submittal to the City and MoDOT. Upon completion of the drilling operation and conduit installation, furnish the engineer with an as-built profile drawing and plan drawing for the drilled conduit showing the horizontal and vertical locations of the installed conduit.

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

3.4 Install Conduit into Existing Pull Box. Where indicated on the plans, install a proposed conduit into an existing pull box. No direct payment will be made for installing conduit into an 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 Drill the appropriate sized hole for the entering conduit at a location within the pull box that will not disturb the existing cabling, and that will not hinder the installation of new cabling within the installed conduit.

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

3.4.4 Backfill shall be carefully tamped in place. All disturbed areas shall be restored to original condition, upon acceptance by the engineer.

3.5 ITS Pull Boxes. ITS Pull boxes shall be installed per plan and as required to allow the successful installation of the fiber cables per manufactures recommendations. ITS Pull Boxes at traffic signal locations, building penetrations, or Cross-Connect cabinets shall be Class 5. ITS Pull Boxes in-line on conduit run shall be Class 2.

3.5.1 All pull boxes shall be affixed with a permanent label identifying the function of the pull box and the maintaining agency (i.e. MoDOT Fiber Optic, MoDOT Signal, City Fiber Optic, City Signal, City Lighting). Material, method, and legend of labeling shall be approved by the engineer.

3.5.2 All pull boxes installed within sidewalks or raised paved shoulders shall be installed flush with the surrounding pavement, with slip-resistant cover, allowing for ADA-compliant pedestrian path. Any sidewalk pavement removed and replaced shall be incidental to the cost of the conduit and pull box.

4.0 Shop Drawing Submittal Requirements.

4.1 Catalog cuts sheets shall be provided for all conduit types, for approval by the Engineer.

5.0 Basis of Payment.

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

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

5.3 The pay items for conduit are:

Item No.	Type	Description
910-52.00	LF	Conduit, 2 - 2 IN., Rigid, In Trench
910-72.00	LF	Conduit, 2 - 2 IN., Rigid, Pushed
910-99.02	EA	Pull Box, Preformed Class 2, ITS
910-99.02	EA	Pull Box, Preformed Class 5, ITS

HHH. <u>FLASHING YELLOW ARROW (FYA) BACKPANEL</u>

Default Load Switch Assignment – 12 position cabinets

1.2.1 Description. The contractor shall apply 12compact Flashing Yellow Arrow installation method on all 12-position traffic signal cabinets. The NEMA Load Switch assignment for 12compact 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
OLA FYA	PHASE 2	OLB FYA	PHASE 4	OLC FYA	PHASE 6	OLD FYA	PHASE 8	PHASE 1	PHASE 3	PHASE 5	PHASE 7

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

If separate 7conductor 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 7conductor cable 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. The contractor shall use the vendor provided programming software to program the signal monitor. Front panel programming shall not be utilized.

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

1.3 Default Load Switch Assignment – 16 position cabinet

1.2.5 Description. The contractor shall apply 16 standard Flashing Yellow Arrow

installation method on all 16-position traffic signal cabinets. The NEMA Load Switch assignment for 16standard FYA installation method is as follows:

			16-position cabinet FYA NEMA LOAD SWITCH ASSIGNMENTS												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8	OLA FYA	OLB FYA	OLC FYA	OLD FYA	Ph 2 PED	Ph 4 PED	Ph 6 PED	Ph 8 PED

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

If separate 7conductor cable is present for the existing Left Turn signal head:

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

If no separate 7conductor cable present for the existing, permissive only, Left Turn signal head :

- Black Wire = Load Switch 9, 10, 11, or 12 Red output = 3-section Red Left Arrow
- Blue Wire = Load Switch 9, 10, 11, or 12 Yellow output = 3-section Steady Yellow Arrow
- Black/White Wire = Load Switch 9, 10, 11, or 12 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.

1.2.7 Signal Monitor programming. The contractor shall use 12 channel programming mode for the signal monitor. The contractor shall use the vendor provided programming software to program the signal monitor. Front panel programming of the signal monitor shall not be utilized.

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

1.3 The contractor shall perform every FYA installation as outlined in the instructions on the modified D37 plan sheets. All unaccounted for signal problems shall be resolved by the contractor and approved by the engineer for a successful installation and operation of the signal and Flashing Yellow Arrow.

1.4 D-Plug. The contractor shall install a jumper wire between M-12 and DT B1 to activate Special Status 6 on the signal cabinet back panel.

1.5 Cabinet prints. Once work has been accepted, the contractor will provide four full sized sets of revised cabinet hard copy prints (22" x 34"), one electronic copy per intersection in the MicroStation format ".dgn", and one electronic copy in the PDF format, from the cabinet manufacturer to reflect the finished condition of the cabinet and the work done.

1.6 Installation of additional conduit/7-conductor cables. The contractor shall first successfully install additional 7-conductor 16-gauge cables, as detailed in the plans, prior to installation of Flashing Yellow Arrows at the intersections noted in the plans.

1.7 If the existing signal conduit is damaged or does not have enough capacity to accept additional 7-conductor cables, the contractor shall push conduit as noted within the plans and paid for under the contract unit price for the following:

Item 902-72.00	Conduit, 2 Inch, Pushed	L.F.

III. <u>16-POSITION BACK PANEL WIRING – TRAFFIC SIGNAL CABINET</u>

1.0 Description. All new signal cabinets with a 16-position back panel shall conform to the following specifications.

1.1 System Requirements. Regardless of the number of phases specified on the plans, all load switch positions shall be completely wired for use. Sixteen position-back panels for actuated NEMA controllers shall be configured with vehicle phases on Load Switches 1-8, four overlaps on Load Switches 9-12, and four pedestrian phases on Load Switches 13-16. Vehicles, overlaps and pedestrian phases shall be wired such that it must work with a Type 16 MMU. Flashing Yellow Arrow configuration (if any) for the noted movements shall be wired for either immediate or future use as designated on the plans. Cabinet to be a TS2 layout. For intersections with video detection, the cabinet shall be wired to automatically power on the video monitor when the cabinet door is open. The cabinet shall include both a DT panel and a CTB (SDLC) panel with at least 5 harnesses.

2.0 Construction Requirements. Construction requirements shall conform to Sec 902 and 1092.

3.0 Method of Measurement. Method of measurement shall conform to Sec 902 and 1092.

4.0 Method of Payment. Accepted 16-position back panel wiring traffic signal cabinet will be included with pay item 902-42.81 (controller assembly housing, keyboard entry, 8 Phase NEMA controller) paid per each. Payment will be considered full compensation for all labor, equipment and material to complete the described work as shown on the plans. No additional payment will be made to provide conformance to this section.

JJJ. EQUIPMENT CABINETS

1.0 Description. This work shall consist of furnishing and installing new cabinets and base adapters (where applicable).

2.0 Materials.

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

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

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

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

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

2.0.6 All seams shall be continuously welded and ground smooth.

2.0.7 All fasteners must be stainless steel.

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

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

2.1 Type 7 Modified Cabinet (Cross Connect)

2.1.1 Provide a NEMA 3R, aluminum cabinet where indicated in the plans. The aluminum shall be at least 0.188 inches thick, except that the doors and top need be only 0.125 inches thick.

The cabinet shall be approximately 46 inches high, 24 inches wide, and 22 inches deep. The cabinets shall have two doors. The cabinet shall have a three-point door latch. It shall also have provision for padlocking with a 5/8" Hasp. The door hinge shall be continuous and shall be affixed by nuts and bolts that are concealed when the door is closed.

2.1.2 The cabinet shall be equipped with the following:

- **Rack**: For mounting 19-inch equipment. The mounting rails must have holes of the EIA standard size and spacing for the entire height of the cabinet.
- **Mounting Panels**: For terminal blocks, breakers, surge protectors, and other small items on the back and side walls.
- **Fluorescent Light**: Controlled by a door switch.
- **Duplex Ground Fault Interrupt Outlet**: For use by technicians. No permanent traffic management equipment shall be plugged into the GFI outlet.
- **Thermostatically Controlled Fan and Heater**: The fan shall move 100 CFM through vents at the top of the cabinet. The air intake shall be through louvers in the door, and the air shall pass through a replaceable filter as it enters the cabinet. The heater shall use at least 250 watts and shall be designed to prevent accidental contact with dangerous heat or voltage.
- **Electrical Distribution System**: Consisting of two 10 amp main circuit breakers, one within the MoDOT or signal cabinet connected to the existing circuit power feeds and the second within the Cross Connect cabinet. These breakers shall serve the communication and traffic management equipment in the cabinet. Provide at least four outlets on this circuit. The main breaker shall also power auxiliary devices in the cabinet, such as the fan, light, and GFI technician outlet.
- **Sunshield**: On the top.

3.0 Construction Requirements.

3.1 Ground Mounted Cabinets. The Contractor shall mount the cabinet on a concrete base at a height of 3 feet and provide conduit as shown in the plans to connect to an adjacent cabinet.

4.0 Bonding and Grounding. Connect base-mounted cabinets directly to a ground rod.

5.0 Acceptance Testing.

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

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

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

6.0 Documentation.

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

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

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

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

Item No.	Type	Description
910-99.02	Each	MoDOT Modified Type 7 ITS Cabinet

KKK. <u>CLOSED CIRCUIT TELEVISION (CCTV) CAMERA SYSTEM</u>

1.0 General.

1.1 Description. At each camera location, provide and install a color analog camera assembly on the proposed signal pole, as directed on the plans, with connection hardware, mounting plate, surge protection, and all required power and communication cables, set-up of camera assembly, and test for proper operation.

1.2 Qualified Personnel.

1.2.1 The Manufacturer shall train the installation Contractor and the City personnel in the unpacking, assembling, mounting, positioning, connecting to the communication network, set up, and testing of the camera assemblies.

1.2.2 The training will be provided at no additional cost to the City, and will be conducted at the jobsite, via remote webinar, or other engineer-approved method.

1.2.3 No work shall be performed until the Manufacturer has certified the Contractor as qualified.

1.2.4 Only personnel who have been trained by the Manufacturer shall participate in the camera assembly installation, setup, and testing.

2.0 Materials.

2.1 CCTV Camera Assembly.

2.1.1 General.

2.1.1.1 The closed-circuit television (CCTV) camera assembly shall consist of a high performance digital color CCTV camera, zoom lens, pan and tilt drive unit, mounting brackets, connectors and cabling all assembled together into one operational unit. All moving parts shall be contained within the camera dome.

2.1.1.2 The CCTV camera assembly shall weigh less than 50 lbs. and be post-mounted as shown in the plans.

2.1.1.3 The CCTV camera shall meet the following requirements:

2.1.1.3.1 Operate with a continuous 360 degree rotation in both axes.

2.1.1.3.2 Be post-mounted with a camera mounting hardware powder coated black matching the signal post. The Contractor shall note posts from Essex Ave. to Rose Hill Ave. will be fluted. Mounting hardware shall accommodate the shape and configuration of the decorative posts.

2.1.1.3.3 Include a hydrophilic glass approved equal window on the camera unit with an embedded heater element.

2.1.1.3.4 Operate with a minimum 30X optical zoom.

2.1.1.3.5 Include built-in electronic image stabilization.

2.1.1.3.6 The sealed camera must have a minimum of IP66 water immersion test rating.

2.1.1.4 All CCTV equipment shall meet the following electrical, environmental, and technical requirements:

- Power: 120VAC @ 60Hz
- Environmental: Operating Temperature: -40º to 75º C
- Operating Humidity: Up to 100% relative humidity.
- NTCIP 1205 camera control compliant
- Minimum of 8 user-definable video presets
- Minimum of 4 user-definable video tours
- Camera configuration (network settings, user password assignments, video streaming properties, camera imaging properties, defining presets and tours, and assigning ID

labels), operation, control, and viewing via web server compatible with current web browsers

- Capable of video recording for user-defined periods and steam quality, stored at configurable server locations within the City facility, in a traffic signal cabinet, or within the camera housing
- Video resolution of at least 1920x1080
- Overlay text of user-definable size and location for camera ID and preset views
- Capable of concurrent unicast and multicast video streams of varying quality each
- Auto-image settings including focus, iris, color, brightness, sharpness, white balance, backlight compensation, low light compensation
- Analytic capabilities including motion detection, gatekeeping, and auto tracking, with corresponding alarm outputs
- Single IP address access (no separate IP addresses for individual camera components)

2.1.1.5 Video access, control, and viewing shall be available via web browser by entry of the camera IP address. Access shall be provided with or without password protection. A separate camera software may be provided with the cameras at no additional cost, to allow for functionality and control beyond the requirements listed above, but does not alleviate the requirement for full functionality and control via web browser.

2.1.2 Video Encoding.

2.1.2.1 The encoded video shall be provided by installing an integral encoder inside the camera dome.

2.1.2.2 The encoder shall be capable of providing both high quality and low quality H.264 (MPEG-4 Part 10/AVC) compliant video streams and the same time over one channel or over multiple channels.

2.1.2.3 The encoder frame rate shall be adjustable up to 30/25 fps (60/50 Hz) and the encoder must be fully compatible with no-cost commercially available video decoding software and/or viewable within a standard web browser.

2.2 Cables and Connectors.

2.2.1 Provide cable for communications between the camera and the cabinet. The cable shall be provided by the camera assembly manufacturer and shall provide a clear signal from the camera to the cabinet. No splices of camera cabling are allowed.

2.2.2 For power, provide power over ethernet cabling, power injector, 120V cabling and terminations, surge suppression, and grounding as recommended by the Manufacturer. All cabling must be appropriate for the maximum current draw of the equipment, and for the length of the cable runs.

2.2.3 All CCTV camera cables shall be installed internally in the signal pole and are considered incidental to each individual camera assembly. Therefore, cable lengths will not be measured for pay.

