

173

June 17, 2022 Letting

Notice to Bidders, Specifications and Proposal



**Illinois Department
of Transportation**

**Contract No. 78879
JACKSON-WILLIAMSON Counties
Section D9 TRAFFIC SIGNAL 2021-1
Route FAP 331, FAI 57
District 9 Construction Funds**

Prepared by

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Checked by

(Printed by authority of the State of Illinois)



NOTICE TO BIDDERS

- 1. TIME AND PLACE OF OPENING BIDS.** Electronic bids are to be submitted to the electronic bidding system (iCX-Integrated Contractors Exchange). All bids must be submitted to the iCX system prior to 12:00 p.m. June 17, 2022 prevailing time at which time the bids will be publicly opened from the iCX SecureVault.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 78879
JACKSON-WILLIAMSON Counties
Section D9 TRAFFIC SIGNAL 2021-1
Route FAP 331, FAI 57
District 9 Construction Funds**

Signal modifications and fiber optic installation on IL 13 from Reed Station Road in Carbondale to Fair Street in Marion and on I-57 from IL 13 to the DMS sign approximately 3 miles north.

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.

(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to readvertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Omer Osman,
Secretary

FAP ROUTE 331/ FAI ROUTE 57 (IL 13/ I-57)
SECTION D9 TRAFFIC SIGNAL 2021-1
JACKSON AND WILLIAMSON COUNTIES
CONTRACT NO. 78879

INDEX
FOR
SUPPLEMENTAL SPECIFICATIONS
AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2022

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used RECURRING SPECIAL PROVISIONS.

No ERRATA this year.

SUPPLEMENTAL SPECIFICATIONS

Std. Spec. Sec.

Page No.

No Supplemental Specifications this year.

RECURRING SPECIAL PROVISIONS

The following RECURRING SPECIAL PROVISIONS indicated by an "X" are applicable to this contract and are included by reference:

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FAP ROUTE 331/ FAI ROUTE 57 (IL 13/ I-57)
SECTION D9 TRAFFIC SIGNAL 2021-1
JACKSON AND WILLIAMSON COUNTIES
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STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the “Standard Specifications for Road and Bridge Construction”, Adopted January 1, 2022, the latest edition of the “Manual on Uniform Traffic Control Devices for Streets and Highways”, and the “Manual of Test Procedures for Materials” in effect on the date of invitation for bids, and the “Supplemental Specifications and Recurring Special Provisions” indicated on the Check Sheet included herein, which apply to and govern the construction of FAP Route 331/ FAI Route 57 (IL 13/ I-57), Section D9 TRAFFIC SIGNAL 2021-1, Jackson and Williamson Counties, Contract No. 78879, and in case of conflict with any part, or parts, of said Specifications, the said Special Provisions shall take precedence and shall govern.

FAP Route 331/ FAI Route 57 (IL 13/ I-57)
Section D9 TRAFFIC SIGNAL 2021-1
Jackson and Williamson Counties
Contract No. 78879

LOCATION OF PROJECT

The project is located along Illinois 13 in Carbondale, Carterville, Herrin, and Marion from the Reed Station Road intersection to the Fair Street intersection.

The project also includes I-57 from IL Route 13 to the DMS sign, approx. 3 miles north.

DESCRIPTION OF PROJECT

This project consists of installing conduit and fiber optic cable for the purpose of traffic coordination, remote traffic signal phasing, and timing modification capabilities and to upgrade traffic signal controller equipment to be fiber optic compatible along the Illinois 13 and I-57 corridors.

UTILITIES

Add the following after the first paragraph of Article 105.07 of the Standard Specifications:

Existing utility location information is not shown on the plan sheets. The Contractor shall verify the location of all utilities and privately-owned facilities prior to installation of any components. Verification of locations of underground utilities prior to commencing work on the project will be the responsibility of the Contractor. The following utility companies have facilities within the project limits which may require adjustment:

**Status of JULIE Member Utilities
78879 Place Fiber for Traffic Signals Carbondale to Marion
Jackson & Williamson County**

Name and Address of Utility	Type	Location	Estimated Adjustment Status
Ameren Illinois I.P. 2610 Broadway Mt. Vernon, IL 62864 ATTN: Mike Tatlock Tel: (618) 244-8271 Cell: (618) 367-3338 Email: MTatlock@ameren.com	Electric	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Carterville, City of 103 S. Division St. Carterville, IL. 62918 ATTN: Brad Robinson Tel: (618) 985-2700 Cell: 618.713.5688 Email: brobinson@visitcarterville.com	Water/Sewer	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Clearwave Communications 2 North Vine Street Floor #2 / P.O. Box 808 Harrisburg, IL 62946 ATTN: Roth Clayton Tel: (618) 294-8078 Cell: (618) 841-2600 Email: rclayton@corp.clearwave.com	Fiber	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Crainville Water P.O. Box 105 Carterville, IL 62918 ATTN: Ryan Farrar Tel: (618) 985-3322 Cell: (618) 925-1313 Email: rydfarrar@gmail.com	Water	THROUGHOUT	BEFORE OR DURING CONSTRUCTION

FAP ROUTE 331/ FAI ROUTE 57 (IL 13/ I-57)
SECTION D9 TRAFFIC SIGNAL 2021-1
JACKSON AND WILLIAMSON COUNTIES
CONTRACT NO. 78879

<p>Egyptian Electric Cooperative 10169 Old Hwy. 13 Murphysboro, IL 62966 ATTN: Kendell Bunselmeyer Tel: (618) 684-2143 Cell: (618) 528-6524 Email: kbunselmeyer@eeca.coop</p>	<p>Electric</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION</p>
<p>Extenet 3030 Warrenville Road, Suite 340 Lisle, IL 60532 ATTN: Todd Mueller Tel: (630) 799-6808 Cell: (866) 892-5327 Email: tmueller@extenetsystems.com</p>	<p>Fiber</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION</p>
<p>Ferges Water District 13320 Davidson Rd Marion, IL 62959 ATTN: Twylla Cross Tel: (618) 942-2394 Cell: Email:</p>	<p>Water</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION North on I-57</p>
<p>Frontier Communications 208 West Union St. Marion, IL 62959 ATTN: Rick Shaw Tel: (618) 997-0253 Cell: (618) 997-0257 Email: rick.shaw@ftr.com</p>	<p>Telephone</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION</p>
<p>Futiva 600 South Halfway Rd Suite 104 Marion, Illinois 62959 ATTN: Terry Phillips Tel: (618) 736-1023 Cell: (618) 922-3992 Email: terryp@futiva.biz</p>	<p>Fiber</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION</p>
<p>Herrin, City of 300 N. Park Avenue Herrin, IL 62948 ATTN: Tom Somers Tel: (618) 942-3177 Cell: (618) 364-7529 Email: tsomers@cityofherrin.com</p>	<p>Water/Sewer</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION</p>
<p>Johnston City 100 West Broadway Johnston City, IL. 62951 ATTN: Scott Key Tel: Cell: (618) 889-0473 Email: 2011clerk@gmail.com</p>	<p>Water</p>	<p>THROUGHOUT</p>	<p>BEFORE OR DURING CONSTRUCTION North on I-57</p>

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Marathon Pipeline LLC 410 South A Street Vernon, IL 62892 ATTN: Caleb Comstock Tel: (419) 619-0751 Email: ccomstock@marathonpetroleum.com	High Pressure Pipeline	THROUGHOUT	Call Marathon 1 week prior to crossing high pressure line. Line is on the west side of Marion, west of IL 13 and Williamson Co. Pkwy.
Marion, City of 1102 Tower Square Marion, IL 62959 ATTN: Brent Cain Tel: (618) 922-5363 Cell: Email:	Water/Sewer	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Mediacom 1603 E. DeYoung St. Marion, IL. 62959 ATTN: Craig Thompson Tel: (270) 703-9490 Cell: Email: cthompson@mediacomcc.com	CATV	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Southeastern Illinois Electric Cooperative 100 Cooperative Way Carrier Mills, IL 62917 ATTN: Travis Jones Tel: (618) 273-2611 Ext. 166 Cell: (618) 527-0492 Email: travisjones@seiec.com	Electric	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Windstream 102 E Shafer St Forsyth, IL 62535 ATTN: Jerome Light Tel: Cell: (217) 254-0252 Email: jerome.light@windstream.com	Fiber	THROUGHOUT	BEFORE OR DURING CONSTRUCTION
Zito Media 9401 Old Mayfield Rd. Boaz, Ky 42027 ATTN: Dale Bearden Tel: (270) 445-1014 Email: Dale.Bearden@zitomedia.com	CATV	THROUGHOUT	BEFORE OR DURING CONSTRUCTION North on I-57
Protek Communications 1834 N Court St. Marion, IL 65959 ATTN: Cameron McCurdy Tel: (618) 270-2545 Email: Cameron@protekweb.com	Fiber	THROUGHOUT	BEFORE OR DURING CONSTRUCTION North on I-57

Additional utility information may be obtained by calling the "Joint Utility Location Information for Excavators" phone number, 800-892-0123. This project is located in the Carbondale, Carterville, West Marion, East Marion, and Herrin Precincts.