2.2.4 Contractor shall provide all necessary connectors between the CCTV camera and the terminations in the signal cabinet. Connectors shall be potted to prevent water intrusion or degradation of the cable ends at the connector point.

2.3 Surge Protection.

2.3.1 If any of these components are utilized, then provide a surge protection system that shall consist of the following components:

2.3.1.1 Surge Protection on Power Conductors. The conductors carrying power to the camera assembly shall be protected by surge protectors at both ends.

2.3.1.2 Surge Protection on Communication Conductors. The conductors carrying communications from the cabinet to the camera shall be protected by two-stage, plug-in surge protectors in the cabinet.

2.3.2 The Contractor shall submit the surge protection for both the power and the communication cables to the Engineer for approval.

3.0 Construction Requirements.

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

3.1.1 Connect the camera housing and mounting hardware to the grounding system for the signal post or signal cabinet.

3.1.2 Use exothermic welding for all ground wire connections, except the connection to the pole, which shall use the pole's grounding lug.

3.1.4 Terminate all the cables on surge protectors, install the power over ethernet injector in the cabinet, and connect the camera power circuit to the IP addressable power strip in the signal cabinet.

3.1.5 To the extent that it does not interfere with the use of the camera for traffic management purposes, restrict the camera's field of view, at the request of the engineer, so that a user cannot use the cameras to look in the windows of dwellings, businesses, or other sensitive areas adjacent to the camera.

3.1.6 The camera manufacturer's software shall provide tiered user access to privacy settings. It shall not be possible for an operator to override these restrictions without adjustment by administrator-level modifications.

3.1.7 Affixing a mask to the inside of the clear dome shall be an acceptable method to achieve this.

3.1.8 Apply a rain repellent coating to the outside of the lower dome, only if recommended by the camera manufacturer, following the coating manufacturer's instructions. The coating must be recommended by its manufacturer for the material of the dome.

3.1.9 Program each camera with video and image settings as directed by the engineer, and label each camera ID. Establish a minimum of eight (8) presets (North, South, East, West, North Zoom, South Zoom, East Zoom, West Zoom) for each camera location and label appropriate.

3.1.10 The Contractor shall conduct testing of each camera locally at the intersection to confirm functionality of requirements stated elsewhere in this section. Testing shall also be completed from the City facility to prove full functionality from an operator workstation.

4.0 Method of Measurement. Measurement of CCTV system elements, including all camera assemblies, equipment, mounting hardware, cabling, miscellaneous materials, and labor necessary to ensure a fully functional CCTV system at the locations shown in the plans, will be made per each.

5.0 Basis of Payment. CCTV Camera System Elements will be paid for at the unit price for each of the pay items included in the contract. No direct payment will be made for any incidental items necessary to complete the work unless specifically provided as a pay item in the contract.

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

LLL. <u>INSTALL CCTV ASSEMBLY (MANCHESTER ROAD)</u>

1.0 General.

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

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

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

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

2.0 Materials.

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

2.2 The contractor shall acquire cables for power, video, and camera control from MoDOT's current camera supplier manufacturer on this project.

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

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

3.0 Construction Requirements.

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

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

3.3 The signal mast arm and post shall be grounded per MoDOT standard drawings and specifications.

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

3.5 Restrict the camera's field of view, if necessary, so that a user cannot use the cameras to look in the windows of dwellings. To the extent that it does not interfere with the use of the camera for traffic management purposes, ensure that a camera cannot be used to view residential property. Prior to creating these restrictions, submit to the engineer a written description of the proposed restrictions to be installed at each camera, and the proposed method of achieving them. It shall not be possible for an operator to override these restrictions without intervention by his or her supervisor. Affixing a mask to the inside of the clear dome shall be an acceptable method to achieve this. Highlight situations in which there is a conflict between the need to protect privacy and the need to know about traffic situations. Revise the field of view restrictions as directed by the engineer.

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

4.0 Acceptance Testing.

4.1 Upon delivery of a shipment of camera assemblies, the manufacturer's representative shall

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

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

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

Item No.	Type	Description
910-99.02	Each	Install CCTV Assembly

MMM. <u>ETHERNET SWITCH</u>

1.0 Description. Where indicated in the plans, the City of Kirkwood controller cabinets shall be equipped with an industrial-grade, Layer 2, managed Ethernet switch capable of supporting communications between traffic signals and with the centralized traffic management system.

2.0 Equipment Requirements. The Ethernet switch provided shall meet the following minimum specifications:

2.1 RJ45 ports: Six auto-negotiating 10Base-T/100Base-TX ports

2.2 Fiber optic ports: Two Gigabit SFP ports with two 1000Base-LX SFPs, configured for single-mode, duplex, SC connectors

2.3 Power supply: Capable of supporting dual 24VDC power inputs with an operating range of 18 to 36V

2.4 Operating temperature: -40° C to +70° C

2.5 Cooling method: Fanless heat sink

2.6 Redundancy protocols: RSTP and MSTP

2.7 Security protocols: RADIUS, SSL, SSH, HTTPS, and MAC address filtering

2.8 Management protocols: SNMP, Telnet, RMON

2.9 VLAN tagging support

2.10 DIN rail mountable with mounting hardware

2.11 All controller cabinet switches shall be from the same manufacturer, fully compatible with all other Layer 2 switches installed with the project and the existing Cisco 2960 and Juniper EX 4600 switches located with the City Police Department and City Hall facilities, respectively.

2.12 The switch shall have an ability for system configuration backup

3.0 Warranty.

3.1 A full warranty for the longer of three years from the product shipping date or two years from the date of final acceptance of the fully-operational Ethernet network.

4.0Service and Support Requirements.

4.1 Switches shall be configured prior to field deployment.

4.2 The vendor shall develop a comprehensive network IP design, including a VLAN scheme which accounts for segmenting video traffic as well as three future field devices in addition to the traffic signal controller, MMU, video detection processor, UPS controller, network-connected power strip, and PTZ camera.

4.3 The City or City's representatives will work with the vendor to identify a private subnet, subnet mask, default gateway, and an appropriate number of IP addresses to reserve for future expansion at each intersection.

4.4 All equipment designated for networking, including the signal controllers, MMUs, and PTZ cameras shall be configured per the IP scheme designed by the vendor.

4.5 The network topology and all device settings shall be documented on a Visio diagram and delivered to the owner prior to final acceptance of the project. Visio files used to create the project plans will be provided to the contractor by the engineer.

4.6 Configuration backup files shall be provided for each switch deployed.

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

6.0 Basis of Payment. Payment will be for 1 unit per bid item "902-99.02 – Layer 2 Ethernet Switch, Furnish and Install". Payment will be considered full compensation for all labor, equipment and material to complete the described work.

NNN. GPS UNIT

1.0 Description. Where indicated in the plans, the signal controller cabinets shall be equipped with an industrial-grade, GPS clock capable of supporting communications between traffic signals controllers and a designated network time protocol (NTP) server.

2.0 Equipment Requirements. The GPS clock provided shall meet the following minimum specifications:

2.1 Universal compatibility with major traffic signal controller brands.

2.2 Allow for coordination and interoperability between multiple traffic signal controller brands.

2.3 Programming functionality to configure: hour, minute, time zone, Daylight Savings Time (DST), frequency of reset, and rising or falling edge reset.

2.3.1 Allow for automatic adjustment to DST.

2.3.2 Allow for uninterrupted functionality during programming.

2.4 Solid state unit with no moving parts.

2.5 Approximate dimensions: 4” H x 5.5” W x 1.25” D

2.6 Power Requirements: 8-40 volts DC, 100 mA

2.7 Control: Isolated Open Collector Output

2.8 Temperature Range: -34º C to 74º C

2.9 Warranty: 2 years from date of arrival of shipment

3.0 Construction Requirements. The Contractor shall install the GPS Unit per the following requirements:

3.1 Install the cabled antenna unit on the top or side of the proposed signal cabinet, with minimally unobstructed upward view. The opening in the cabinet to allow for cable access shall be water tight with lifetime silicone sealant or other approved material.

3.2 Program the GPS unit and test for proper operation. The NTP server shall sync the internal clock of the connected signal controller on a once per day basis. The NTP server referenced by the unit shall be one or all of the following:

Hostname	IP address
ntp-1.gw.illinois.edu	130.126.24.24
ip.1.20.247.158.ip.kansas.net	158.247.20.1
lookingglass.chi.steadfast.net	208.100.4.54

3.3. Furnish and install all cabling, connectors, sealant, mounting hardware, and other materials necessary for a fully functional GPS unit.

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

5.0 Basis of Payment. Payment will be for 1 unit per bid item "902-99.02 – GPS Module Unit". Payment will be considered full compensation for all labor, equipment and material to complete the described work.

OOO. 120 VOLT IP ADDRESSABLE POWER STRIP

1.0 Description. The contractor shall install (hardwire) the IP Addressable Power Strip in the signal or ITS cabinet. If installed in the signal cabinet, the CCTV as well as intersection video detection processor and cameras and In-Pavement Sensors Access Point (in remaining un-used outlets) shall be the only devices that shall be plugged into the switched outlets (ports). The contractor shall Use-In-Place the existing non-manageable power strip or install new one for other signal devices. Network switch shall not be installed in the manageable IP Power Strip outlets (ports).

All device cabinets where power is routed from the primary power drop into the cabinet, whether existing or new, will require the installation of one (1) IP addressable 120V power strip inside the cabinet. The IP Power Strip shall be hardwired to the terminal on the side of the panel that is supplied by the auxiliary breaker. Size of the strip shall allow for mounting onto a side panel of the cabinet. Fiber distribution cabinets containing no network devices will not require a power strip.

2.0 Power Strip Requirements. The power strip shall have a circuit breaker rated at least 15 amps, an on/off switch, and at least six (6) individually switched outlets and two (2) unswitched outlets for AC plugs. The power strip shall be accessible with a browser compliant with the latest recommended HTML specification from the W3C Web Platform Working Group. All device configuration and management operations shall be accessible without using browser plugins or extensions. The web interface shall have password security, allow for the remote rebooting of individual devices, and shall contain a description of the attached devices. At MoDOT intersections, he device descriptions shall be populated by the contractor using device descriptions provided by MoDOT Gateway Guide ITS staff.

3.0 Installation Requirements. Mounting shall be on the left side panel of the cabinet above the detector panel attached to 2 DIN rails, with the power cable facing away from the door. If in a signal cabinet, the location shall be above the detector panel. The hardwire interconnect panel, if present, should be removed to make room. A plastic wire tie shall secure any transformer packs plugged into this unit. The power source shall be hardwired to cabinet auxiliary breaker circuit with no plug in to any cabinet outlet allowed.

The contractor shall submit information to the City and MoDOT's SLITS Group via an email to SLITS@modot.mo.gov or 314-275-1526 and inform of the signal cabinet IP Addressable Power Strip device port assignments.

4.0 Basis of Payment. No direct payment. Payment to be included as part of signal cabinet modification or installation.

PPP. NETWORK CONNECTED SIGNAL CONTROLLER (CITY INTERSECTIONS) Addendum #1

1.0 Description. The proposed signal controllers shall conform to the following requirements in order to place the signal controllers into the City's proposed Ethernet network. Controllers installed at MoDOT-owned locations (Manchester Road and Big Bend Road), shall meet requirements stated in JSP QQQ.

2.0 System Requirements. At City-owned intersections, the signal controller will, in addition to the Standard Specifications of 1092.4, have the following features: Addendum #1

a) Be compatible with NEMA TS-2 Type 1 signal cabinet setup.
b) Have a minimum of one internal RJ-45 plug for 10/100 Ethernet communication, programmable with local IP address, gateway IP address, and subnet mask.
c) Allow for acceptance of the door alarm trigger via internal cabinet panels.
d) Shall be compatible with the City's Centracs LE software system, including full upload and download of the controller's database editor through the signal editor using NTCIP segment and quick ftp file exchange methods.
e) Shall include hardware and CPU elements allowing for open architecture and compliance with NEMA Standard Publication for Advanced Traffic Controllers (ATC) Draft Version 6.10 or newer.
f) Shall comply with the NEMA TS-2 with NTCIP v02.06 Standard.
g) Shall have installed the latest software and firmware upgrades as recommended by the controller manufacturer.
h) Shall provide peer-to-peer functionality for the passage of custom inputs and outputs via an Ethernet connection to other signal controllers on the network. This function shall be compatible for immediate passage of railroad preemption calls to be shared amongst other controllers along the corridor. This function shall also provide the ability to pass detection calls, phase status, coordination holds, or traffic responsive data.
i) Allow for each controller to be utilized as a master controller for the corridor, while also controlling the local intersection operations. Passage of time syncs and other information necessary to maintain coordinated signal operation shall be accomplished via peer-to-peer communications over the Ethernet network.
j) Shall provide for receipt of preemption calls from the cabinet backpanel, and provide actuation of railroad blank-out signs at the locations contained in the plans upon receipt and processing of a call from the nearby railroad-owned cabinet facility.
k) Shall allow operating system updates via USB port or Ethernet connection. Upgrades shall be performed with a single executable file process via either or both port options.

3.0 Construction Requirements. Construction requirements shall conform to Sec 902 and 1092. The contractor shall notify the Engineer three (3) working days in advance of performing work at an affected intersection(s). The contractor shall not begin work prior to approval from the Engineer.

4.0 Training. The controller manufacturer or vendor shall provide a training session for City engineering and maintenance staff of up to 8 hours (one day) at a City facility. Training shall include instructions on the basic configuration, setup, and troubleshooting of errors or faults, as well as advanced features such as railroad preemption and peer-to-peer communications applicable to the project.

Addendum #1

5.0 Method of Measurement. Method of measurement shall conform to Sec 902 and 1092.

6.0 Basis of Payment. Contractor shall provide to the Engineer dated documentation from the controller's vendor showing the controller's serial number, software and firmware versions, and installation dates in order to satisfy the provisions of this specification. Payment for the traffic signal controller will be incidental to the bid price for the associated traffic signal controller cabinet assembly, meaning there will be no direct pay for abiding by this provision.