Add the following after the first paragraph of Article 107.39 of the Standard Specifications:

The Contractor is advised that this project includes areas of highway illumination and/or signalized intersections. These areas have underground cable or conduit throughout which is to remain in service. Before driving any posts or beginning any excavation operations, the Contractor shall locate, uncover by hand, and relocate any wiring which conflicts with the proposed work. Any cable or conduit which is damaged as a result of the Contractor's operations shall be replaced by him or her at their expense. Replacement material and methods shall meet or exceed the original specifications for the wiring. Splicing will not be permitted.

TRAFFIC CONTROL PLAN

During the entire construction period, the road shall be kept open to traffic as follows:

- (a) I-57 shall remain open to two lanes of traffic in each direction at all times. IL 13 shall be kept open to two lanes of traffic in each direction for daytime operations and at least one lane of traffic in each direction for nighttime operations. See Nighttime Lane Closures Special Provision.
- (b) Access to all public roads and private entrances shall be maintained during all stages of the work. If at any time signs are in place but not applicable, they shall be turned from the view of motorists or covered as directed by the Engineer.
- (c) All lanes of I-57 and IL 13 shall be open to traffic during the 2024 solar eclipse from 8:00 am on Saturday, April 6, 2024, to 10:00 pm on Monday, April 8, 2024. No exceptions will be allowed.

NIGHTTIME LANE CLOSURES

The workday will be divided into a 12 hour nighttime period and a 12 hour daytime period defined as follows. The nighttime period shall be from 7:00 pm to 7:00 am, and the daytime period shall be from 7:00 am to 7:00 pm. Multiple lane closures are allowed only during the nighttime period. If due to equipment failure or any other reason the Contractor is not able to open two lanes of IL 13 to traffic by 7:00 am, the Contractor will be charged for traffic control deficiency deduction as per Article 105.03(b) of the Standard Specifications.

COOPERATION BETWEEN CONTRACTORS

Revised 2/10/17

The Contractor is to be aware that traffic control limits of this contract may overlap those of other project(s) that may be under construction along IL 13 concurrently with this work. The Contractor shall coordinate his/her work with the other Contractors to minimize any possible conflicts. The Contractor shall also notify the Engineer five (5) working days in advance of any work that may affect other adjacent contracts.

Adjacent Project, Contract No. 78916 and 78925

SEEDING, MINOR AREAS

Seeding and fertilizing shall be done in accordance with Article 250 of the Standard Specifications, except for the following revisions:

All areas disturbed by the work performed shall be seeded, fertilized, and mulched in accordance with Article 251.03(a) and as directed by the Engineer.

The seed mixture shall be applied at 110 kg/ha (100 pounds/acre). All seeds shall meet the mixture, purity, and noxious weed requirements of Article 1081.04 of the Standard Specifications and be approved by the Engineer.

The fertilizer nutrients shall be applied at a rate of 300 kg/ha (270 pounds/acre). The fertilizer furnished shall be ready mixed material having a ratio of (1-1-1).

The Contractor shall provide the Engineer with the test results from the seed container and the chemical analysis of the fertilizer nutrients.

Basis of Payment: The seed and fertilizer placed at all disturbed areas will not be measured for payment but will be included in the contract bid prices for UNDERGROUND CONDUIT, COILABLE NONMETTALIC CONDUIT.

UNDERGROUND CONDUIT, COILABLE NONMETALLIC CONDUIT

Revised: March 22, 2018

This work shall consist of furnishing and installing a conduit of the type and size specified in accordance with Sections 810 and 1088.01(b) or 1088.01(c) of the Standard Specifications for Road and Bridge Construction, except as described herein.

Coilable Nonmetallic Conduit, Augured:

The term augured shall cover both the pushed and bored method of installing conduit. Because of differences in equipment and techniques, the Contractor may use either method to install the conduit for the term AUGURED.

If subsurface conditions are encountered which prevent conduit from being augured or pushed through an entire conduit run in three (3) sincere attempts, as determined by the Engineer, compensation for the proposed conduit run will be as follows:

1. The Department will delete the contract specified method of payment for the subject conduit run.
2. The Department will pay for the installation of the conduit run and the three unsuccessful attempts to install the conduit run under Article 109.04 of the Standard Specification on a force account basis.
3. The Engineer will determine the method to be utilized to install the conduit run.

Basis of Payment: This work will be paid for at the contract unit price per FOOT for CONDUIT, of the size and type specified, which price shall be payment in full for furnishing and installing the complete conduit run including all fittings.

SIDEWALK REMOVAL AND REPLACEMENT

Required removal and replacement of existing sidewalk due to the placement of conduit and/or communication vaults will not be paid for separately but shall be included in the contract bid price for UNDERGROUND CONDUIT, COILABLE NONMETTALIC CONDUIT, 1 ½" DIA.

The work shall be in accordance with applicable portions of Sections 424 and 440 of the Standard Specifications.

MODIFY EXISTING CONTROLLER CABINET

This work shall consist of the modification of the existing traffic signal cabinets at the locations shown in the plans. The work shall be in accordance with applicable portions of Sections 857, 864, and 895 of the Standard Specifications.

Under this pay item, the Contractor shall supply and install a new fiber optic distribution enclosure. The distribution enclosure shall be of adequate capacity to accommodate the number of fibers to be terminated in the cabinet as noted in the plans.

The Contractor shall remove and return to the Department any communications equipment made obsolete by the addition of the new fiber optic network and network equipment. This equipment shall include, but not limited to, cellular modems, existing network switches, serial communications, etc. This work shall be paid for separately under the Remove Existing Traffic Signal Equipment.

In all existing cabinets, the enclosure shall be a wall mount with type LC duplex adapters equal to or exceed for fusion splicing of individual pigtails. The pigtails shall be mounted on 12 port panels using type LC optical connectors unless otherwise approved by the Engineer. The new fiber optic distribution enclosure shall be equal to or exceed Corning Single Panel Housing (SPH) Pigtailed 12 F, LC Duplex, Single Mode (OS2), Single fiber, 250-micron meter, Multilink,

Inc, or approved equivalent. All the mounting hardware and cable management (spool for slack storage, adapter plate plugs, documentation labels, etc.) shall be incidental to the modify existing controller cabinet pay item.

The Contractor shall use type LC duplex adapters only, unless otherwise specified in the Plans or as directed by the Engineer. The optical connectors shall comply with the following:

- All connectors shall be factory installed LC compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- Terminated fibers as shown on the plans shall be connectorized at each end as directed by the Engineer. Unterminated fibers shall be capped and coiled neatly in the splice tray.
- Applicable fiber strands, as shown on the plans, shall be terminated at a fiber patch panel. The Contractor shall coordinate with the Engineer before any fibers are connected to IDOT network equipment. No additional terminations or splicing shall be done by the Contractor without direction from IDOT.
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- All connectors shall comply with the TIA/EIA -568-A and TIA/EIA-604 standards, as applicable, and are tested according to the Telcordia/Belcore GR326-CORE standard.
- When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)- 171 (TIA/EIA-455-171), ensure that the connectors test to an average insertion loss of less than or equal to 0.4 dB.

Pre-terminated Connector Assemblies (Pigtails): Pre-terminated cable assemblies shall consist of 12-strand fiber optic cable with factory-installed and tested connectors on one end of the cable and unterminated optical fiber on the other. Each strand of the pre-terminated cable assembly shall not exceed a maximum attenuation 0.4dB. The pre-terminated cable assembly shall be fusion spliced to the connector panel within the fiber optic distribution enclosure. All buffer tubes and fibers shall be appropriately protected once the attachment of pre-terminated connector assemblies is complete. In addition, the pigtails shall comply with the following:

- The pigtails shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the pigtail shall meet or exceed the requirements for approved connectors specified herein. The fiber portion of each pigtail shall have optical properties identical to the optical cable furnished under the contract.

Buffer Tube Fan-Out Kits: A buffer tube fan-out kit can be installed when fiber optic cables are terminated if approved by the Engineer. The kit shall be compatible with the fiber optic cable being terminated and shall be color-coded to match the optical fiber color scheme. The buffer tube fan-out kit shall support 12 fiber strands and the output tubing, and the fiber strands contained therein shall be of sufficient length for routing and attachment of fiber optic cable to connected electronics or as directed by the Engineer. The kit and the connectors shall be supplied by the same manufacturer.

All panels shall be furnished with splice trays, heat shrinks, strain relief, mounting hardware, and any miscellaneous hardware required to facilitate the lateral cable termination at the controller cabinet.

Construction Requirements.

The Contractor shall install the fiber optic distribution enclosure along with associated hardware, including any ancillary material items as shown on the plans and as directed by the Engineer. All cables shall be neatly dressed, labeled, and fastened to the corresponding equipment with the appropriate hardware. Tie wraps are not permitted. Hook and loop bundling straps shall be used for cable management. In addition, the Contractor shall also supply and install the necessary material to properly ground and bond the equipment in accordance with the NEC, telecommunications industry standards (ANSI/TIA/BICSI/IEEE) and manufacturers requirements.

Prior to inspection, testing, and connecting fiber optic jumpers or patch cables to the bulkheads within the fiber optic distribution enclosure, all LC connectors require proper cleaning using lens grade and lint free tissues and a 98% isopropyl alcohol cleaning solution unless another method and material is approved by the Engineer. Rubbing alcohol and medical wipes shall not be used and are not appropriate, as both may contain oil or water and of which both leave residue. The Contractor shall wipe each connector twice with a moistened and dry tissue area, and failure to wipe the connector immediately with the dry tissue area will result in needing to redo the entire process.

Testing

The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and un-terminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an optical time domain reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

Fibers which are not to be terminated shall be tested with a temporary fusion spliced pigtail fiber. **Mechanical splice or bare fiber adapters are not acceptable.**

The Contractor shall provide the date, time, and location of any tests required by this specification to the Engineer at least 5 working (7 calendar) days before performing the test. Included with the notification shall be a record drawing of the installed fiber optic cable system. The drawings shall indicate actual installed routing of the cable, the locations of splices, and locations of cable slack with slack quantities identified.

Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A certified technician utilizing an optical time domain reflectometer (OTDR) and optical source/power meter shall conduct the installation test. The test equipment used shall have been calibrated within the year. Documentation shall be provided. The technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box, commonly known as a launch kit, shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers, bi-directionally.

All test results shall be provided on or the day following the test date. A copy of the test results on a CD ROM shall be submitted.

At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Project Engineer. The test documentation shall be submitted as (3) three CD ROM copies and shall include the following:

Cable & Fiber Identification:

• Cable ID	• Operator Name
• Fiber ID, including tube and fiber color	• Date & Time
• Pulse width (OTDR)	• Setup Parameters
• Cable Location -beginning and end point	• Range (OTDR)
• Wavelength	• Scale (OTDR)
• Refractory index (OTDR)	• Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR test results-Including the raw test results file and the results in a .pdf format.
- Total Fiber Trace
- Measured Length (Cable Marking)
- Total Length (OTDR)
- Optical Source/Power Meter Total Attenuation (dB/km)
- Splice Loss/Gain
- Events> 0.10 dB
- OTDR Fiber Trace Viewer Software details

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

A copy of the test equipment manufacturer's software to read the test files, OTDR, and power shall be provided to IDOT. These results shall also be provided in tabular form. See sample below:

Sample OTDR Summary					
Cable Designation	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date:	<i>1/1/00</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)	Loss	
			1310 nm	1550 nm	
<i>1</i>	<i>Termination</i>	<i>23500 Ft.</i>	<i>.082</i>	<i>.078</i>	
<i>1</i>	<i>Termination</i>	<i>29000 Ft.</i>	<i>.075</i>	<i>.063</i>	
<i>2</i>	<i>Termination</i>	<i>29000 Ft.</i>	<i>.091</i>	<i>.082</i>	
<i>3</i>	<i>Termination</i>	<i>26000 Ft.</i>	<i>.072</i>	<i>.061</i>	
<i>3</i>	<i>Bend</i>	<i>27000 Ft.</i>	<i>.010</i>	<i>.009</i>	

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.4 dB/km at 1310 nm and 0.5 dB/km at 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to IDOT, both labor and materials.

Basis of Payment. This work shall be paid for at the contract unit cost per EACH for MODIFY EXISTING CONTROLLER CABINET and shall include all labor and materials necessary for the complete installation and operation of the distribution enclosures and star couplers as described herein, and no additional compensation will be allowed.

MODIFY EXISTING CONTROLLER CABINET TYPE A

This work shall consist of the modification of the existing DMS controller cabinet at the locations shown in the plans. The work shall be in accordance with applicable portions of Sections 857, 864, and 895 of the Standard Specifications.

Under this pay item the contractor shall furnish and install a new fiber optic distribution enclosure, install an ethernet switch (paid under a different pay item), and install a matching SFP at the layer III switch at the traffic signal cabinet at I-57 and IL-13 (paid under a different pay item) and remove and return to IDOT the Sierra Wireless Cellular modem, existing IE-3000 switch and multimode Antaira unmanaged fiber optic switch, and any supporting components including power supplies and antennas.

The SFP's for the DMS shall be equal to or exceed Cisco GLC-LH-SMD=

Contractor shall supply all necessary duplex LC fiber patch cords and cat 6 ethernet jumpers as necessary to connect equipment to the new fiber optic network.

The distribution enclosure shall be a wall mount with type LC duplex adapters equal to or exceed for fusion splicing of individual pigtailed. The pigtailed shall be mounted on 12 port panels using type LC optical connectors unless otherwise approved by the Engineer. The new fiber optic distribution enclosure shall be equal to or exceed Corning Single Panel Housing (SPH) Pigtailed 12 F, LC Duplex, Single Mode (OS2), Single fiber, 250-micron meter, Multilink, Inc, or an approved equivalent. All the mounting hardware and cable management (spool for slack storage, adapter plate plugs, documentation labels, etc.) shall be incidental to the modify existing controller cabinet pay item.

The Contractor shall use type LC duplex adapters only unless otherwise specified in the plans or as directed by the Engineer. The optical connectors shall comply with the following:

- All connectors shall be factory installed LC compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- Terminated fibers as shown on the plans shall be connectorized at each end as directed by the Engineer. Unterminated fibers shall be capped and coiled neatly in the splice tray.
- Applicable fiber strands, as shown on the plans, shall be terminated at a fiber patch panel. The Contractor shall coordinate with the Engineer before any fibers are connected to IDOT network equipment. No additional terminations or splicing shall be done by the Contractor without direction from IDOT.
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- All connectors shall comply with the TIA/EIA -568-A and TIA/EIA-604 standards, as applicable, and are tested according to the Telcordia/Bellcore GR326-CORE standard.
- When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)- 171 (TIA/EIA-455-171), ensure that the connectors test to an average insertion loss of less than or equal to 0.4 dB.

Pre-terminated Connector Assemblies (Pigtails): Pre-terminated cable assemblies shall consist of 12-strand fiber optic cable with factory-installed and tested connectors on one end of the cable and unterminated optical fiber on the other. Each strand of the pre-terminated cable assembly shall not exceed a maximum attenuation 0.4dB. The pre-terminated cable assembly shall be fusion spliced to the connector panel within the fiber optic distribution enclosure. All buffer tubes and fibers shall be appropriately protected once the attachment of pre-terminated connector assemblies is complete. In addition, the pigtailed shall comply with the following:

- The pigtailed shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the pigtail shall meet or exceed the requirements for approved connectors specified herein. The fiber portion of each

pigtail shall have optical properties identical to the optical cable furnished under the contract.

Buffer Tube Fan-Out Kits: A buffer tube fan-out kit can be installed when fiber optic cables are terminated if approved by the Engineer. The kit shall be compatible with the fiber optic cable being terminated and shall be color-coded to match the optical fiber color scheme. The buffer tube fan-out kit shall support 12 fiber strands and the output tubing, and the fiber strands contained therein shall be of sufficient length for routing and attachment of fiber optic cable to connected electronics or as directed by the Engineer. The kit and the connectors shall be supplied by the same manufacturer.

All panels shall be furnished with splice trays, heat shrinks, strain relief, mounting hardware, and any miscellaneous hardware required to facilitate the lateral cable termination at the controller cabinet.

Construction Requirements.

The Contractor shall install the fiber optic distribution enclosure along with associated hardware including any ancillary material items as shown on the plans and as directed by the Engineer. All cables shall be neatly dressed, labeled, and fastened to the corresponding equipment with the appropriate hardware. Tie wraps are not permitted. Hook and loop bundling straps shall be used for cable management. In addition, the Contractor shall also supply and install the necessary material to properly ground and bond the equipment in accordance with the NEC telecommunications industry standards (ANSI/TIA/BICSI/IEEE) and manufacturer requirements.

Prior to inspection, testing, and connecting fiber optic jumpers or patch cables to the bulkheads within the fiber optic distribution enclosure, all LC connectors require proper cleaning using lens grade and lint free tissues and a 98% isopropyl alcohol cleaning solution unless another method and material is approved by the Engineer. Rubbing alcohol and medical wipes shall not be used and are not appropriate, as both may contain oil or water and of which both leave residue. The Contractor shall wipe each connector twice with a moistened and dry tissue area, and failure to wipe the connector immediately with the dry tissue area will result in needing to redo the entire process.

Testing

The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and un-terminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an optical time domain reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

Fibers which are not to be terminated shall be tested with a temporary fusion spliced pigtail fiber.
Mechanical splice or bare fiber adapters are not acceptable.