QQQ. ADVANCED TRAFFIC CONTROLLER (MODOT INTERSECTIONS)

1.0 Description. At Manchester and Big Bend, all electronic components, workmanship, and functionality of the traffic signal controller shall conform to the applicable standards for TS-2 Type 1 traffic signal controllers mandated by the National Electrical Manufacturers Association's (NEMA) current edition NEMA Standards Publication TS2-2003 v02.06 for Traffic Controller Assemblies with National Transportation Communications for ITS Protocol (NTCIP) Requirements. Controller motherboard and CPU shall also support open architecture and be compliant with current ITE, AASHTO, and NEMA Standard Publication for Advanced Traffic Controllers (ATC) Draft Version 6.10 or newer.

Supplier shall provide all NTCIP Management Information Base (MIB) files associated with the licensed controller software including manufacturer specific and extended objects. Supplier places no limitations under this contract on the re-distribution and re-use of the MIBs associated with the licensed controller software. The Commission and its partners shall be permitted to copy, redistribute and/or reuse the MIBs as they see fit to support their authorized use of the license software.

All major components shall meet the environmental, design, and operating standards outlined in NEMA Standards Publication TS2-2003 v02.06, Section 2.

All traffic signal controllers must be fully supported by the Commission's Advanced Traffic Management System (ATMS): TransCore's TransSuite Traffic Control System (TCS). Supplier shall be responsible for providing documentation from TransCore indicating full support and will be responsible for demonstrating this support if requested by the Commission.

2.0 Materials.

2.1 Enclosure. The controller enclosure shall be designed for placement on a shelf. The enclosure shall have a protective finish and enclose all electrical components of the controller. All hardware and electrical components shall be modular for ease of replacement and repair. All controller input/output connectors, fuse holders, indications, displays, switches and control devices required for the operation and adjustments of the controller shall be mounted on the front panel. The front panel of the controller shall be permanently marked to identify I/O connections, fuse holders, indicators, etc.

2.2 Additional Hardware Requirements.

- Power supply must be capable of supplying 110 VAC 50/60HZ.
- Engine Board and CPU shall be compliant with the ATC Standard Draft 6.10 or newer as noted above.

- Minimum required board memory: 64 MB Flash, 64 MB DRAM, and 1 MB SRAM.
- There shall be no batteries or moving parts such as fans or memory storage devices with rotating parts on the controller unit.
- Optional color touch display screen shall run on an Android Processing System and support standard 3rd party applications.
- LCD Display shall be 16 lines x 40 characters in size.
- All keypads shall be mounted on the controller front panel and shall be covered with a one piece water-resistant membrane
- The active status light shall be a LED for better visibility in direct sunlight.
- Controller hardware shall facilitate the use of the controller in TS-1 and TS-2 Type 1 or 2 traffic signal control cabinets.

2.3 Communications Ports. In addition to the NEMA TS-2 with NTCIP v02.06 Standard, the traffic signal controller shall include the minimum following communications ports and configurations:

- One, two-port Ethernet network cards with independent user programmable subnets (IP Address, Subnet Mask, and Default Gateway).
- One, Universal Serial Bus (USB) Hub.

2.4 Operating System.

2.4.1 O/S Version. The Traffic Signal Controller shall use a Linux operating system (O/S) with kernel version 3.0 or later to facilitate application level access to the ATC hardware, a Board Support Package (BSP) shall be provided by the controller manufacturer for access to hardware specific drivers.

2.4.2 O/S Updates. Operating System updates shall be completed from a personal computer over an Ethernet connection, or directly from a USB flash drive plugged into the controller's front panel. The update process shall be automated and packaged as a simple executable file enabling the user to perform the update within a few steps.

2.4.3 Intersection Control Software. The intersection control software should provide, at a minimum, the mandatory functionality and operations specified in the NEMA TS-2 with NTCIP v02.06 Standard. All objects and functions available in the local control software should be named and defined according to the current NTCIP standard. Additional, non-required or manufacturer specific objects and functions should have a straight-forward, logical label and/or definition. All status and configuration objects shown on the controller front panel shall be defined and accessible as NTCIP objects. Custom status objects or features that are not defined according to the NTCIP protocol and included in the manufacturer's MIBs will not be accepted.

2.4.4 Basic Functionality. In addition to the aforementioned NEMA TS-2 Standard, the controller software must satisfy the following additional requirements:

- 16 programmable phases.
- 4 timing rings that can be configured by the user to run concurrently or independently.
- 16 overlaps.
- 16 unique phase sequences that can be programmed and operated by time of day. Each

sequence should allow the user to specify specific phase order and sequence beyond basic phase pair reversal/switching.

- 102 unique timing patterns, each with a unique:
    - Cycle length, free, or flash command
    - Phase split table
    - Offset
    - Phase or pedestrian recall or omit (per pattern)
- User can easily configure:
    - Flashing Yellow Arrow functionality by Time of Day
    - Pedestrian Overlaps
    - Pedestrian advance or exclusive pedestrian intervals
    - Trailing green sequences for compound intersections
    - Preemption routines in accordance with the NEMA TS-2 specification (v02.06)
    - Right turn overlap with permissive FYA and conflicting Ped
        - Protected/Permissive Left Turn or FYA by Time of Day with the ability to adjust to various left turn modes (protected, protected/permissive, permissive) seamlessly
- Detectors:
    - 10 detector tables selectable by TOD
    - 60 detectors per detector table
    - Ability to call multiple phases with one detector
    - Ability to call overlaps directly
    - Detector diagnostics
- 16 Preempt Routines:
    - Return to Coord without transition
    - Return to the longest waiting phase
    - Return to the last phase skipped in sequence
- 10 Overlap tables selectable by TOD.
- Transit Priority functionality.
- Peer to Peer communications:
    - Allows for direct messaging between two controllers
    - Allows user to send the status of ANY input/output function in the controller as well as phase intervals, preempt intervals, etc.
- 32 Customizable Alarms.

2.4.5 User Interface. In addition to the front panel screen, the traffic signal controller shall have a user interface for monitoring and configuring the intersection control software. Remote front panel emulation or custom mobile platform applications can satisfy this requirement. Optional web server interface shall provide access from any Internet enabled device with a web browser. No additional or proprietary software shall be needed to use the graphical user interface.

2.4.6 Input/Output Configuration. The intersection control software should allow the user to dynamically configure and modify input and output pins on an individual, pin by pin basis. In addition, the user should be able to configure the signal output channels (phase/overlap to load switch) so that any phase, overlap, or pedestrian output can drive any available load-switch in the traffic signal cabinet. The user shall perform such configurations and modifications from the controller front panel or web user interface, without the need for additional configuration software or downloading additional files to the controller.

2.4.7 Master and Peer to Peer Communications. The signal controller shall be capable of operating in a closed loop network with other controllers as a master or slave controller without the need for additional software or licensing. The master unit must be able to perform the duties of a master controller in the closed loop network while simultaneously conducting traffic signal operations at the local intersection. The signal controllers within the network will communicate with other controllers via serial or Ethernet communications. The closed loop functionality shall support clock sync over serial or Ethernet and traffic responsive operation.
The Intersection Control Software shall support Peer to Peer functionality. Peer to Peer allows the controllers to send messages to other controllers connected in the same network via serial or Ethernet communications. The user shall configure any input our output function to send over peer to peer including phase time intervals, preempt intervals, coordination holds, etc.

2.5 Reference Manual. Signal controller must include a training/programming manual in an electronic PDF format. Manual must be readable for staff with a rudimentary understanding of traffic signal controllers. Manual must have step by step descriptions of the various features of the controller.

3.0 Basis of Payment. No direct payment will be made for the cost of equipment, labor, materials or time required to fulfill this provision.

RRR. <u>RELOCATE EXISTING COMMUNICATION EQUIPMENT (MANCHESTER ROAD)</u>

1.0 Description.

1.1 Where specified in the plans at the Manchester Road intersection, the Contractor shall relocate equipment associated with MoDOT maintained facilities. Equipment could include, but is not limited to, the following items:

a) CCTV cameras and/or related system equipment
b) Traffic signal controllers
c) Network switch and related equipment such as DIN rail, power supply, and miscellaneous mounting hardware

1.2 The Contractor shall provide all labor, materials, and equipment required for the work described above.

2.0 Basis of Payment. Payment will be for 1 unit per bid item “902-99.02 – Relocate Existing MoDOT ITS Equipment”. Payment will be considered full compensation for all labor, equipment and material to complete the described work.

SSS. <u>COORDINATION WITH ITS STAFF AND UTILITY LOCATES</u>

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 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. Initial contact must be made at least seven calendar days before work that may impact the existing communications network commences. Contact the ITS staff via an email at SLITS@modot.mo.gov. 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.

TTT. RAILROAD WAYFINDING SIGN

1.0 Description. The proposed railroad wayfinding signs shall be installed at the location indicated in the plans and mounted to the signal structures as depicted in the mast arm details.

2.0 Equipment Requirements. The railroad wayfinding signs shall meet the following requirements:

- Housing shall be extruded aluminum cabinet with welded seams, powder coated black matching the signal mast arm color, NEMA 4X/IP66 rated
- All internal components shall be rated for outdoor use
- Hinged door with water-proof silicone gasket and tool-less stainless steel latches
- Legend shall be comprised of white ultra bright direct view LEDs meeting 100,000 hour service life requirements
- Input voltage of 100-240 VAC
- Two (2) redundant power supplies per message
- Three (3) redundant fail-safe photocells for auto photo dimming during varying ambient light levels
- Character height shall be a minimum of 4.5”
- Wayfinding message shall be as indicated in the plans
- When activated by preemption call from the adjacent signal controller cabinet, the message shall flash at a rate of 3 seconds ON, 0.3 seconds OFF. The flash rate shall be modifiable by components within the sign housing.

3.0 Construction Requirements. Mounting of the sign shall be performed via MoDOT standard Type 1 mast arm mount (902.40Q) with 3” maximum bracket exposure above or below the sign housing. Mounting hardware shall match the color of the sign housing and signal mast arm. Wayfinding sign cabling shall be routed through the mast arm and post to the signal cabinet and terminated per cabinet manufacturer. All cabling external to structure or conduit

shall be minimized, tied neatly to permanent components, and have drip loops at appropriate entry points to the structure and sign housing.

The Contractor shall test the wayfinding sign to ensure activation during active preemption status. The testing shall also include confirmation of LED dimming during varying light levels.

4.0 Method of Measurement. Method of measurement shall conform to Sec 902 and 1092.

5.0 Basis of Payment. Payment for the railroad wayfinding sign will be paid per each at the bid price for "902-99.02 – Railroad Wayfinding Sign". All cabling, mounting hardware, and miscellaneous materials for a fully functional system are included in the bid price for this item.

UUU. NEMA TS2 TRAFFIC CONTROLLER ASSEMBLIES JSP-00-04

Addendum #1

1.0 Description. This work shall consist of furnishing and installing a NEMA TS2 traffic controller assembly at the location shown on the plans.

2.0 Training. MoDOT may require training on the maintenance and operation of NEMA TS2 controller assemblies. Maintenance and operation personnel shall be trained on programming, troubleshooting, maintenance and repair of controllers and all serviceable equipment. Training shall include field level troubleshooting and bench repair. This training shall be for a minimum of sixteen (16) hours over two days. Training shall be conducted at a time and location mutually agreeable by the contractor and the engineer.

3.0 Equipment. Delete Secs 902.11, 1092.4.3 and 902.13 in their entirety and substitute the following:

902.11 Traffic Controller Assemblies. Traffic controller assemblies are defined as the complete assembly of all required equipment and components for control of traffic signal indications. Traffic controller assemblies shall conform to the requirements of the latest revision of NEMA Standards Publications No. TS 2, hereafter called NEMA. Each assembly shall consist of a controller cabinet (TS2 Type 1), controller unit, back panel, malfunction management unit, all required wiring, switches and connectors and all other equipment as defined in these specifications and as shown on the plans. Double controller assemblies to control two intersections shall consist of a controller cabinet (TS2 Type 1), two controller units, two back panels, two malfunction management units all required wiring, switches and connectors and all other equipment as defined in these specifications and as shown on the plans.

902.11.1 General.

902.11.1.1 Voltage and Temperature Variations. Variations in the voltage of the power supply from 89 to 135 volts or sustained temperatures inside the cabinet between -30 F (-34 C) and +165 F (+74 C) shall not change the timing of any functions or cause electrical or mechanical damage. Heater elements shall not be used to attain compliance with these requirements.

902.11.1.2 Fuse Protection. All controllers and other specified auxiliary equipment shall be properly protected with fuses on each applicable unit. Fuses shall be installed in 1/4 twist or screw-in type fuse holders or shall be automotive blade-type fuses. Pop-out fuse

holders shall not be used. There shall be no exposed high voltage contacts on the outside of any unit.

902.11.1.3 Manuals and Wiring Diagrams. Three instruction manuals covering all operational and maintenance information shall be furnished for each type of detector, and any other auxiliary unit(s) provided as specified. Once work has been accepted, the contractor shall provide four full sized sets of revised cabinet hard copy prints (22" x 34"), one electronic copy per intersection in the ".dgn" format, and one electronic copy in the PDF format, from the cabinet manufacturer to reflect the finished condition of the cabinet and the work done for each cabinet location. The cabinet wiring diagrams shall include labeling for all field terminal connections and shall provide an orientation of the terminal layout that conforms with the intersection information specified. Updated cabinet drawings shall be provided for any cabinet modification performed. All flash program wiring configurations shall be included on the cabinet print (Red, Amber, No Flash, FYA, Ped, FYA & Ped).

902.11.1.4 Warranty. All, malfunction management units, terminals and facilities, detectors and any other auxiliary unit(s) provided as specified shall be warranted by the manufacturer to be free from defects in workmanship and material for at least one year from the date of project acceptance. Any components found to be defective during the warranty period shall be replaced free of charge. All warranties provided shall be transferred to the Commission upon project acceptance. No direct payment will be made for warranties.

902.11.4 Terminals and Facilities. All terminals and facilities in the controller assembly shall conform to NEMA TS2 Type 1 and the following requirements. For double controller assemblies, two complete sets of all terminals and facilities shall be provided with all items contained in the same compartment as the associated CU.

902.11.4.1 Wiring and Terminations

(a) Field Wiring. Incoming field circuits shall be routed horizontally from the conduit to the back of the cabinet, then vertically to the terminal block. All field leads shall be identified by means of round aluminum identification tags with a minimum thickness of 0.1 mils (2.5 mm) attached to the cables with a copper wire to correspond with the plans. The outgoing signal circuits shall be of the same polarity as the line side of the power supply and the common return of the signal circuits shall be of the same polarity as the ground side of the power supply. The power supply shall be provided through three single conductor cables. All field conductors shall be terminated in the controller cabinet on a 600-volt heavy duty one piece mechanical screw connector offset tang assembly attached to a barrier terminal strip. Each mechanical screw connector shall accommodate up to four No. 12 AWG (2.5 mm2) conductors. For double controller cabinets, all wiring for each intersection shall be terminated in the same compartment of the cabinet as the signal controller for that intersection.

(b) Back Panel Wiring. All wiring carrying 120 volts AC shall be discrete insulated wires and shall be soldered directly to lugs on the back of terminal blocks or sockets. All discrete wiring on the back side of the back panel shall be neatly bundled and secured with plastic cable ties.

(c) Any multiconductor cable shall be contained in an expandable braided sleeving.

(d) Bus Interface Units (BIU) and BIU racks shall be provided for all required terminals and facilities. All connections shall be soldered at the termination point. All SDLC cable connections shall be protected by an in-line surge suppressor such as the EDCO (SRS BIU 15) or functionally equivalent.

(e) All Port 1 cable connectors shall have positive strain relief latches such that tension on the cable will not disconnect the connector from the unit they are connected to.

902.11.4.2 Switches and Controls. Each controller cabinet shall be furnished with the following switches and controls. For double controller cabinets, two sets of switches and controls are provided, one set for each controller installed in each compartment. All toggle switches shall be equipped with protective switch guards.

(a) Power Interrupt Switch - A switch located inside the main cabinet shall interrupt electrical power to the controller during maintenance on the controller. Operation of this switch shall not affect the flash operation. This switch shall not be accessible via the police panel.

(b) Flash Switches - The following switches shall place the signal on flash. Operation of these switches shall not affect the electrical power supply to the controller. When the signals are returned to normal operation the external start shall be activated causing the controller to revert to the programmed initialization phase(s).

(1) Each controller cabinet shall be furnished with a clearly labeled flash switch mounted in the access or police panel.

(2) Each controller cabinet shall be furnished with a clearly labeled flash switch mounted on the cabinet door in the inside of the cabinet.

(c) Stop Time Switch - A three position switch mounted inside the main cabinet shall provide the following functions:

(1) Stop Time - Causes the controller to stop time.

(2) Normal - Allows the controller to cycle all phases, but during MMU flash causes the controller to stop time.

(3) Run - Allows the controller to cycle all phases and during any flashing operation allows the controller to continue cycling all phases without displaying them on the signal heads.

(d) Switches or relays which completely interrupt power to the signal heads other than the protective circuit breaker shall not be installed in the cabinet.

(e) If specified, a manual operation push button shall be installed in the police panel. The push button shall be wired for manual operation of the signals. The push button shall be water resistant and designed to protect the user against electrical shock and shall be

supplied with a coiled cord with a nominal 6 foot (2-m) stretched length. A clearly labeled switch shall also be installed in the police panel to switch between manual or automatic operation of the controller.

902.11.4.3 Detector Facilities.

(a) At a minimum, one NEMA Configuration 2 detector rack shall be provided with the associated BIU. If more than 16 detector channels are specified, additional NEMA Configuration 1 or 2 detector racks and associated BIU(s) shall be provided for the required number of detectors. Each detector channel shall be assigned to a separate detector input into the CU.

(b) Detector loop connections shall be provided for the total number of detector channels available in the detector racks supplied as specified above.

(c) Two terminals shall be provided for each detector as follows.

(1) Screw terminal strips mounted vertically on the left side of the cabinet approximately 6 inches (150 mm) from the bottom of the cabinet.

(d) The detector rack shall be attached to the controller cabinet shelf by an easily removable attachment. Sufficient wire lengths shall be provided for access to the back of the rack. The rack shall not block the back panel or other termination panels.

(e) Unless shown differently on the plans, each detector field input into the card rack shall be associated with the appropriate card position as follows:

Channel	*Card Position*								
	1	2	3	4	5	6	7	8	
1	Phase 1		1 or 6	6	6	3	3 or 8	8	8
2	Phase 5		5 or 2	2	2	7	7 or 4	4	4

(f) Each detector channel shall be clearly labeled with detector number, phase and direction.

902.11.4.4 Power Distribution.

(a) Each assembly shall contain a separate aluminum power panel located in the lower right portion of the cabinet containing the following equipment:

(1) Main breaker - one type B circuit breaker conforming to Sec 901.4.4 that shall interrupt power to the controller and signals. The frame size and trip rating is shown on the traffic signal plans or designated in the contract.

(2) Auxiliary breaker - one type B circuit breaker conforming to Sec 901.4.4 that interrupts power to cabinet lamp and receptacle. The frame size and trip rating shall be 15 amperes.

(3) The signal bus contactor shall be a solid state relay device.

(4) One radio frequency interference suppresser.

(5) The AC service transient suppression device shall be a modular device.

(6) One terminal block for AC power input.

(7) One earth ground bus terminal block.

(8) One isolated AC neutral bus terminal block.

(b) Each controller assembly shall have LED lighting that provides at least 800 lumens with a max of 1000 lumens.

902.11.5 Auxiliary Interfaces for Controllers. Interface panels shall be aluminum panels with deburred edges and rounded corners installed in the controller cabinet containing the required terminals and equipment. Interface panels shall be neatly laid out, neatly wired and easily accessible. For double controller cabinets, the auxiliary interface shall be located in the same compartment as the associated CU.

902.11.5.1 Pre-emption Interface. The preemption operation and interface shall conform to NEMA. The pre-emption interface shall include any field wire termination panels, relays or isolators, wiring and connectors required for proper operation.

902.11.5.6 Other Interfaces. Where other interfaces are specified in the plans or required for specified operation, the required circuitry and any other required devices shall be installed on an interface panel or in a suitable metal enclosure.

902.11.6 Auxiliary Devices. Each auxiliary unit shall be enclosed in a suitably finished metal or molded plastic case. It shall be mounted in the controller cabinet unless otherwise specified. The function of each auxiliary unit shall be indicated by an identification plate on the case. Auxiliary equipment cases shall be ventilated. Temperature, voltage and frequency shall meet the requirements of Sec 902.4.5 unless otherwise specified.

902.11.7 Controller Cabinets. Controller cabinets shall be cast aluminum or 0.125 inch (3.2 mm) reinforced sheet aluminum alloy and be of clean-cut design and appearance. The cabinet shall be reinforced at all mounting points. The controller cabinet tech panel shall contain a 15 amp duplex receptacle. Two lifting brackets shall be provided for installation and removal. The cabinet shall provide ample space for housing all equipment and components. Controller cabinets housing solid state controllers shall be furnished with unused cabinet space measuring 18 inches (450 mm) wide by 12 inches (300 mm) high by 12 inches (300 mm) deep. Cabinet size shall be not less than 54 inches (1350 mm) high by 38 inches (950 mm) wide by 25 inches (625 mm) deep and support a 16 position back panel. The cabinet shall contain shelves of such

construction that the CU and auxiliary equipment may be withdrawn from the cabinet without breaking any electrical connections or interrupting normal controller operation. Controller cabinet shelves shall have the ability to be independently removed, relocated, and adjusted. All shelves must be adjustable to accommodate for heights of different equipment. All panels and shelves shall be affixed to cabinet by the following means: vertical rail/channels shall contain a removable threaded insert such as a spring nut, to allow the panels and shelves to be bolted to the rail/channels. Shelves and their fasteners must be able to be easily adjusted, removed and put into place without the need of removing other equipment.

(a) A hinged door or doors shall provide complete access to the interior of the cabinet. Door holds shall be furnished which shall hold the door in an open position at least 90 degrees from the closed position. The doors shall fit against a rain tight gasket. An auxiliary door, positioned on each main cabinet door, equipped with a rain tight gasket, shall allow access to a switch panel and shall be equipped with a lock whose key will not unlock the main door. Two keys shall be furnished for each type lock used. The door hinges and pins shall be of corrosion resistant metal. Pins shall be rolled or solid rod, at least 1/8 inch (3.18 mm) in diameter, except if continuous hinges are furnished, the pins shall be continuous the full length of the hinges and shall be not less than 1/16 inch (1.59 mm) in diameter.

(b) The back panel in all controller cabinets shall be hinged at the bottom to permit the top of the panel to be rotated forward and down to an angle of not less than 45 degrees with all components, including load switches, attached for maintenance purposes. The bottom of the back panel shall be not less than 6 inches (150 mm) above the bottom of the cabinet. Additionally, access to the rear side of the back panel shall be provided for troubleshooting and repair by means of hinged door located on the rear side of the cabinet, for MoDOT intersections at Manchester Road and Big Bend Road only. The City of Kirkwood intersections do not require a door on the rear side of the cabinet.

(c) Cabinets shall have a thermostatically controlled ventilating fan with exhausting capability, in an enclosure, of at least 150 cubic feet per minute (4.25 m3/min) for cabinets up to 30.5 cubic feet (0.86 m3) and at least 250 cubic feet per minute (7.08 m3/min) for cabinets 30.5 cubic feet (0.86 m3) and more, installed in the top of the cabinet. These cabinets shall be supplied with a replaceable furnace type fiberglass filter of at least one square foot (0.093 m2) area mounted behind louvers in the lower one fourth of the door. The cabinet shall be supplied with an independent, thermostatically controlled heating mechanism. Addendum #2

(d) Double controller cabinets for two controllers shall be not less than 57 inches (1425 mm) high by 74 inches (1850 mm) wide by 17 inches (425 mm) deep and shall support two 16 position back panels. All double cabinets shall have two doors that are hinged on the outside corners of the cabinet so that the doors open away from each other. Double cabinets shall have a divider between the two halves of the cabinet with an 8-inch (200-mm) opening between the compartments at the bottom of the divider for wiring between the compartments.

1092.4.3 Induction Loop Detectors. Induction loop detectors consist of loop detector cable in the pavement, lead-in cables, associated conduit and pull boxes and loop detector units. The following section covers loop detector units. Other components of loop detectors are covered in other parts of Sec 902 and Division 1000. Loop detector units shall conform to NEMA. If specified, each channel shall have extension and delay timing features as specified in NEMA. Each detector shall have a regulator for the power input. The regulator shall have the appropriate power and voltage rating for operation of the detector.

1092.4.3.1 Card Rack Detectors. All detectors shall be card rack mounted detectors as specified in NEMA unless otherwise specified in the plans.

1092.4.3.1.1 Card Rack Dual Output Detectors. Card rack dual output detectors shall conform to NEMA and the following. Dual output detectors shall provide two relay outputs per induction loop detector. One output shall be capable of pulse detection for the purpose of traffic counting, speed and occupancy measurements. The other output shall be capable of presence detection. Each detector output shall be assigned to a separate detector input into the CU.

10**92.4.3.2 Shelf Mounted Detectors.** If shelf mounted detectors are specified, each shelf mounted inductive loop detector unit shall be self-contained. the detector shall conform to the applicable sections of NEMA and the following. The main chassis shall include the power supply for 120 VAC line power, line fuse and MS type connector.

(a) The MS connector shall be a chassis jack, type MS3 102A-18-1P and cable plug, type MS3160A-18-1S, with a type MS3057-10 cable clamp and boot.

(b) Wire size for the cable shall be 18 AWG (1 mm2) minimum and continuous between the connections and the detector panel. Minimum cable length shall be 6 feet (18 m).

(c) The pin connection shall be as follows:

Pin	*Function*
A	120 VAC (Common)
B	Relay Output (Common)
C	120 VAC (Line)
D	Loop Input
E	Loop Input
F	Relay Output (Normally Open)
G	Relay Output (Normally Closed)
H	Chassis Ground
I	Spare
J	Time Control

902.13 Other Detection Devices.
Video Monitor should have switched outlet with 3 pos switch to engage (reference SCSA)

902.13.1 Probe-Type Detectors. Probe-type detectors shall be as specified on the plans and shall conform to the following.

(a) The sensing probes shall be cylindrical having maximum dimensions of 7/8 inch (21.9 mm) diameter by four inches (100 mm) long. The sensing probes shall be suitable for installation in a one inch (25 mm) diameter bored hole. The interconnecting four conductor cable and lead-in cable shall be suitable for installation in a 1/4 inch (6.25 mm) wide pavement sawed slot.

(b) The jacket on the interconnecting cable and the casing on the sensing probe shall be an abrasion resistant polyurethane elastomer. The device shall be impervious to

moisture and chemically resistant to all normal motor vehicle petroleum products. Lead-in cables shall be shielded, chemical resistant and completely waterproof.

(c) The combined probe sets, manufacturer specified lead-in cable and detector probe shall detect all vehicles up to a lead-in cable length of 750 feet (228.6 m) with up to 6 probes per set.