The Contractor shall provide the date, time, and location of any tests required by this specification to the Engineer at least 5 working (7 calendar) days before performing the test. Included with the notification shall be a record drawing of the installed fiber optic cable system. The drawings shall

indicate actual installed routing of the cable, the locations of splices, and locations of cable slack with slack quantities identified.

Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A certified technician utilizing an optical time domain reflectometer (OTDR) and optical source/power meter shall conduct the installation test. The test equipment used shall have been calibrated within the year. Documentation shall be provided. The technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box, commonly known as a launch kit, shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers, bi-directionally.

All test results shall be provided on or the day following the test date. A copy of the test results on a CD ROM shall be submitted.

At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Project Engineer. The test documentation shall be submitted as (3) three CD ROM copies and shall include the following:

Cable & Fiber Identification:

• Cable ID	• Operator name
• Fiber ID, including tube and fiber color	• Date & time
• Pulse width (OTDR)	• Setup parameters
• Cable location -beginning and end point	• Range (OTDR)
• Wavelength	• Scale (OTDR)
• Refractory index (OTDR)	• Setup option chosen to pass OTDR "dead zone"

Test results shall include:

- OTDR test results-including the raw test results file and the results in a .pdf format.
- Total fiber trace
- Measured length (cable marking)
- Total length (OTDR)
- Optical source/power meter total attenuation (dB/km)
- Splice loss/gain
- Events > 0.10 dB
- OTDR fiber trace viewer software details

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

A copy of the test equipment manufacturer's software to read the test files, OTDR, and power shall be provided to IDOT. These results shall also be provided in tabular form. See sample below:

Sample OTDR Summary					
Cable Designation	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date:	<i>1/1/00</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)	1310 nm	1550 nm
<i>1</i>	<i>Termination</i>	<i>23500 Ft.</i>	<i>.082</i>	<i>.078</i>	
<i>1</i>	<i>Termination</i>	<i>29000 Ft.</i>	<i>.075</i>	<i>.063</i>	
<i>2</i>	<i>Termination</i>	<i>29000 Ft.</i>	<i>.091</i>	<i>.082</i>	
<i>3</i>	<i>Termination</i>	<i>26000 Ft.</i>	<i>.072</i>	<i>.061</i>	
<i>3</i>	<i>Bend</i>	<i>27000 Ft.</i>	<i>.010</i>	<i>.009</i>	

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.4 dB/km at 1310 nm and 0.5 dB/km at 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to IDOT, both labor and materials.

Basis of Payment. This work shall be paid for at the contract unit cost per EACH for MODIFY EXISTING CONTROLLER CABINET TYPE A and shall include all labor and materials necessary for the complete installation and operation of the DMS site and as described herein.

MODIFY EXISTING CONTROLLER CABINET, NETWORK COMMUNICATIONS

The purpose of this special provision is to describe the work necessary to modify key traffic signal locations to provide network communications back to District 9 HQ. This work shall consist of the modification of the existing traffic signal controller cabinets at Reed Station, I-57, and IL-37 Court St. as shown in the plans. The work shall be in accordance with applicable portions of Sections 857, 864, and 895 of the Standard Specifications.

The Contractor shall modify the existing controller cabinets to facilitate the installation of network communications between layer III network switches and existing traffic signal cabinets along IL-13 and IL-37 to IDOT District 9 HQ. The contractor shall terminate the backbone fiber in the traffic signal cabinets as shown on the plans and install layer III network switches at Reed Station, I-57, and IL-37 Court St cabinets. Work shall include, but not be limited to, drilling existing foundations, installing and terminating SM fiber optic cable, testing fiber and fiber terminations, mounting fiber optic patch panels, installing layer III network switches, configuring network equipment, and salvaging/returning to IDOT cell modems, switches, and other miscellaneous communications equipment no longer in use to transmit and receive data over the fiber optic network.

The following pay items shall be used to facilitate the work.

1. Drilling existing foundation shall be paid for separately.
 2. Layer III network switches shall be paid for separately.
 3. Fiber optic cable 12, 48, and 144 fibers SM shall be paid for separately.
 4. Fiber optic patch panels 144 port rack mount and 48 port rack mounts shall be paid for separately.
 5. Fiber distribution panels at Reed Station shall be paid for separately as modify existing controller cabinet.
 6. All fiber optic splicing shall be paid for separately.
 7. Removal of existing equipment at the modified traffic signal cabinets shall be paid for separately.
- Reed Station
 - Contractor shall install and terminate three (3) 12 SM fiber laterals and terminate it in the cabinet. They shall perform the splice as shown in the Proposed Reed Station Splice Detail.
 - Contractor shall remove existing Moxa fiber optic switch and return to the Department.
 - Contractor shall install and configure layer III network switch.
 - I-57 Traffic Signal cabinet
 - Contractor shall terminate 144 SM fibers from West.
 - Contractor shall terminate 144 SM fibers from East
 - Contractor shall terminate 144 SM fibers North to DMS on I-57
 - Contractor shall remove existing communications equipment and return to the Department.
 - Contractor shall install and configure Layer III network switch.
 - IL-37 Court St

- Contractor shall terminate 144 SM fibers from the West
- Contractor shall terminate 144 SM fibers to the East
- Contractor shall remove existing communications equipment and return to the Department.
- Contractor shall install and configure Layer III network switch.

Contractor shall supply all necessary duplex LC fiber patch cords and cat 6 ethernet jumpers as necessary to connect re-configured equipment to the new fiber optic network.

The Contractor shall not be entitled to any extra compensation. The above-described work shall be paid for through the listed contract pay items.

FULL ACTUATED CONTROLLER AND TYPE V CABINET

The work shall be in accordance with applicable portions of Sections 857 and 864 of the Standard Specifications, except as revised by this special provision.

The installation of the cabinets shall include removing the existing UPS battery cabinet, service meter, disconnect switch, and disconnecting the UPS and reinstalling them on/in the new cabinet. The relocation work shall be paid for under the RELOCATE EXISTING TRAFFIC SIGNAL EQUIPMENT pay item.

A traffic actuated solid state digital controller shall comply with the requirements of NEMA Standards for Traffic Control Systems, TS2-2016. This unit shall be capable of being used as a master or local controller. One possible start up mode shall be an all red display for a minimum of 15 seconds.

The controller(s) supplied shall be the Siemens M60 Series or an approved equal for integration into the existing District 9 Eagle Signal system and shall be fully compatible with the District's Tactics software.

The controller shall be capable of telemetry for controller to controller and controller to computer system or solo operation data transfer. Through telemetry, the system or solo operation shall be capable of being monitored on an IBM AT or compatible personal computer. Typically, the controller shall be completely uploaded or downloaded through telemetry either from a remote location or side by side from the computer. The latest computer software shall be provided, so data, including all timing parameters, can be transferred. The controller will use non-volatile EEPROM memory. All harnesses shall be furnished, if different than provided previously, for the controller to controller and controller to computer data transfer. The controller shall contain all normal connectors and any special connectors required for data transfer. The controller's "D" connector termination panel and all other connectors shall be completely terminated, even if not required in this application. The twisted shielded field cables should remain shielded to within 1" of the cabinet terminals.

A slide out shelf shall be provided below the standard shelf and above the back panel terminal board. The pull-out shelf should be mounted as far left as possible. The cabinet shall be equipped with an IP addressable power strip. A standard TS-2 detector card rack shall be provided. The cabinet shall have a thermostat controller heater.

During conflict monitor flash, a means shall be provided to restart the controller at the beginning of startup, just as if the power had been removed, and reset the monitor with a momentary pulse. The signal to restart/reset shall be delivered by telemetry and/or a momentary switch, labeled RESET, located in the police door. The pulse shall only be functional while the signals are in a monitor flash mode. Jumpers shall be installed in the unused load switch sockets to prevent false red fail reports. Hardwiring of this feature on the back panel will not be permitted. The cabinet series/parallel surge protector shall be the plug in type. The controller cabinet shall be a TS-2, Type 1 equipped with a 16 load switch, load bay using a conflict monitor capable of operating with 16 or 12 channels.

The conflict monitor shall be a malfunction management unit meeting NEMA TS2-2016 standards and capable of supporting Flashing Yellow Arrow (FYA) operation, and it shall also be equipped with IP addressable network capability. The conflict monitor shall be capable of providing modes in both TS-2 and TS-1 cabinet configurations. The conflict monitor shall provide error sensing of two +24Vdc cabinet supplies and the controller power supplies via +24V MONITOR I, +24V MONITOR II, and Controller Voltage Monitor (CVM) inputs respectively. The conflict monitor shall use a programmable alpha-numeric liquid crystal display (LCD) to show monitor status and two icon based LCDs to show field signal channel and fault status.

Communication. Controller shall be designed to communicate in two formats. Controller shall communicate in NTCIP format in full compliance with standard NTCIP 1201. Controller shall communicate in the format of the legacy controllers of the District's Siemens traffic signal controller models: M01, M10, M30, M40, and M50. The communication format may be altered by installation of an alternate firmware version. Both firmware versions shall reside on the controller hardware at the same time, be fully licensed, and available for use.

Controller shall have the following communication ports at a minimum:

- USB
- (1)RJ-45
- 25 pin RJ-232 ports for serial communication
- Flat format 37 pin D-Connector with FSK modem

The USB port shall offer the following capabilities to a standard USB storage device that can be purchased at any big box store. The number of files eligible for access to the thumbdrive shall be limited by the storage size of the USB storage device.

- Save data from/load data to controller
- Update controller firmware

Controller shall be capable of communicating to the central office software over the following mediums: IP, FSK over copper, phone modem, and serial over fiber. Controller shall be capable of communication in a closed-loop system with an existing master controller.

Interface. Controller display screen shall be in a menu format with a minimum of 16 lines of display. The interface shall be capable of displaying at least two active status screens from the menu of active status screen choices. Controller shall offer at least five favorites keys which store a display for easy access.

General Capabilities. Controller shall support the following functions:

- 4 rings and 16 phases

- Dynamic max timers
- 4 phase banks - an alternate set of phase data selectable by time of day command
- 8 overlaps in formats: Standard, Flashing Yellow Arrow (FYA), Timed, and Pedestrian
- Detector diagnostics – 3 measurements, 2 levels activated by time of day
- FYA Support for any NEMA cabinet manufacturer format
- 64 vehicle detectors
- 8 special detectors
- 8 pedestrian detectors
- 6 pre-empt detectors

The cabinet shall include a new fiber optic distribution enclosure. The distribution enclosure shall be of adequate capacity to accommodate the number of fibers to be terminated in the cabinet as noted in the plans.

The enclosure shall be a wall mount with type LC duplex adapters for fusion splicing of individual pigtails. The pigtails shall be mounted on minimum 6 port panel using type LC optical connectors, unless otherwise approved by the Engineer. The new fiber optic distribution enclosure shall be Multilink, Inc. or an approved equivalent. All of the mounting hardware and cable management (spool for slack storage, adapter plate plugs, documentation labels, etc.) shall be incidental.

The Contractor shall use type LC duplex adapters only, unless otherwise specified in the plans or as directed by the Engineer. The optical connectors shall comply with the following:

- All connectors shall be factory installed LC compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- Terminated fibers as shown on the plans shall be connectorized at each end as directed by the Engineer. Unterminated fibers shall be capped and coiled neatly in the splice tray.
- Applicable fiber strands, as shown on the plans, shall be terminated at a fiber patch panel. The Contractor shall coordinate with the Engineer before any fibers are connected to IDOT network equipment. No additional terminations or splicing shall be done by the Contractor without direction from IDOT.
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- All connectors shall comply with the TIA/EIA -568-A and TIA/EIA-604 standards, as applicable, and are tested according to the Telcordia/Bellcore GR326-CORE standard.
- When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)- 171 (TIA/EIA-455-171), ensure that the connectors test to an average insertion loss of less than or equal to 0.4 dB.

Pre-terminated Connector Assemblies (Pigtails): Pre-terminated cable assemblies shall consist of 12-strand fiber optic cable with factory-installed and tested connectors on one end of the cable and unterminated optical fiber on the other. Each strand of the pre-terminated cable assembly shall not exceed a maximum attenuation 0.4dB. The pre-terminated cable assembly shall be fusion spliced to the connector panel within the fiber optic distribution enclosure. All buffer tubes and fibers shall be appropriately protected once the attachment of pre-terminated connector assemblies is complete. In addition, the pigtails shall comply with the following:

- The pigtails shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the pigtail shall meet or exceed the requirements for approved connectors specified herein. The fiber portion of each pigtail shall have optical properties identical to the optical cable furnished under the contract.

Buffer Tube Fan-Out Kits: A buffer tube fan-out kit can be installed when fiber optic cables are terminated if approved by the Engineer. The kit shall be compatible with the fiber optic cable being terminated and shall be color-coded to match the optical fiber color scheme. The buffer tube fanout kit shall support 12 fiber strands, and the output tubing and the fiber strands contained therein shall be of sufficient length for routing and attachment of fiber optic cable to connected electronics or as directed by the Engineer. The kit and the connectors shall be supplied by the same manufacturer.

The controller shall be provided with an RS232 Port 3 as well as an RS232 Port 2. Connections on the "D" panel, Aux. one output should be connected to red rest. Aux. three should be connected to the special status 3 inputs. Special status 1 shall be connected to report if the cabinet door is open. A door open switch shall be provided. The controller's "D" connector termination panel shall be provided and fully connected to provide information to the controller of manual or monitor flash status. A slide out shelf shall be provided below the standard shelf and above the back panel terminal board. The pullout shelf should be mounted as far left as possible.

During conflict monitor flash, a means shall be provided to restart the controller at the beginning of startup, just as if the power had been removed, and reset the monitor with a momentary pulse. The signal to restart/reset shall be delivered by telemetry and/or a momentary switch, labeled RESET, located in the police door. The pulse shall only be functional while the signals are in a monitor flash mode. Jumpers shall be installed in the unused load switch sockets to prevent false red fail reports. Hardwiring of this feature on the back panel will not be permitted. The cabinet series/parallel surge protector shall be the plugin type. The controller cabinet shall be equipped with a 16 load switch bay using a 12 channel conflict monitor. The phasing for the new cabinet shall be as shown in the plans.

The traffic signal controller will not be approved for installation until the requirements of Articles 801.10(b) and 801.07 are satisfied. The Contractor shall prepare traffic signal materials at a suitable location meeting the approval of the Engineer. The cabinet shall be tested and approved by IDOT personnel at the Contractor's shop before moving it to the jobsite.

Basis of Payment. This work will be paid for at the contract unit price per EACH for FULL-ACTUATED CONTROLLER AND TYPE V CABINET, which price shall be payment in full for furnishing and installing the controller complete with the necessary connections for proper operation.

FULL ACTUATED CONTROLLER IN EXISTING CABINET

The work shall be in accordance with applicable portions of Sections 857 and 864 of the Standard Specifications, except as revised by this special provision.

A traffic actuated solid state digital controller shall comply with the requirements of NEMA Standards for Traffic Control Systems, TS1-1983, Sections 1, 2, 13, and 14. This unit shall be capable being used as a master or local controller. One possible start up mode shall be an all red display for a minimum of 15 seconds.

The controller shall be capable of telemetry for controller to controller and controller to computer system or solo operation data transfer. Through telemetry, the system or solo operation shall be capable of being monitored on an IBM AT or compatible personal computer. Typically, the controller shall be completely uploaded or downloaded through telemetry either from a remote location or side by side from the computer. The latest computer software shall be provided, so data, including all timing parameters, can be transferred. The controller will use non-volatile EEPROM memory. All harnesses shall be furnished, if different than provided previously, for the controller to controller and controller to computer data transfer. The controller shall contain all normal connectors and any special connectors required for data transfer. The controller shall contain all normal connectors and any special connectors required for data transfer utilizing the new fiber optic communication being install as part of this project.

The controller(s) supplied shall be the Siemens M60 Series or an approved equal for integration into the existing District 9 Eagle Signal system and shall be fully compatible with the District's Tactics software.

Cabinet Capability. Controller shall be designed to be relocated into a traffic signal cabinet formatted NEMA TS-1, NEMA TS-2 Type 1, or NEMA TS-2 Type 2 controller.

Communication. Controller shall be designed to communicate in two formats. Controller shall communicate in NTCIP format in full compliance with standard NTCIP 1201. Controller shall communicate in the format of the legacy controllers of the District's Siemens traffic signal controller models: M01, M10, M30, M40, and M50. The communication format may be altered by installation of an alternate firmware version. Both firmware versions shall reside on the controller hardware at the same time, be fully licensed, and available for use.

Controller shall have the following communication ports at a minimum:

- USB
- (1)RJ-45
- 25 pin RJ-232 ports for serial communication
- Flat format 37 pin D-connector with FSK modem

The USB port shall offer the following capabilities to a standard USB storage device that can be purchased at any big box store. The number of files eligible for access to the thumbdrive shall be limited by the storage size of the USB storage device.

- Save data from/ load data to controller
- Update controller firmware

Controller shall be capable of communicating to the central office software over the following mediums: IP, FSK over copper, phone modem, and serial over fiber. Controller shall be capable of communication in a closed-loop system with an existing master controller.

Interface. Controller display screen shall be in a menu format with a minimum of 16 lines of display. The interface shall be capable of displaying at least two active status screens from the menu of active status screen choices. Controller shall offer at least five favorites keys which store a display for easy access.

General Capabilities. Controller shall support the following functions:

- 4 rings and 16 phases
- Dynamic max timers
- 4 phase banks - an alternate set of phase data selectable by time of day command
- 8 overlaps in formats: Standard, Flashing Yellow Arrow (FYA), Timed, and Pedestrian
- Detector diagnostics – 3 measurements, 2 levels activated by time of day
- FYA support for any NEMA cabinet manufacturer format
- 64 vehicle detectors
- 8 special detectors
- 8 pedestrian detectors
- 6 pre-empt detectors

Basis of Payment. This work will be paid for at the contract unit price per EACH for FULL-ACTUATED CONTROLLER IN EXISTING CABINET of the type specified, which price shall be payment in full for furnishing and installing the controller complete with the necessary connections for proper operation.