(d) The conductor cable from the probes to the detector panel in the controller assembly shall be as specified by the detector manufacturer, shall be continuous and unspliced and shall be a minimum of 50 feet (15.2 m) in length. Probes shall be assembled in a set to form a vehicle detector as shown on the plans. No more than 6 probes shall be assembled as a set. The cables between probes shall be long enough to provide the spacing shown on the plans plus 5 feet (1.5 m). If no spacing is shown, 15 feet (5 m) of cable shall be provided between probes. Each set of probes shall have one lead-in cable.

(e) Probes installed under bridge decks shall be protected by completely encapsulating them in a conduit system. The probes shall be oriented so that the detection zone is above the bridge deck and shall be installed in gasketed junction boxes anchored to the bottom of the deck. The junction boxes shall have a minimum size of 6 (150 x 6 (150) x 4 inches (100 mm) and the probes shall be rigidly anchored in the box. The probes shall be no more than 18 inches (450 mm) below the top of the bridge deck. Conduit shall be sized so that the probe and cable can be pulled through the conduit. Any conduit bends shall be such that probe and cable can be pulled through the bend. External conduit on the structure shall conform to Sec 902.5.3.

902.13.1.1 Induction Detector Probes. The encapsulated induction detector probe shall detect the passage or presence of all vehicles with a standard induction loop detector amplifier.

(a) The induction detector probe shall operate in a temperature range from -35 F (-37 C) to +165 F (74 C) with 0 to 100 percent humidity.

(b) The operating field intensity range shall be 0.2 to 1.0 Oersted with a nominal inductance of 20 uH plus 20 uH per 100 feet (30 m) of cable. The nominal DC resistance shall be 0.5 ohms plus 3.2 ohms per 100 feet (30 m) of probe cable.

902.13.2 Push-Button. Pedestrian push-button detectors shall be direct push contact type. Each detector shall be a removable contact assembly mounted in a cast aluminum case. The housing shall be shaped to fit the curvature of the post to which it is attached and shall provide a rigid installation. Contacts shall be normally open, entirely insulated from the case and operating button and have connecting terminals. The case shall have one outlet tapped for 1/2-inch (12.5-mm) pipe. The operating button shall be recessed and made of brass or corrosion resistant metal alloy or non-metallic material. The operating voltage shall not exceed 24 volts. The entire assembly shall be weatherproof, secure against electrical shock to the user and of such construction as to withstand continuous hard usage.

902.13.3 Microwave Vehicle Detectors. The unit shall detect all licensed vehicles moving within the field of detection at speeds from 2 to 80 miles per hour (3.2 km/hr to 128.4 k/hr). The unit shall have a minimum detection range from 3 to 200 feet (1 m to 66.7 m) for all licensed vehicles. The pattern spread of the detection field shall be no more than 16 degrees.

The unit shall be self tuning and capable of continuous operation over a temperature range of -35 F (-37 C) to 165 F (74 C). The unit shall be microprocessor based using Doppler microwave at an operating frequency of 10.525 GHz. The unit shall have Federal Communications Commission (FCC) certification and be tested to the applicable FCC specifications. The unit shall be capable of side-fire mount or overhead mount. The enclosure shall be constructed of aluminum or stainless steel and shall be water resistant. The unit shall be capable of detecting directional traffic and the direction shall be user selectable. All user operated controls and adjustments shall be clearly marked and easily accessible. The unit shall have a relay detection output to the controller with a minimum 5 amp rating and be designed to place a constant call to the controller in the event of any failure. The unit shall have an easily accessible indicator showing activation of detection relay. Required wiring shall be as specified by the manufacturer. Mounting hardware for the type of mounting shown on the plans and power supply equipment shall be as specified by the manufacturer and shall be provided with the unit.

902.13.4 Ultrasonic Presence Detectors. The unit shall detect the continuous presence of any object within the field of detection. The unit shall have a minimum detection range from 3 (1 m) to 24 feet (8 m) from the front face of the unit and the detection range shall be adjustable. The detection pattern shall be conical with a nominal beam width of 20 degrees. The unit shall be capable of continuous operation over a temperature range of -35 F (-37 C) to 165 F (74 C). The unit shall be self tuning and operate in the ultrasonic frequency range. The unit shall be capable of side-fire mount or overhead mount. The unit shall contain a variable detection time delay up to a minimum of 10 seconds. All user operated controls and adjustments shall be clearly marked and easily accessible. The enclosure shall be constructed of aluminum or stainless steel and shall be water resistant. The detector shall have a relay detection output to the controller with a minimum 5 amp rating and be designed to place a constant call to the controller in the event of any failure. The unit shall have an easily accessible indicator showing activation of detection relay. Required wiring shall be as specified by the manufacturer. Mounting hardware for the type of mounting shown on the plans and power supply equipment shall be as specified by the manufacturer and shall be provided with the unit.

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

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

5.1 Measurement of training including all specified training will be made per each.

6.0 Basis of Payment. Accepted NEMA TS2 traffic controller assemblies will be made at the contract unit price per each. Payment will be considered full compensation for all labor, equipment and material to complete the described work.

6.1 If training is required by the engineer, payment for the training will be made at the contract unit price per each. Payment will be considered full compensation for all labor, equipment and material to complete the described training.

6.1.1 If training is not required as determined by the engineer, no payment will be made for training.

VVV. RAILROAD COORDINATION, FLAGGING, AND INSURANCE

To Report an Emergency on the UP railroad call: 1-888-877-7267
To Report an Emergency on the BNSF railroad call: 1-800-832-5452

UP Jefferson City Subdivision, St. Louis County, DOT# 425014J (MP 13.46).
BNSF Cuba Subdivision, St. Louis County, DOT# 664305G (MP 12.70).

1.0 AUTHORITY OF RAILROAD ENGINEER AND CITY'S REPRESENTATIVE

1.1 The authorized representative of UP and/or BNSF Railway Company, herein called "Railroad Engineer", shall have final authority in all matters affecting the safe maintenance and operation of railroad traffic including the adequacy of the foundations and structures supporting the railroad tracks.

1.2 The authorized representative of the City of Kirkwood, herein called "Engineer", shall have authority over all other matters as prescribed herein and in the project specifications.

2.0 CONTRACTOR'S INDEMNITY OBLIGATIONS TO THE RAILROAD

2.1 The term "contractor" as used in this special provision includes any and all subcontractors. The contractor shall indemnify, defend and hold harmless the Railroad from and against any and all loss, damage, claims, demands, causes of action, costs and expenses of whatsoever nature arising out of injury to or death of persons whomsoever, or out of damage to or destruction of property whatsoever, including, without limitation, damage to fiber optic, communication and other cable lines and systems, where such injury, death, damage or destruction results from any cause arising out of work performed by the contractor pursuant to the agreement between Railroad and the City for the project, and shall also release the Railroad from and shall waive any claims for injury or damage to equipment or other property, which may result from the construction, maintenance and operation of railroad tracks, wire lines, fiber optic cable, pipe lines and other facilities on said right of way of the Railroad by the contractor. THE LIABILITY ASSUMED BY THE CONTRACTOR WILL NOT BE AFFECTED BY THE FACT, IF IT IS A FACT, THAT THE DAMAGE, DESTRUCTION, INJURY, DEATH, CAUSE OF ACTION OR CLAIM WAS OCCASIONED BY OR CONTRIBUTED TO BY THE NEGLIGENCE OF THE RAILROAD, THE RAILROAD'S AGENTS, SERVANTS, EMPLOYEES OR OTHERWISE, EXCEPT TO THE EXTENT THAT SUCH CLAIMS ARE PROVEN BY ANY CLAIMANT TO HAVE BEEN PROXIMATELY CAUSED BY THE INTENTIONAL MISCONDUCT OR SOLE OR GROSS NEGLIGENCE OF THE RAILROAD. The contractor's indemnity shall include loss of profits or revenue arising from damage or destruction to fiber optic, communication and other cable lines and systems.

2.2 In addition to the indemnity obligations contained in the preceding paragraph, the contractor shall indemnify, defend and hold harmless the Railroad from any claims, expenses, costs, actions, demands, losses, fines, penalties, and fees, of whatsoever nature arising from, related to or connected, in whole or in part, with the following:

a) The removal of the contractor's agents, servants, employees or invitees from the Railroad's property for safety reasons.

b) Contractor's compliance or failure to comply with the provision of applicable law in connection with the performance of contractor's work.

3.0 NOTICE OF STARTING WORK

3.1 The contractor shall not commence any work on Railroad's right of way until the contractor has complied with the following conditions:

a) At least 30 days in advance of the date the contractor proposes to begin work on Railroad's right of way, the contractor shall give the Railroad written notice to the address below with copy to the Engineer who has been designated to be in charge of the work.

PRATT, James R.
MANAGER OF TRACK MAINTENANCE
402/8 233-1701
jrpratt@up.com
1848 Wayne Lanter Ave
Madison, IL 62060

EICHELBERGER, Travis J.
MANAGER OF SIGNAL MAINTENANCE
402/8 233-1274
tjeichel@up.com
11321 Lookout Trail
Centertown, MO 65023

John Caufield, PE
Manager of Public Projects
BNSF Railway
4515 Kansas Ave
Kansas City, KS 66106
Cell 817-789-0879
Office 913-551-4965

b) Obtain written or electronic authorization from the Railroad to begin work on the Railroad's right of way, such authorization to include an outline of specific conditions with which contractor shall comply.

c) Obtain the required Right of Entry Agreement with the Railroad prior to work within the Railroad right of way.

d) Obtain the insurance coverage required in Section 13.0 and Section 14.0 of this job special provision or as otherwise specified by the Railroad. Contractor shall submit written evidence of such coverage to Railroad prior to commencing any work.

e) Prior to performing any work on Railroad's property, right of way or in an area that may impact Railroad's operations, the contractor's employees, representatives or agents who are regularly assigned to perform work on the project shall complete the safety orientation training available on the internet at www.contractororientation.com, hereinafter called, "Internet Safety Orientation". If the contractor's employee, representative or agent is not regularly assigned to perform work on the project, hereinafter called "Flexible Worker(s)", the contractor shall ensure that any Flexible Worker receives appropriate safety training prior to performing any work on the Railroad's property, right –of way or in an area that may impact the Railroad's operations. The content of safety training for Flexible Workers shall include the information covered in the Internet Safety Orientation. The approximate cost of the Internet Safety Orientation is $13 per person, subject to annual escalation.

3.2 The Railroad's written authorization to proceed with the work, with a copy to the Engineer, will include the names, addresses and telephone numbers of the Railroad's representatives who are to be notified as hereinafter required. Where more than one representative is designated, the area of responsibility of each representative shall be specified.

4.0 INTERFERENCE WITH RAILROAD OPERATIONS

4.1 The contractor shall arrange and conduct all work so that there shall be no interference with the Railroad's operations, including train, signal, telephone and telegraphic services; or damage to the Railroad's property; poles, wires and other facilities of tenants, licensees, easement grantees and invitees on the Railroad's right of way. Whenever work may affect the operations or safety of trains, the method of doing such work shall first be submitted to the Railroad Engineer for approval, but such approval shall not relieve the contractor from liability. Any work to be performed by the contractor that requires flagging service or inspection service shall be deferred by the contractor until the flagging service required by the Railroad is available at the job site.

4.2 Whenever work within the Railroad's right of way is of such a nature that impediment to the Railroad's operations is unavoidable, such as use of runaround tracks or necessity for reduced speed, the contractor shall schedule and conduct these operations so that such impediment is reduced to the absolute minimum.

4.3 Should conditions arising from, or in connection with the work require that immediate and unusual provisions be made to protect the Railroad's operations and property, the contractor shall make such provisions. If in the judgment of the Railroad Engineer, or the Engineer if the Railroad Engineer is absent, such provision is insufficient, the Railroad Engineer or Engineer may require or provide such provisions as deem necessary. In any event, such provisions shall be at the contractor's expense and without cost to the Railroad or the City.

4.4 The contractor shall be responsible for any damage to the Railroad as a result of work on the project, which shall include but not be limited to interference with the normal movement of trains caused exclusively by the work performed by the contractor. The contractor shall be responsible for damages for the Railroad's train delays that are caused exclusively by the contractor. The Railroad agrees not to perform any act to unnecessarily cause any train delay. The damages for train delays per freight hour will be billed at an average rate per hour as determined from the Railroad's records. These records shall be provided by the Railroad, upon request, to the City or the City's contractor.

5.0 TRACK CLEARANCES

5.1 The minimum track clearances to be maintained by the contractor during construction are shown on the project plans. However, before undertaking any work within Railroad's right of way, or before placing any obstruction over any track, the contractor shall:

a) Notify the Railroad Engineer at least 72 hours in advance of the work.

b) Receive assurance from the Railroad Engineer that arrangements have been made for flagging service as may be necessary.

c) Receive permission from the Railroad Engineer to proceed with the work.

d) Ascertain that the Engineer has received copies of notice to the Railroad and of the Railroad's response.

5.2 The contractor shall fully comply with any horizontal and vertical clearance requirements imposed by Missouri state statutes and regulations and Federal statutes and regulations regarding the placement of structures or equipment near or over railroad tracks.

6.0 CONSTRUCTION PROCEDURES

6.1 Construction work on the Railroad's property shall be:

a) Subject to the inspection and review of the Railroad.

b) In accordance with the Railroad's written outline of specific conditions (provided in the Bid Book, under the "Railroad Agreements" Section).

c) In accordance with this special provision.

6.2 ***Excavation*** - The subgrade of an operated track shall be maintained with the berm edge at least 12 feet from centerline of track and not more than 26 inches below top of the rail. The contractor will not be required to make existing section meet this specification if substandard, in which case the existing section will be maintained. The contractor shall cease all work and notify the Railroad immediately before continuing excavation in the work area if obstructions are encountered which do not appear on the drawings. If the obstruction is a utility and the owner of the utility can be identified, then the contractor shall also notify the owner immediately. If there is any doubt about the location of underground cables or lines of any kind, no work shall be performed until the exact location has been determined. There will be no exceptions to these instructions. Additionally, all excavations shall be conducted in compliance with applicable Occupational Safety and Health Act regulations and, regardless of depth, shall be shored where there is any danger to tracks, structures or personnel. Any excavations, holes or trenches on the Railroad's property shall be covered, guarded and/or protected when not being worked on. When leaving work site areas at night and over weekends, the areas shall be secured and left in a condition that will ensure that Railroad's employees and other personnel who may be working or passing through the area are protected from all hazards. All excavations shall be back filled as soon as possible.

6.3 ***Excavation for Structure*** - The contractor shall be required to take special precaution and care in connection with excavating, shoring pits and in driving piles for footings adjacent to tracks to provide adequate lateral support for the tracks and the loads which the tracks carry, without disturbance of track alignment and surface, and to avoid obstructing track clearances with working equipment, tools or other material. The procedure for doing such work, including need of and plans for shoring, shall be approved by the Railroad Engineer before work is performed, but such approval shall not relieve the contractor from liability. Before submission of plans to the Railroad Engineer for approval, the Engineer will first review such plans in accordance with the Missouri Standard Specifications for Highway Construction, hereinafter called "Standard Specifications". The responsibility for the design and construction of the sheeting rests solely with the contractor. The temporary shoring along the railroad tracks shall be designed for the Cooper E80 loading. The design shall insure that the shoring is braced or substantially securely to prevent movement. The contractor shall submit plans for the temporary shoring that shall be signed, sealed, and stamped in accordance with the laws relating to Architects and Professional Engineers, Chapter 327, RSMo. and then submitted for review by the Engineer.

6.4 ***Demolition of Existing Structures*** - The contractor shall be required to take special precaution and care in connection with demolition of existing structures. The procedure for

doing such work, including need of and plans for temporary falsework, shall first be approved by Railroad Engineer before work is performed, but such approval shall not relieve the contractor from liability. Before submission of plans to the Railroad Engineer for approval, the Engineer will first review such plans.

6.5 ***Falsework*** - The contractor shall be required to take special precaution and care to prevent any material from falling on the Railroad's right of way. The procedure for preventing material from falling, including need of and plans for temporary falsework, shall first be approved by the Railroad Engineer, but such approval shall not relieve the contractor from liability. Before submission of plans to the Railroad Engineer for approval, the Engineer will first review such plans.

6.6 ***Blasting -*** The contractor shall obtain advance approval of the Railroad Engineer and the Engineer for use of explosives on or adjacent to the Railroad's property. If permission for use of explosives is granted, the contractor shall be required to comply with the following:

a) Blasting shall be done with light charges under the direct supervision of a responsible officer or employee of the contractor.

b) Electric detonating fuses shall not be used because of the possibility of premature explosions resulting from operation of two-way train radios.

c) No blasting shall be done without the presence of the Railroad Engineer. At least 72 hours advance notice to the person designated in the Railroad's notice of authorization to proceed as mentioned in Section 2.2 of this job special provision, the contactor shall be required to arrange for the presence of the Railroad Engineer and such flagging as the Railroad may require.

d) The contractor shall have at the job site adequate equipment, labor and materials and allow sufficient time to clean up debris resulting from the blasting without delay to trains, as well as correcting, at contractor's expense, any track misalignment or other damage to the Railroad's property resulting from the blasting as directed by the Railroad Engineer. If contractor's actions result in delay of trains, the contractor shall bear the entire cost thereof.

6.6.1 The Railroad Engineer will:

i. Determine the approximate location of trains and advise the contractor the approximate amount of time available for the blasting operation and clean-up.

ii. Have the authority to order discontinuance of blasting if blasting is too hazardous or is not in accordance with this special provision.

6.7 ***Maintenance of Railroad Facilities*** - The contractor shall be required to maintain all ditches and drainage structures free of silt or other obstructions which may result from contractor's operations. The contractor shall promptly repair eroded areas within Railroad's right of way and repair any other damage to the Railroad's property, tenants, licensees, easement grantees and invitees. All such maintenance and repair of damages due to the contractor's operations shall be done at the contractor's expense.

6.8 ***Storage of Materials and Equipment -*** The contractor shall not store or stockpile construction materials or equipment closer than 25 feet to the centerline of the nearest railroad track or on the Railroad's property not covered by construction easement, contractor's permit, lease or agreement. Additionally, the contractor shall not store or leave materials or equipment within 25 feet of the edge of any highway/rail at- grade crossings. Further, both sides of a main track shall remain unobstructed for a distance of 10 feet from the exterior edge of the track at all times to allow for stopped train inspection.

a) Machines or vehicles shall not be left unattended with the engine running. Parked machines or equipment shall be in gear with brakes set and with blade, pan or bucket lowered to the ground if so equipped. All grading or construction machinery that is left parked near the track unattended shall be effectively immobilized so that unauthorized persons cannot move such equipment.

6.9 ***Cleanup -*** Upon completion of the work, the contractor shall remove from within the limits of the Railroad's right of way, all machinery, equipment, surplus materials, falsework, rubbish or temporary buildings of the contractor, and leave said right of way in a neat condition satisfactory to the Railroad Engineer.

6.10 ***Buried Cable and Other Buried Facilities.***

a) The contractor is placed on notice that fiber optic, communication and other cable lines and systems, collectively the "Lines", owned by various telecommunications companies may be buried on Railroad's property or right of way. The locations of the buried Lines, pipelines or utility facilities have been included on the plans based on information from the telecommunications companies, pipeline operators, or utilities, as the case may be. The contractor shall be responsible for contacting the Railroad Engineer, the telecommunications companies, pipeline operators and utilities and notifying them of any work that may damage the buried Lines, pipelines, utility facilities and/or interfere with their service. The contractor shall verify the location of all buried Lines, pipelines and utility facilities shown on the plans or marked in the field in order to establish their exact locations prior to or while doing work on the Railroad's property or right of way. The contractor shall also use all reasonable methods when working on the Railroad's property or right of way to determine if any other buried Lines, pipelines or utility facilities exist on the Railroad's property or right of way.

b) Failure to mark or identify the buried Lines, pipelines or utility facilities will be sufficient cause for the Railroad Engineer to stop construction at no cost to the City or Railroad until these items are completed. The contractor shall be responsible for the rearrangement of any buried facilities, Lines, pipelines or utility facilities determined to interfere with the construction. The contractor shall cooperate fully with any telecommunications companies, pipeline operators and utility facility owners in performing such rearrangements.

7.0 DAMAGES

7.1 The Railroad will not assume liability for any damages to the contractor, contractor's work, employees, servants, equipment and materials caused by railroad traffic. Any cost incurred by the Railroad for repairing damages to Railroad's property or to property of the Railroad's tenants, licensees, easement grantees and invitees caused by or resulting from the contractor's operations shall be paid directly to the Railroad by contractor.

8.0 FLAGGING SERVICES

8.1 When Required. Under the terms of the agreement between the City and the Railroad, the Railroad has sole authority to determine the need for flagging required to protect the Railroad's operations. In general, the requirements of such services will be whenever the contractor's personnel or equipment are, or are likely to be, working on the Railroad's right of way within 25 feet of the centerline of any track, or across, over, adjacent to, or under a track, or when such work has disturbed or is likely to disturb a railroad structure or the railroad roadbed or surface and alignment of any track to such extent that the movement of trains must be controlled by flagging, or reasonable probability of accidental hazard to Railroad's operations or personnel. Normally, the Railroad will assign one flagger to a project; but in some cases, more than one may be necessary, such as yard limits where 3 flaggers may be required. However, if the contractor works within distances that violate instructions given by the Railroad Engineer or performs work that has not been scheduled with the Railroad Engineer, flaggers may be required full time until the project has been completed.

8.2 Scheduling and Notification.

a) Not later than the time that approval is initially requested to begin work on the Railroad's right of way (30 days), contractor shall furnish to the Railroad and the City a schedule for all work required to complete the portion of the project within Railroad's right of way and arrange for a job site meeting between the contractor, the Engineer, and the Railroad Engineer. Flaggers may not be provided until the job site meeting has been conducted and the contractor's work scheduled.

b) The contractor shall be required to give the Railroad Engineer at least 30 days of advance written notice of intent to begin work within Railroad's right of way in accordance with this special provision. Once begun, if such work is then suspended at any time, or for any reason, the contractor shall be required to give the Railroad Engineer at least 5 working days of advance notice before resuming work on Railroad's right of way. Such notices shall include sufficient details of the proposed work to enable the Railroad Engineer to determine if flagging will be required. If such notice is in writing, the contractor shall furnish the Engineer a copy; if notice is given verbally, the notice shall be confirmed in writing with copy to the Engineer. If flagging is required, no work shall be undertaken until the flagger or flaggers are present at the job site. Obtaining a flagger or flaggers may take up to 30 days to obtain initially from the Railroad. When flagging begins, the flagger is usually assigned by the Railroad to work at the project site on a continual basis until no longer needed and cannot be called for on a spot basis. If flagging becomes unnecessary and is suspended, obtaining a flagger or flaggers may take up to 30 days to again obtain from the Railroad. Due to Railroad labor agreements, 10 working day notice may be necessary before flagging services may be discontinued and responsibility for payment stopped. Notification for flagging should be addressed to:

PRATT, James R.
MANAGER OF TRACK MAINTENANCE
402/8 233-1701
jrpratt@up.com
1848 Wayne Lanter Ave
Madison, IL 62060

EICHELBERGER, Travis J.
MANAGER OF SIGNAL MAINTENANCE
402/8 233-1274
tjeichel@up.com
11321 Lookout Trail
Centertown, MO 65023

John Caufield, PE
Manager of Public Projects

BNSF Railway
4515 Kansas Ave
Kansas City, KS 66106
Cell 817-789-0879
Office 913-551-4965

c) If, after the flagger is assigned to the project site, emergencies arise which require the flagger's presence elsewhere, then the contractor shall delay work on the Railroad's right of way until such time as the flagger is again available. Any additional costs resulting from such delay shall be borne by the contractor and not the Railroad.

8.3 Payment.

a) The Contractor will pay the Railroad directly for the cost of flagging services associated with the project.

b) The Railroad shall submit progress invoice to the Engineer during the time flagging services are required. A final invoice shall be submitted to the Engineer within 180 days of completion of the project. This is defined as the point in time at which the City and the Railroad both accept the project and the contractor is relieved of contractual obligation. Should the invoice not be received within this time period, the Railroad will be responsible for obtaining payment directly from the contractor.

c) Should a dispute between the Railroad, the City and the contractor develop concerning the cost of flagging service or should the contractor fail to promptly pay the Railroad for flagging services, the full amount of the Railroad's invoice will be deducted from the contractor's payment request. However, The City will send only 95 percent of the amount requested to the Railroad. The City will make a corrected payment once a settlement is reached between the Railroad, the City and the contractor.

d) The contractor shall be responsible for arranging needed flagging services as required by the Railroad to accomplish the highway improvement.

e) The cost of flagging service is approximately $1,300 per day based on an 8-hour work day and a 40-hour work week. This cost includes the base pay for the flagger, overhead, and per diem charge for travel expenses, meals and lodging. The charge to the contractor by the Railroad will be the actual cost based on the rate of pay for the Railroad's employees who are available for flagging service at the time the service is required. Work by a flagger in excess of 8 hours per day or 40 hours per week but not more than 12 hours a day will result in overtime pay at 1 1/2 times the appropriate rate. Work by a flagger in excess of 12 hours per day will result in overtime pay at 2 times the appropriate rate. If work is performed on a holiday, the flagging rate is 2 1/2 times the normal rate. Railroad expenses incurred preparing and handling invoices will also be charged to the contractor and/or the City. Charges to the contractor and/or the City by the Railroad shall be in accordance with applicable provisions of Volume 1, Chapter 4, §3 and Volume 6, Chapter 6, §2, Subsection 1 of the Federal-Aid Highway Program Manual issued by the Federal Highway Administration, including all current amendments. Flagging costs are subject to change. The above estimates of flagging cost are provided for information only and are not binding in any way. Each time a flagger is called, the minimum period for billing will be the 8-hour basic day unless the flagger can be assigned to other Railroad work during the work day.

f) In addition to the hours of providing flagging at the construction site, the flagger hours will include, but is not limited to, travel time to and from the project, time to complete paperwork for the flagging operations and time for setting warning signs/flags for the train traffic.

8.4 Verification.

a) Any complaints concerning a flagger shall be resolved in a timely manner. If need for a flagger is questioned, please contact the Railroad Engineer. All verbal complaints shall be confirmed in writing by the contractor within 5 working days with copy to the Railroad Engineer and Engineer.
b) The Railroad flagger assigned to the project will be responsible for notifying the Engineer upon arrival at the job site on the first day, or as soon thereafter as possible, that flagging services begin and on the last day that flagger performs such services for each separate period that services are provided. The Engineer will document such notification in the project records.

9.0 HAUL ACROSS RAILROADS

9.1 Where the plans show or imply that materials of any nature must be hauled across the Railroad's tracks, unless the plans clearly show that the City has included arrangements for such haul in the agreement with the Railroad, the contractor shall be required to make all necessary arrangements with the Railroad regarding means of transporting such materials across the Railroad's tracks. The contractor shall be required to bear all costs incidental to such crossings, including flagging, whether services are performed by contractor's own forces or by Railroad's personnel.

9.2 No crossing may be established for use of the contractor for transporting materials or equipment across the tracks of the Railroad unless specific authority for the installation, maintenance, necessary watching and flagging thereof and removal, all at the expense of the contractor, is first obtained from the Railroad Engineer.