UNINTERRUPTABLE POWER SUPPLY EXTENDED

This work shall consist of furnishing and installing an uninterruptable power supply, hereinafter referred to as the "UPS", in the local controller cabinet.

The UPS shall be capable of keeping the signals running green, yellow, and red during periods of utility power failure. The UPS shall meet the following requirements:

1. Maintain power for a minimum of 60 minutes upon power failure.
2. Electrical inputs:
 - a. AC Input Voltage: 85-140 Volts
 - b. AC Input Current: 15 Amps Max
 - c. Frequency: 60 +/- 0.5Hz
3. Electrical outputs:
 - a. Output Voltage: 120 VAC +/- 3%
 - b. Output Current: 1000W: 8.3A / 1500W: 12.5A
 - c. Output Wave Form: Pure Sinewave
4. The batteries shall be kept charged by a balanced charging system.
5. A bypass transfer switch shall be provided.
6. The UPS shall use nickel-zinc battery technology.
7. The UPS shall have network capability.

Basis of Payment. This work will be paid for at the contract unit price per EACH for UNINTERRUPTABLE POWER SUPPLY, EXTENDED, which price shall be payment in full for furnishing and installing the UPS complete with necessary connections for proper operation at the local controller intersection.

SERVICE INSTALLATION (TRAFFIC SIGNALS)

Revise Section 805 of the Standard Specifications to read:

Description.

This work shall consist of all materials and labor required to install, modify, or extend the electric service installation.

General.

The electric service installation shall be the electric service disconnecting means, and it shall be identified as suitable for use as service equipment.

The Contractor must request in writing for service and/or service modification within 10 days of contract award and must follow-up with the electric utility to assure all necessary documents and payment are received by the utility. The Contractor shall forward copies of all correspondence between the Contractor and utility company to the Engineer and Owner. The service agreement and sketch shall be submitted for signature to the Owner.

Materials.

- a. General. The completed control panel shall be constructed in accordance with UL Std. 508A, Industrial Control Panel, and carry the UL label. Wire terminations shall be UL listed.
- b. Enclosures.
 1. Ground Mounted Cabinet. The cabinet shall be UL 50, NEMA Type 3R unfinished with a customer & utility section with lockable hasp design. The cabinet shall be constructed from raw uncoated aluminum. Seams shall be continuous welded and ground smooth. Hinges shall be stainless steel and piano type. The cabinet shall be 16" wide. The cabinet shall be bolted with stainless steel hardware to mounting base secured in concrete pad as indicated on the plans. The foundation is paid for separately.
- c. Electric Utility Meter Housing. The electric meter housing and meter socket shall be supplied and installed by the Contractor. The Contractor is to coordinate the work to be performed and the materials required with the utility company to make the final connection at the power source. Electric utility required risers, weather/service head, and any other materials necessary for connection shall also be included in the pay item. Materials shall be in accordance with the electric utility's requirements. For ground-mounted service, the electric utility meter shall be exposed. The meter shall be supplied by the utility company. Metered service shall not be used unless specified in the plans.
- d. Surge Protector. SPD installed on load side of main breaker, Hubbell Part HBLSDSA36 -- 36KA single phase with LED indicator, or approved equal.

- e. Circuit Breakers. Circuit breakers shall be standard UL listed molded case, thermal-magnetic bolt-on type circuit breakers with trip free indicating handles. Must include lug to lug connections. Circuit breakers need to be 480 V rated Cutler EHD series or approved equal. Unless otherwise indicated, the main disconnect circuit breaker shall be rated 100 amperes, 120 V-240V single phase 3 wire. The auxiliary circuit breakers shall be rated 30 amp-2pole, 120 V-240V for signals and 20 amp-2 pole, 120V-240V for lighting.
- f. GFCI Receptacle. A 20 Amp GFCI shall be mounted to dead front.
- g. Lighting Circuit. If lighting circuits are present in power supply, a photocell and a hand off auto (HOA) will be required. Photocell to be mounted internally with a window and external shield. A contactor 30A-2 pole electrically held (120V coil) is needed for each lighting circuit. Contactor shall be square D 8903LO20V02 or approved equal.
- h. Ground and Neutral Bus Bars. A single copper ground and neutral bus bar mounted on the equipment panel shall be provided.
- i. Utility Services Connection. The Contractor shall notify the utility company marketing representative a minimum of 30 working days prior to the anticipated date of hook-up. This 30-day advance notification will begin only after the utility company marketing representative has received service charge payments from the Contractor. Prior to contacting the utility company marketing representative for service connection, the service installation controller cabinet and cable must be installed for inspection by the utility company.
- j. Ground Rod. Ground rods shall be copper-clad steel, a minimum of 10 feet (3.0m) in length, and 3/4 inch (20mm) in diameter. Ground rod resistance measurements to ground shall be 10 ohms or less. If necessary, additional rods shall be installed to meet resistance requirements at no additional cost to the contract.

Installation.

- a. General. The Contractor shall confirm the orientation of the traffic service installation and its door side with the Engineer prior to installation. All conduit entrances into the service installation shall be sealed with a pliable waterproof material.
- b. Ground Mounted. The service installation shall be mounted plumb and level on the foundation. The space between the bottom of the enclosure and the top of the foundation shall be caulked at the base with silicone.

Basis of Payment.

The service installation shall be paid for at the contract unit price per EACH for SERVICE INSTALLATION of the type specified, which shall be payment in full for furnishing and installing the service installation complete. The concrete foundation shall be paid for at the contract unit price per CUBIC YARDS for CONCRETE FOUNDATION, GROUND MOUNT, which includes the ground rod. Any charges by the utility companies shall be approved by the Engineer and paid for as an addition to the contract according to Article 109.05 of the Standard Specifications.

VIDEO VEHICLE DETECTION SYSTEM

Description:

This work shall include installation of vehicle detection system that detects vehicles on a roadway using a multi-sensor detection system. This work shall consist of furnishing and installing video cameras, cables, video processors, a controller interface unit, and a remote communication module to operate the video vehicle detection system.

The multi-sensor system shall utilize two different sensors of different technologies, video imaging and radar, to detect and track licensed and unlicensed vehicles at distances over 500 feet (152 meters). The sensor system shall fuse vehicle information from the two sensors to provide highly accurate and precise detection for simultaneous stop bar presence detection, advanced detection, and special or advanced applications.

Detection Performance:

The system shall use video imaging for stop bar detection and radar for advanced detection up to 500 ft. Advanced detection will only be required on the IL 13 approaches. The system features shall include vehicle volumes (including turning movements) on all four approaches and advanced detection on IL 13, as well as speed and dilemma zone detection on IL 13. The system shall have the capability of detecting and differentiating bicycles. The system shall be able to detect and count pedestrians in the crosswalk.

All video detection systems shall be equipped with the latest software and firmware revision.

Hardware:

The multi-sensor detection system (MSDS) shall consist of two hybrid video camera/radar sensors, two video-only sensors, up to two detection processors (DP) capable of processing from one to two sensors each, one central control unit (CCU), (either 19" rack or shelf-mount form factor), input/output extension modules, video surge suppressors, HDMI monitor and a pointing device, or any combination thereof.

The vehicle detection system shall include all necessary camera risers, electric cable, electrical junction boxes, hardware, software, programming, and any camera brackets that are required for installation and configuration. These items should be taken into consideration and shall be included in the bid price for the video detection system.

The CCU shall be supplied in three separate form factors. Users may choose one form factor for use within their controller cabinet system:

1. Standard One (1) Rack Unit (1U) 19" rack format. There shall be brackets to allow the CCU to be mounted under shelves where a 19" frame is not available.
2. Shelf-Mount format; TS1 version. The CCU shall be able to stand up on available shelf-space within the cabinet. All connections shall be made from the front of the CCU, including connections to separate DPs located within the cabinet.
3. Shelf-Mount format; TS2 version. The CCU shall be able to stand up on available shelf-space within the cabinet. All connections shall be made from the front of the CCU, and no external DPs will be required.

The CCU shall incorporate surge suppression for each sensor input. The CCU shall be appropriately grounded to the cabinet ground rod using 14 AWG (2.5mm²) minimum.

The CCU shall incorporate power surge suppression both on the input power and on the power supplied to the sensors. The CCU shall be appropriately grounded to the cabinet ground rod using 14 AWG (2.5mm²) minimum.

An ethernet communications port shall be provided on the front panel. The ethernet port shall be compliant with IEEE 802.3 and shall use a RJ-45 type connector mounted on the front panel of the CCU. The ethernet communications interface shall allow the user to remotely configure the system and/or to extract calculated vehicle/roadway information. The interface protocol shall be documented or interface software shall be provided. Each MSDS shall have the capability to be IP addressable. The DP shall support data rates of up to 100 Mbps.