10.0 WORK FOR THE BENEFIT OF THE CONTRACTOR

10.1 All temporary or permanent changes in wire lines or other facilities which are considered necessary to the project are shown on the plans and are included in the agreement between the City and the Railroad or will be covered by appropriate revisions to same which will be initiated and approved by the City and/or the Railroad. Should the contractor desire any changes in addition to the above, then contractor shall make separate arrangements with the Railroad for same to be accomplished at the contractor's expense.

11.0 COOPERATION AND DELAYS

11.1 The contractor shall arrange a schedule with the Railroad for accomplishing staged construction involving work by the Railroad or tenants, licensees, easement grantees and invitees of the Railroad. In arranging a schedule, the contractor shall ascertain, from the Railroad, the lead time required for assembling crews, materials and make due allowance. No charge of claims of the contractor against the Railroad will be allowed for hindrance or delay on account of railway traffic for any work done by the Railroad, other delay incident to or necessary for safe maintenance of railway traffic, or for any delays due to compliance with this special provision.

12.0 TRAINMAN'S WALKWAYS

12.1 Along the outer side of each exterior track of multiple operated track and on each side of single operated track, an unobstructed continuous space suitable for trainman's use in walking along trains shall be maintained extending to a line not less than 12 feet from centerline of track. Any temporary impediments to walkways and track drainage encroachments or obstructions allowed during work hours while Railway's protective service is provided shall be removed before the close of each work day. Any excavation near the walkway, the contractor shall install a handrail with a 12 feet minimum clearance from centerline of track.

13.0 INSURANCE - BNSF

13.1 The amount of work to be performed upon, over or under Railroad's right of way is estimated to be one (1) percent of the contractor's total bid for the project.

13.2 In addition to any other forms of insurance or bonds required under the terms of the contract and specifications, Contractor must, at its sole cost and expense, procure and maintain during the life of this Agreement the following insurance coverage:

a) ***Commercial General Liability Insurance*** - This insurance shall contain broad form contractual liability with a combined single limit of a minimum of $2,000,000 each occurrence and an aggregate limit of at least $6,000,000 but in no event less than the amount otherwise carried by the contractor. Coverage must be purchased on a post 2004 ISO occurrence form or equivalent and include coverage for, but not limit to the following:

- Bodily Injury and Property Damage
- Personal Injury and Advertising Injury
- Fire legal liability
- Products and completed operations

This policy must also contain the following endorsements, which must be indicated on the certificate of insurance:

- The definition of insured contract must be amended to remove any exclusion or other limitation for any work being done within 50 feet of railroad property.
- Waiver of subrogation in favor of and acceptable to Railway.
- Additional insured endorsement in favor of and acceptable to Railway.
- Separation of insureds.
- The policy shall be primary and non-contributing with respect to any insurance carried by Railway.

It is agreed that the workers' compensation and employers' liability related exclusions in the Commercial General Liability insurance policy(s) required herein are intended to apply to employees of the policy holder and shall not apply to Railway employees.

No other endorsements limiting coverage as respects obligations under this Agreement may be included on the policy with regard to the work being performed under this agreement.

b) ***Business Automobile Insurance -*** This insurance must contain a combined single limit of at least $1,000,000 per occurrence, and include coverage for, but not limited to the following:

- Bodily injury and property damage
- Any and all vehicles owned, used or hired

The policy shall also contain the following endorsements or language, which shall be indicated on the certificate of insurance:

- Waiver of subrogation in favor of and acceptable to Railway.
- Additional insured endorsement in favor of and acceptable to Railway.
- Separation of insureds.
- The policy shall be primary and non-contributing with respect to any insurance carried by Railway.

c) Workers Compensation and Employers Liability insurance - including coverage for, but not limited to:

- Contractor's statutory liability under the worker's compensation laws of the state(s) in which the work is to be performed. If optional under State law, the insurance must cover all employees anyway.
- Employers' Liability (Part B) with limits of at least $500,000 each accident, $500,000 by disease policy limit, $500,000 by disease each employee.

This policy shall also contain the following endorsements or language, which shall be indicated on the certificate of insurance:

- Waiver of subrogation in favor of and acceptable to Railway.

d) Railroad Protective Liability insurance - naming only the Railway as the Insured with coverage of at least $2,000,000 per occurrence and $6,000,000 in the aggregate. The policy Must be issued on a standard ISO form CG 00 35 10 93 and include the following:

- Endorsed to include the Pollution Exclusion Amendment (ISO form CG 28 31 10 93)
- Endorsed to include the Limited Seepage and Pollution Endorsement.
- Endorsed to remove any exclusion for punitive damages.
- No other endorsements restricting coverage may be added.
- The original policy must be provided to the Railway prior to performing any work or services under this Agreement

In lieu of providing a Railroad Protective Liability Policy, Licensee may participate in Licensor's Blanket Railroad Protective Liability Insurance Policy available to contractor.

13.3 Other Requirements:

13.3.1 All policies (applying to coverage listed above) must not contain an exclusion for punitive damages and certificates of insurance must reflect that no exclusion exists.

13.3.2 Contractor agrees to waive its right of recovery against Railway for all claims and suits against Railway. In addition, its insurers, through the terms of the policy or policy endorsement, waive their right of subrogation against Railway for all claims and suits. The certificate of insurance must reflect the waiver of subrogation endorsement. Contractor further waives its right of recovery, and its insurers also waive their right of subrogation against Railway for loss of its owned or leased property or property under contractor's care, custody or control.

13.3.3 Contractor is not allowed to self-insure without the prior written consent of Railway. If granted by Railway, any deductible, self-insured retention or other financial responsibility for claims must be covered directly by contractor in lieu of insurance. Any and all Railway liabilities that would otherwise, in accordance with the provisions of this Agreement, be covered by contractor's insurance will be covered as if contractor elected not to include a deductible, self- insured retention or other financial responsibility for claims.

13.3.4 Prior to commencing the Work, contractor must furnish to Railway an acceptable certificate(s) of insurance including an original signature of the authorized representative evidencing the required coverage, endorsements, and amendments and referencing the contract audit/folder number if available. Contractor shall notify Railway in writing at least 30 days prior to any cancellation, non-renewal, substitution or material alteration. Upon request from Railway, a certified duplicate original of any required policy must be furnished. Contractor should send the certificate(s) to the appropriate address.

13.3.5 Any insurance policy must be written by a reputable insurance company acceptable to Railway or with a current Best's Guide Rating of A- and Class VII or better and authorized to do business in the state(s) in which the service is to be provide.

13.3.6 Contractor represents that this Agreement has been thoroughly reviewed by contractor's insurance agent(s)/broker(s), who have been instructed by contractor to procure the insurance coverage required by this Agreement. Allocated Loss Expense must be in addition to all policy limits for coverages referenced above. Not more frequently than once every five years, Railway may reasonably modify the required insurance coverage to reflect then-current risk management practices in the railroad industry and underwriting practices in the insurance industry.

13.3.7 If any portion of the operation is to be subcontracted by contractor, contractor must require that the subcontractor provide and maintain the insurance coverages set forth herein, naming Railway as an additional insured, and requiring that the subcontractor release, defend and indemnify Railway to the same extent and under the same terms and conditions as contractor is required to release, defend and indemnify Railway herein.

13.3.8 Failure to provide evidence as required by this section will entitle, but not require, Railway to terminate this Agreement immediately. Acceptance of a certificate that does not comply with this section will not operate as a waiver of contractor's obligations hereunder.

13.3.9 The fact that insurance (including, without limitation, self-insurance) is obtained by contractor will not be deemed to release or diminish the liability of contractor including, without limitation, liability under the indemnity provisions of this Agreement. Damages recoverable by Railway will not be limited by the amount of the required insurance coverage.

13.3.10 For purposes of this section, Railway means "MNA RAILWAY COMPANY" and the subsidiaries, successors, assigns and affiliates of each.

13.3.11 Railroad will not accept binders as evidence of insurance, the original policy shall be provided. The named insured, description of the work and designation of the job site to be shown on the Policy are as follows:

a) Named Insured: MNA Railway Company
b) Description and Designation: Grand Street Bridge Improvements, Greene County

13.3.12 The contractor must notify MNA General Manager at Rick.Oeltjen@gwrr.com (417-313-3046) when applying for railroad insurance coverage.

13.4 If any part of the work is sublet, similar insurance and evidence thereof in the same amounts as required of the prime contractor, shall be provided by or in behalf of the subcontractor to cover the subcontractor's operations. Endorsements to the prime contractor's policies specifically naming subcontractors and describing their operations will be acceptable for this purpose.

13.5 All Insurance hereinbefore specified shall be carried until all work required to be performed under the terms of the contract has been satisfactorily completed within the limits of the Railroad's right of way as evidenced by the formal acceptance by the City. Insuring Companies may cancel insurance by permission of the City and Railroad or on 30 days written notice to the Railroad and City.

14.0 INSURANCE - Union Pacific Railroad Company

Licensee shall, at its sole cost and expense, procure and maintain during the life of this Agreement (except as otherwise provided in this Agreement) the following insurance coverage:

14.1. Commercial General Liability insurance. Commercial general liability (CGL) with a limit of not less than $2,000,000 each occurrence and an aggregate limit of not less than $4,000,000. CGL insurance must be written on ISO occurrence form CG 00 01 12 04 (or a substitute form providing equivalent coverage).

The policy must also contain the following endorsement, WHICH MUST BE STATED ON THE CERTIFICATE OF INSURANCE: "Contractual Liability Railroads" ISO form CG 24 17 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Railroad Company Property" as the Designated Job Site.

14.2 Business Automobile Coverage insurance. Business auto coverage written on ISO form CA 00 01 10 01 (or a substitute form providing equivalent liability coverage) with a limit of not less $2,000,000 for each accident, and coverage must include liability arising out of any auto (including owned, hired, and non-owned autos).

The policy must contain the following endorsements, WHICH MUST BE STATED ON THE CERTIFICATE OF INSURANCE: "Coverage For Certain Operations In Connection With Railroads" ISO form CA 20 70 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Property" as the Designated Job Site.

14.3 Workers Compensation and Employers Liability insurance. Coverage must include but not be limited to:

Licensee's statutory liability under the workers' compensation laws of the state(s) affected by this Agreement.

Employers' Liability (Part B) with limits of at least $500,000 each accident, $500,000 disease policy limit $500,000 each employee.

If Licensee is self-insured, evidence of state approval and excess workers compensation coverage must be provided. Coverage must include liability arising out of the U. S. Longshoremen's and Harbor Workers' Act, the Jones Act, and the Outer Continental Shelf Land Act, if applicable.

14.4 Railroad Protective Liability insurance. Licensee must maintain "Railroad Protective Liability" insurance written on ISO occurrence form CG 00 35 12 04 (or a substitute form providing equivalent coverage) on behalf of Railroad only as named insured, with a limit of not less than $2,000,000 per occurrence and an aggregate of $6,000,000.

The definition of "JOB LOCATION" and "WORK" on the declaration page of the policy shall refer to this Agreement and shall describe all WORK or OPERATIONS performed under this agreement

14.5. Umbrella or Excess insurance. If Licensee utilizes umbrella or excess policies, and these policies must "follow form" and afford no less coverage than the primary policy.

Other Requirements

14.6. All policy(ies) required above (except worker's compensation and employers liability) must include Railroad as "Additional Insured" using ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage). The coverage provided to Railroad as additional insured shall, to the extent provided under ISO Additional Insured Endorsement CG 20 26, and CA 20 48 provide coverage for Railroad's negligence whether sole or partial, active or passive, and shall not be limited by Licensee's liability under the indemnity provisions of this Agreement.

14.7 Punitive damages exclusion, if any, must be deleted (and the deletion indicated on the certificate of insurance), unless (a) insurance coverage may not lawfully be obtained for any punitive damages that may arise under this agreement, or (b) all punitive damages are prohibited by all states in which this agreement will be performed.

14.8. Licensee waives all rights of recovery, and its insurers also waive all rights of subrogation of damages against Railroad and its agents, officers, directors and employees for damages covered by the workers compensation and employers' liability or commercial umbrella or

excess liability obtained by Licensee required in this agreement, where permitted by law This waiver must be stated on the certificate of insurance.

14.9. All insurance policies must be written by a reputable insurance company acceptable to Railroad or with a current Best's Insurance Guide Rating of A- and Class VII or better and authorized to do business in the state(s) in which the work is to be performed.

14.10. The fact that insurance is obtained by Licensee or by Railroad on behalf of Licensee will not be deemed to release or diminish the liability of Licensee, including, without limitation, liability under the indemnity provisions of this Agreement. Damages recoverable by Railroad from Licensee or any third party will not be limited by the amount of the required insurance coverage.

15.0 HAZARDOUS MATERIALS COMPLIANCE AND REPORTING

Contractor shall be responsible for complying with all applicable federal, state and local governmental laws and regulations, including, but not limited to environmental laws and regulations (including but not limited to the Resource Conservation and Recovery Act, as amended; the Clean Water Act, as amended; the Oil Pollution Act, as amended; the Hazardous Materials Transportation Act, as amended; and the Comprehensive Environmental Response, Compensation and Liability Act, as amended), and health and safety laws and regulations. In addition to the liability provisions contained elsewhere in this job special provision, the contractor hereby indemnifies, defends and holds harmless the Railroad for, from and against all fines or penalties imposed or assessed by federal, state and local governmental agencies against the Railroad which arise out of contractor's work under this special provision. Notwithstanding the preceding sentence, the contractor will not be liable for pre-existing hazardous materials or hazardous substances discovered on Railroad’s property or right of way so long as such hazardous materials or hazardous substances were not caused by (in whole or in part) contractor’s work, acts or omissions. If contractor discovers any hazardous waste, hazardous substance, petroleum or other deleterious material, including but not limited to any non-containerized commodity or material, on or adjacent to Railroad’s property, in or near any surface water, swamp, wetlands or waterways, while performing any work under this special provision, the contractor shall immediately:

a) Notify the Railroad’s General Manager, of such discovery.
b) Take safeguards necessary to protect employees, subcontractors, agents and/or third parties.
c) Exercise due care with respect to the release, including the taking of any appropriate measure to minimize the impact of such release

16.0 PERSONAL INJURY REPORTING

The Railroad is required to report certain injuries as a part of compliance with Federal Railroad Administration (“FRA”) reporting requirements. Any personal injury sustained by any employee of the contractor, subcontractor or contractor’s invitees while on the Railroad’s property shall be reported immediately, by phone or mail if unable to contact in person, to the Railroad’s representative in charge of the project.