The CCU shall provide a Wi-Fi connection. The connection shall be over a standard 2.4GHz connection. The Wi-Fi connection shall be enabled and disabled by a switch on the CCU. The CCU shall provide an indicator when the Wi-Fi connection is active.

Software:

The system shall include software that discriminately detects the presence of individual vehicles and bicycles in a single or multiple lanes using only the video image. Detection zones shall be defined using only an embedded software application. A monitor, a keyboard, and a pointing device are used to place the zones on a video image. A minimum of 32 video detection zones and 16 radar detection zones plus 5 trip lines per sensor shall be available.

A separate computer shall not be required to program the detection zones. In addition to creating vehicle and bicycle zones, the system shall automatically define a pedestrian crossing area in front of the stop bar zones. The system shall provide a tracking mechanism that counts pedestrian volume moving within this crossing area and also determine the average, maximum, and minimum speed of pedestrians moving within this crossing zone. The system shall also provide discrete outputs when pedestrians are in the crosswalk during normal crossing phases (one for each direction of travel) and when a red phase input has been detected. The system shall also provide a visual indication on the video image that a pedestrian is in the crosswalk.

Installation:

The video detection cameras shall be installed in accordance with the manufacturer recommendations. All holes drilled into signal poles, mast arms, or posts shall require rubber grommets to prevent the chafing of wires.

Warranty and Support:

A vendor/ manufacturer representative shall be present the day of activation to assist in the setup of the detection zones.

The video detection system shall be warranted by the supplier for a minimum of 3 years from the date of turn-on. This warranty shall cover all material defects and shall also provide all parts and labor as well as unlimited technical support.

Ongoing software updates to the system shall be included in the cost of the system.

A training session shall be provided to City/IDOT personnel in the operation, setup, and maintenance of the video detection system if requested.

Basis of Payment: This work will be paid for at the contract unit price per EACH for VIDEO VEHICLE DETECTION SYSTEM.

VIDEO VEHICLE DETECTION SYSTEM, SINGLE APPROACH

Description:

This work shall include replacement of the Iteris Vantage Next detection camera with a hybrid video/radar detection unit as shown in the plans. This work shall consist of furnishing and installing detection units and any necessary cabling as well as any cabinet modifications to provide a fully operational video detection system.

Materials:

The detection unit shall be Iteris Vantage Vector, or an approved equal, to match the existing video detection system.

The pay item shall include all necessary electric cable, electrical junction boxes, electrical and communications surge suppression, hardware, software, programming, and any camera brackets that are required for installation and configuration.

All video detection systems shall be equipped with the latest software and firmware revision.

Installation:

The video detection cameras shall be installed in accordance with the manufacturer recommendations. All holes drilled into signal poles, mast arms, or posts shall require rubber grommets to prevent the chafing of wires.

Warranty and Support:

A vendor/ manufacturer representative shall be present the day of activation to assist in the setup of the detection zones.

The video detection system shall be warranted by the supplier for a minimum of 3 years from the date of turn-on. This warranty shall cover all material defects and shall also provide all parts and labor as well as unlimited technical support.

Ongoing software updates to the system shall be included in the cost of the system.

Basis of Payment: This work will be paid for at the contract unit price per EACH for VIDEO VEHICLE DETECTION SYSTEM, SINGLE APPROACH.

SIGNAL PERFORMANCE MEASURES (SPM) SERVICE

Description:

The Signal Performance Measure (SPM) Service is a cloud-based data and software service that shall allow the agency easy access to performance measures and visualizations derived from high-resolution data that is extracted from field-located signal controllers. This work shall consist of licensing and programming SPM software at the intersections listed below:

1. IL Route 13 & Giant City Road
2. IL Route 13 & Reed Station Road
3. IL Route 13 & Spillway Road
4. IL Route 13 & Greenbriar Road
5. IL Route 13 & Division Street
6. IL Route 13 & IL Route 148
7. IL Route 13 & Terminal Drive
8. IL Route 13 & Pentecost Road
9. IL Route 13 & Redco Drive/Bainbridge Trail
10. IL Route 13 & Skyline Drive
11. IL Route 13 & Sinclair Drive
12. IL Route 13 & Walton Way/Williamson County Parkway
13. IL Route 13 & Halfway Road
14. IL Route 13 & I-57
15. IL Route 13 & Carbon Street
16. IL Route 13 & Russell Street
17. IL Route 13 & IL Route 37
18. IL Route 13 & State Street
19. IL Route 13 & Fair Street
20. IL Route 37 & Boulevard Street
21. IL Route 37 & Main Street
22. IL Route 37 & Boyton Street/Hendrickson Street
23. IL Route 15 & 44th Street
24. IL Route 15 & 42nd Street
25. IL Route 15 & Crownview Drive
26. IL Route 15 & 34th Street
27. IL Route 15 & 27th Street
28. IL Route 13 /IL Route 127 & IL Route 154
- 29-30. Additional signals within IDOT District 9 to be added within the 3 year service period.

Signal Controller Data:

IDOT District 9 uses exclusively Siemens/Yunix traffic signal controllers and operates a TACTICS ATMS. The SPM Service shall have the capability of collecting, storing, and analyzing high-resolution (10 Hz) signal controller data from controllers that log this data in the industry-standard format. This list of controllers includes:

- Siemens
 - M50 Linux & M60 ATV

Data Acquisition and Transmission:

The SPM Service shall include SPM data collection software that is installed at the customer's site on a server that is supplied by the agency or the vendor. The server and software shall reside within the agency's traffic equipment network. The server shall have internet access. The software

shall be configured by the vendor to run at specified intervals, connecting to each traffic signal controller, downloading stored high-resolution controller data off of them, and uploading the data to the SPM Service's secure https REST API endpoint.

In order to install and update the SPM data collection software, the vendor shall have access to the server, either remotely or onsite.

The following is required for data acquisition and transmission:

- The vendor shall work with the agency to acquire a list of controller IP addresses and port numbers
- Outbound access from the SPM data collection server to the field controllers (typically via port 22 for SFTP data transfer, port 21 for FTP data transfer, or other ports as designated by the controller manufacturer or agency).
- If needed, outbound access from the SPM data collection server to field controllers via port 161 (UDP) or other designated port. This access shall be used to identify the controller firmware version via SNMP.
- If needed, access from the SPM data collection server to a designated IP address (to be supplied to the agency by the vendor) to the agency via Port 443 (TCP) for transfer of high-resolution data logs from the SPM data collection server to the SPM cloud hosted environment
- If needed, TACTICS 5.3 or later

Service Setup Requirements:

To support the SPM service, the vendor shall acquire detector layouts and assignments. These shall be obtained from agency drawings, if available, or otherwise shall be obtained from the ATMS or by field visits. The vendor shall perform set-up of the detector layouts and assignments within the SPM software tool.

Functional Requirements:

This section describes the functional requirements of the software tool (SPM tool) provided as part of the SPM service.

- The SPM tool shall be available to users through a standard web browser.
- The SPM tool shall display a map of all connected traffic signals.
- The SPM tool shall allow users to navigate to signals of interest via a map, a list, and by search.
- The SPM tool shall provide an interactive visualization that shows, for each phase and cycle during coordinated timing plans, when vehicles arrived at the intersection and whether they arrived during the programmed green split, yellow, red, or early return to green. The visualization shall provide metrics on the percentage of arrivals on green by plan or specified interval (1-,2-, or 4-hour) and phase as well as the platoon ratio and whether it is favorable or unfavorable. It shall be user-selectable if the visualization shows

the point of 'detector on' or the duration of the 'detector on' for vehicle arrivals. A second date/time field shall be available that, when populated, will show a comparison of the visualization and provide the metrics described above for the same phase side-by-side on two different days.