17.0 FAILURE TO COMPLY

In the event the contractor violates or fails to comply with any of the requirements of this special provision, the below orders will be applied. Any such orders shall remain in effect until the

contractor has remedied the situation to the satisfaction of the Railroad Engineer and the Engineer.

a) The Railroad Engineer may require that the contractor to vacate the Railroad's property.

b) The Engineer may withhold all monies due to the contractor until contractor has remedied the situation to the satisfaction of the Railroad Engineer and the Engineer.

18.0 MINIMUM SAFETY REQUIREMENTS

The term "employees" as used herein refer to all employees of Licensee or its contractors, subcontractors, or agent of Licensee.

18.1. Clothing

A. All employees of Licensee will be suitably dressed to perform their duties safely and in a manner that will not interfere with their vision, hearing, or free use of their hands or feet.

Specifically, Licensee's employees must wear:

(i) Waist-length shirts with sleeves.
(ii) Trousers that cover the entire leg. If flare-legged trousers are worn, the trouser bottoms must be tied to prevent catching.
(iii) Footwear that covers their ankles and has a defined heel. Employees working on bridges are required to wear safety-toed footwear that conforms to the American National Standards Institute (ANSI) and FRA footwear requirements.

B. Employees shall not wear boots (other than work boots), sandals, canvas-type shoes, or other shoes that have thin soles or heels that are higher than normal.

C. Employees must not wear loose or ragged clothing, neckties, finger rings, or other loose jewelry while operating or working on machinery.

18.2 Personal Protective Equipment

Licensee shall require its employee to wear personal protective equipment as specified by Railroad rules, regulations, or recommended or requested by the Railroad representative.

(i) Hard hat that meets the American National Standard (ANSI) Z89.1 – latest revision. Hard hats should be affixed with Licensee's company logo or name.
(ii) Eye protection that meets American National Standard (ANSI) for occupational and educational eye and face protection, Z87.1 – latest revision. Additional eye protection must be provided to meet specific job situations such as welding, grinding, etc.
(iii) Hearing protection, which affords enough attenuation to give protection from noise levels that will be occurring on the job site. Hearing protection, in the form of plugs or muffs, must be worn when employees are within:

100 feet of a locomotive or roadway/work equipment
15 feet of power operated tools
150 feet of jet blowers or pile drivers
150 feet of retarders in use (when within 10 feet, employees must wear dual ear protection – plugs and muffs)

Other types of personal protective equipment, such as respirators, fall protection equipment, and face shields, must be worn as recommended or requested by the Railroad Representative.

18.3 On Track Safety

Licensee and its contractor are responsible for compliance with the Federal Railroad Administration's Roadway Worker Protection regulations – 49CFR214, Subpart C and Railroad's On-Track Safety rules. Under 49CFR214, Subpart C, railroad contractors are responsible for the training of their employees on such regulations. In addition to the instructions contained in Roadway Worker Protection regulations, all employees must:

(i) Maintain a minimum distance of at least twenty-five (25) feet to any track unless the Railroad Representative is present to authorize movements.
(ii) Wear an orange, reflectorized work wear approved by the Railroad Representative.
(iii) Participate in a job briefing that will specify the type of On-Track Safety for the type of work being performed. Licensee must take special note of limits of track authority, which tracks may or may not be fouled, and clearing the track. Licensee will also receive special instructions relating to the work zone around machines and minimum distances between machines while working or traveling.

18.4 Equipment

A. It is the responsibility of Licensee to ensure that all equipment is in a safe condition to operate. If, in the opinion of the Railroad Representative, any of Licensee's equipment is unsafe for use, Licensee shall remove such equipment from Railroad's property. In addition, Licensee must ensure that the operators of all equipment are properly trained and competent in the safe operation of the equipment. In addition, operators must be:

Familiar and comply with Railroad's rules on lockout/tagout of equipment.
Trained in and comply with the applicable operating rules if operating any hy-rail equipment on-track.
Trained in and comply with the applicable air brake rules if operating any equipment that moves rail cars or any other rail bound equipment.

B. All self-propelled equipment must be equipped with a first-aid kit, fire extinguisher, and audible back-up warning device.

C. Unless otherwise authorized by the Railroad Representative, all equipment must be parked a minimum of twenty-five (25) feet from any track. Before leaving any equipment unattended, the operator must stop the engine and properly secure the equipment against movement.

D. Cranes must be equipped with three orange cones that will be used to mark the working area of the crane and the minimum clearances to overhead powerlines.

18.5. General Safety Requirements

A. Licensee shall ensure that all waste is properly disposed of in accordance with applicable federal and state regulations.
B. Licensee shall ensure that all employees participate in and comply with a job briefing conducted by the Railroad Representative, if applicable. During this briefing, the Railroad Representative will specify safe work procedures, (including On-Track Safety)

and the potential hazards of the job. If any employee has any questions or concerns about the work, the employee must voice them during the job briefing. Additional job briefings will be conducted during the work as conditions, work procedures, or personnel change.

C. All track work performed by Licensee meets the minimum safety requirements established by the Federal Railroad Administration's Track Safety Standards 49CFR213.

D. All employees comply with the following safety procedures when working around any railroad track:

(i) Always be on the alert for moving equipment. Employees must always expect movement on any track, at any time, in either direction.

(ii) Do not step or walk on the top of the rail, frog, switches, guard rails, or other track components.

(iii) In passing around the ends of standing cars, engines, roadway machines or work equipment, leave at least 20 feet between yourself and the end of the equipment. Do not go between pieces of equipment of the opening is less than one car length (50 feet).

(iv) Avoid walking or standing on a track unless so authorized by the employee in charge.

(v) Before stepping over or crossing tracks, look in both directions first.

(vi) Do not sit on, lie under, or cross between cars except as required in the performance of your duties and only when track and equipment have been protected against movement.

E. All employees must comply with all federal and state regulations concerning workplace safety.

19.0 COMPLY WITH CITY PERMITS AND LICENSE AGREEMENTS

The Contractor shall comply with any additional terms as required by agreements or licenses between the City of Kirkwood and the BNSF Railway or the Union Pacific Railroad Company.

20.0 WORK WITHIN BNSF RAILWAY PROPERTY

A. The contractor is responsible to comply with the requirements of the "LICENSE FOR COMMUNICATION LINE, TELEVISION CABLE, AND/OR FIBER OPTIC LINE ACROSS OR ALONG RAILWAY PROPERTY." This agreement is included in the Bid Book, under the "Railroad Agreements" Section.

B. The contractor is responsible to comply with the requirements of the "MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION SUPPLEMENTAL AGREEMENT FOR HIGHWAY/RAIL CROSSING IMPROVEMENTS" This agreement is included in the Bid Book, under the "Railroad Agreements" Section.

C. The contractor is responsible to complete Exhibits C & C1 agreement in order to complete work within BNSF Railway Property. These agreements are included in the Bid Book, under the "Railroad Agreements" Section. The City will assist the Contractor with completing the exhibits.

21.0 WORK WITHIN UP RAILWAY PROPERTY

A. The contractor is responsible to comply with the requirements of the "WIRELINE CROSSING AGREEMENT." This agreement is included in the Bid Book, under the "Railroad Agreements" Section.

B. The contractor is responsible to comply with the requirements of the existing maintenance agreements "MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION SUPPLEMENTAL AGREEMENT FOR HIGHWAY/RAIL CROSSING IMPROVEMENTS" and the agreement for roadway and sidewalk improvements along Kirkwood Road within the Union Pacific ROW executed September 7, 1978. These agreements are included in the Bid Book, under the "Railroad Agreements" Section. Sidewalk improvements will be constructed within maintenance terms of this agreement.

C. The contractor is responsible to obtain a Temporary Use of Railroad Property from the Union Pacific Railway in order to complete work within UP Railway Property.

Permit Procedures.

A. A non-refundable application fee in the amount of $545.00 must accompany your completed Application for Right of Entry form sent to the appropriate Real Estate Manager. Please make payable to Union Pacific Railroad Company, with the Federal Tax Identification No. 94-6001323. Please be aware that a licensee fee will be charged on top of the application fee. The manager will only be able to provide you with fee information after your application has been reviewed and approved.

B. If possible, please provide a city, county or topographical map of the area, showing the proposed installation. If you require a railroad right of way map to locate your right of way use location, such a map may be obtained (a fee may be required) from:

Engineering Map Area
Union Pacific Railroad Company
Phone: (402) 501-4941
Fax: (402) 501-4932

C. When using a street name on the application, which has been changed, please include the current name as well as any previous name. Many of the old railroad company maps do not reflect these name changes.

D. Please refer to the information on Fixed Object Identity for examples to assist you in locating "fixed objects."

E. The information on Identifying Railroad Mile Post Locations will assist in locating mile post markers, which are helpful in establishing the location of the proposed site or installation.

F. Union Pacific's Real Estate Department is the initial contact for all right of entry requests. Applications should be submitted by U.S. mail, or express mail to the Pipeline, Wireline, Right of Entry and Drainage Contacts

G. The application should be accompanied by all of the items listed in the Temporary Use Checklist before your request can be given an initial review. Incomplete applications will halt processing.

H. The normal turn-around time for processing applications is now running between 30-45 days. Please allow sufficient time for the handling of your request. Please do not call within the initial 30 days of receipt of your request for the status of your application. Time in answering your phone calls only delays the processing of your request as well as all other requests from other applicants.

I. Rush Handling: If you require rush handling of your application, please complete and return the right of entry application form, the Rush Handling form found elsewhere in this section, and a check in the amount of $545 plus the appropriate RUSH fee and enclose all in an envelope labeled "RUSH." Please note that not all projects are eligible for Rush Handling.

J. Before you enter the railroad company's right of way, the following must be completed:
   - All agreements must be executed by the applicant and the railroad company. A copy of the executed agreement must be within the applicant's possession before entering the railroad company's right of way.

   - Verbal Authorizations will not be permitted or granted. Generally, a minimum of 48 hours' advance notice after execution of an agreement will be required prior to entry.

   - License fees and insurance certificates, if required, must be submitted at the time you execute and return the agreement.

   - Clearance and approval from the railroad company's Fiber Optic Cable Hotline (800) 336-9193.

   - Arrangements must have been made with the railroad company's local manager of track maintenance, as listed in the agreement, for flagging protection (if required).

   - You will be required to obtain Railroad Protective Liability Insurance. This may be purchased from an insurance agent of your choice, or you may be eligible for inclusion in UPRR's Railroad Protective Liability Insurance program.

   - If a Contractor is employed by the Licensee to perform any of the agreed to activities under the Right of Entry Agreement, that Party will need to complete and return the Contractor's Endorsement Form and submit along with a $500 Administrative Fee and a copy of their General Liability Insurance certificate meeting the specified coverages as shown in the License Agreement. A

Railroad Protective Liability Insurance policy must be in procured by the Licensee OR its Contractor.

K. The terms of the railroad company's standard agreements are non-negotiable. Please do not attempt to make any changes to the agreement or request alteration to any of the terms and/or provisions to the agreement.

22.0 BASIS OF PAYMENT

No separate payment will be made for any extra cost incurred on account of compliance with this special provision.

All application or processing fees shall be included in the contractor's unit price for items included in the contract.

Railroad will not be responsible for paying the contractor for any work performed under this special provision.

The unit prices located in the bid form have been completed already. These shall remain as they are and not modified by the bidder.

For Railroad insurance pay items: The pre-filled unit costs for these pay items will be adjusted via change order to the actual costs incurred during the contract work. Proof of the insurance costs shall be given to the Engineer.

For Flagger pay items: The unit costs filled out in the bid form are the final maximum costs for these items of work. The contractor shall work efficiently within the railroad right of way to reduce the costs for flaggers. If applicable, the pre-filled unit costs for these pay items will be adjusted down via change order to the actual costs incurred during the contract work, but will not be adjusted up from the pre-filled unit costs.

Payment will be made as follows:

Item No.	Type	Description
616-99.16	DOLLARS	FLAGGER - BNSF
616-99.16	DOLLARS	FLAGGER - UP
616-99.16	DOLLARS	RAILROAD INSURANCE - BNSF
616-99.16	DOLLARS	RAILROAD INSURANCE - UP

WWW. LIQUIDATED DAMAGES SPECIFIED FOR RAILROAD WIRELINE INSTALLATION

1.0 Description. The contractor shall be aware that the City has acquired License Agreements for the installation of signal conduit and wirelines under the BNSF and UP Railroads. These licenses expire one (1) year following execution of the agreements. The contractor is required to complete all work associated with the installation of conduits under the BNSF and UP Railroads by **January 21, 2019**. This work includes all reviews and approvals by the railroad(s) to be completed by this date as specified by the license agreements provided within the Bid Book.

Addendum #1

If the approved wireline/conduit crossings underneath the railroad is not constructed according to the license agreement prior to the termination of said agreements the City will be damaged through the cost and time to enter into a new license agreement for the completion of this work. Therefore, the contractor will be charged with liquidated damages specified in the amount of **$13,500** if the work is not completed and approved by **January 21, 2019**.

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.

Addendum #1