- The SPM tool shall provide an interactive visualization of a timeline for each timing plan or specified interval (1-,2-, or 4-hour) that shows preemption, signal priority, and pedestrian activity requests and when the intersection is in free, preempt, transition, vs in-step modes. The visualization shall provide metrics on the percentage of each coordinated timing plan spent in transition and the number of preempt events per timing plan.
- The SPM tool shall provide an interactive visualization that shows, for each timing plan or specified interval (1-,2-, or 4-hour) and phase, the percentage of terminations by type, the distribution of phase durations by termination type relative to the programmed split, and the percentage of cycles of each termination type that terminate with a vehicle left at the stop bar.
- The SPM tool shall provide an interactive visualization that shows, for each phase and cycle over a day, the phase duration, how it terminated, and whether a vehicle was left at the stop bar when it terminated. The visualization shall display the programmed splits of each coordinated plan, pedestrian activity, as well as when each phase was skipped.
- The SPM tool shall provide an interactive visualization to show vehicle arrivals into the intersection during the yellow clearance interval and all-red clearance intervals to help users assess red-light running at intersections.
- The SPM tool shall provide access to traffic volume counts at intersections with appropriate detection. The counts shall include protected left turn movements, permissive left turns, through movements, right turns on green, and right turns on red. The counts shall be shown as hourly counts in 15-minute intervals.
- The SPM tool shall provide an interactive visualization to show the maximum wait time per phase per cycle that a vehicle arriving on red waited for a green signal. The visualization shall also include the amount of time that vehicle waited on red with no detection on phases that were green.
- The SPM tool shall provide an interactive visualization to show the duration of time that pedestrians waited for a pedestrian interval after pushing the pushbutton. The chart shall also show the Walk and Flashing Don't Walk durations of that interval.
- The SPM tool shall produce configurable, automated alerts of maintenance issues at intersections. Maintenance alerts shall include phases that exceed a configurable number of max-outs, force-offs, or ped calls during a configurable hour range and advanced detectors with counts below a configurable threshold during a configurable hour range. The alerts shall be configurable per intersection per phase.
- The SPM tool shall produce configurable automated alerts of operational issues at intersections. Operational alerts shall include plans that exceed a configurable percentage of time spent in transition, plans that exceed a configurable number of preempt calls, plans and phases with unfavorable progression, and phases with a high number of terminations

that leave vehicles at the stop bar. The alerts shall be configurable per intersection per phase.

Support:

A vendor/manufacture representative shall provide technical support and onsite training for IDOT staff and other users. The technical support services shall include:

- Hosting the service in a cloud environment
- Troubleshooting issues
- Responding to user questions and bug reports
- Regularly releasing new and improved versions of the software tool

The initial SPM installation shall provide service for 3 years from the date when 75% of the intersections listed are fully operating the SPM software.

Basis of Payment: This work will be paid for at the contract unit price per EACH for SIGNAL PERFORMANCE MEASURES SERVICE.

TRAFFIC COUNT DATA COLLECTION SYSTEM

Description:

The traffic count data collection system is a cloud-based data service that provides central collection and presentation of vehicle, bicycle, and pedestrian traffic count data, communication status, and integrated Bluetooth/Wi-Fi travel time data. Access to service shall be through a web browser to view and analyze this data. This work shall consist of licensing and programming of the service at the intersections listed below:

1. IL Route 13 & Giant City Road
2. IL Route 13 & Reed Station Road
3. IL Route 13 & Spillway Road
4. IL Route 13 & Greenbriar Road
5. IL Route 13 & Division Street
6. IL Route 13 & IL Route 148
7. IL Route 13 & Terminal Drive
8. IL Route 13 & Pentecost Road
9. IL Route 13 & Redco Drive/Bainbridge Trail
10. IL Route 13 & Skyline Drive
11. IL Route 13 & Sinclair Drive
12. IL Route 13 & Walton Way/Williamson County Parkway
13. IL Route 13 & Halfway Road
14. IL Route 13 & I-57
15. IL Route 13 & Carbon Street
16. IL Route 13 & Russell Street
17. IL Route 13 & IL Route 37
18. IL Route 13 & State Street
19. IL Route 13 & Fair Street
20. IL Route 37 & Boulevard Street
21. IL Route 37 & Main Street
22. IL Route 37 & Boyton Street/Hendrickson Street
23. IL Route 15 & 44th Street

24. IL Route 15 & 42nd Street
25. IL Route 15 & Crownview Drive
26. IL Route 15 & 34th Street
27. IL Route 15 & 27th Street
28. IL Route 13 & IL Route 127 & IL Route 154
- 29-30. Additional signals within IDOT District 9 to be added within the 3-year service period.

Data Collection:

It shall be possible to register individual intersections to provide data through the service. The service shall have the ability to collect speed and turning movement count data from sensor systems located at intersections. The data to be collected shall include:

- Vehicle count zone data, all movements
- Bicycle count zone data
- Pedestrian count data, bi-directional
- Spot speed data from sensors configured with a radar sensor
- Weather data localized per intersection

Data shall be collected from each intersection and uploaded to a cloud-based storage platform once per day. The service shall accommodate any interruptions in the data upload process by reattempting the upload. During the initial data upload, the service will attempt to collect the data three times. If the data upload is unsuccessful on the initial upload date, the system will flag the process for future retries. The service will attempt to collect data every day for the following 30 days from the date of failure. Data shall be maintained by cloud hosting provider holding ISO 27001:2013 certification or a comparable security certification. Data collected during any day shall be made available for analysis on the following day.

Functional Requirements:

The service shall provide a summarized display, or dashboard, which shows the following data items:

- A system-wide map that identifies each location that is collecting data and what type of data is being collected. The map shall provide for alternate colors of locations based on condition status of communication and data.
- A list of the top intersections, approaches, and movements ranked by total vehicle volume from the previous day.
- A list of the top intersections ranked by total bicycle volume from the previous day.
- A list of the top intersections ranked by total pedestrian volume from the previous day.
- The total vehicle volume for all intersections from the previous day.
- The total bicycle volume for all intersections from the previous day.
- The total pedestrian volume for all intersections from the previous day.
- A chart showing the total vehicle volume for all intersections from the previous 7 days.
- A chart showing the total bicycle volume for all intersections from the previous 7 days.
- A chart showing the total pedestrian volume for all intersections from the previous 7 days.
- A chart comparing the percentage split of vehicle, bicycle, and pedestrian volume for only those intersections configured to collect bicycle and/or pedestrian data from the previous day.
- A chart that shows real-time status of communication from each intersection.
- A chart that shows the percentage of time that the intersection was detecting from the previous day.

The service shall have the capability of displaying travel time data overlaid on calculated segment volume. When an agency is utilizing a Bluetooth/Wi-Fi travel time system from a third party, the service shall have the capability of merging the travel time dataset with the volume data, and provide a graphical display of the two datasets. Either travel time or speed data can be selected by the user, which will be overlaid on the calculated segment volume between two intersections.

The service shall provide a CSV format export of turning movement count data in standard universal traffic data format (UTDF). This CSV file shall be suitable for import into Synchro Signal Timing and Analysis Software. It shall be possible to select either 15 minute or 60 minutes as the count bin interval for the report. It shall be possible to select the start date and end date for the report. It shall be possible to select one or more of the registered intersections for the report. For Synchro compatibility, it shall be possible to associate a unique numerical intersection ID (or node) for each of the selected intersections for the report.

The service shall provide a peak hour summary report, which will report the hour with the highest total vehicle count volume in each of the morning, midday, and evening periods. The user shall be able to define start and end times to define the morning, midday, and evening periods. It shall be possible to select one or more contiguous dates for the peak hour summary report. A chart shall show the AM, midday, and PM peak hour turning movement counts in a traditional four-approach intersection formation with actual lane counts and vehicle volume figures. It shall be possible to download and save a graphical image of the peak hour summary chart in PNG, JPEG, or SVG format. The service shall provide a XLS format export of the peak hour summary report.

The service must be scalable to accept and process data from an unlimited number of detection devices. The service must have the ability to accommodate an unlimited number of users on the system simultaneously.

Installation:

The data engine (DE) may reside on a physical server with the minimum necessary processor and memory and having the correct OS and applications suitable for running the service. The DE may alternately reside on a virtual server with the minimum necessary processor and memory and having the correct OS and applications suitable for running the service. The DE must be set on a suitable network which provides access to both the detector systems and the Cloud.

The DE will be configured with all details necessary to collect data from the detectors.

Support:

A vendor/ manufacturer representative shall provide technical support and on-site training for IDOT staff and other users. The technical support services shall include:

- Hosting the service in a cloud environment
- Monitoring the collection and storage of data into the system and troubleshooting issues
- Responding to user questions and bug reports
- Regularly releasing new and improved versions of the software tool

The initial installation shall provide service for 3 years from the date when 75% of the intersections listed are fully operating the traffic count data collection service.

Basis of Payment: This work will be paid for at the contract unit price per EACH for TRAFFIC COUNT DATA COLLECTION SYSTEM.

ATMS SOFTWARE SUPPORT

This pay item shall include a three year extension of the Siemens 360 service agreement for IDOT District 9 Tactics System. This shall include 36 months of remote and/or on-site support for the ATMS software (Tactics) and associated network by the software vendor.

Basis of Payment: This work will be paid for at the contract unit price per LUMP SUM for ATMS SOFTWARE SUPPORT.

FIBER OPTIC INTERNET SERVICE

This pay item shall include a three year internet service plan for the IDOT District 9 ATMS network. The provided internet speed shall be 100 Mbps/30 Mbps over fiber optic cable. Any necessary equipment needed to connect the fiber services shall be provided and reflected in the cost of service.

Basis of Payment: This work will be paid for at the contract unit price per LUMP SUM for FIBER OPTIC INTERNET SERVICE.

COMMUNICATIONS VAULT, 24"X36"

This work shall be in accordance with Sections 814 and 1088 of the Standard Specifications, except as modified herein.

This work shall consist of furnishing and installing a communications vault constructed of polymer concrete stackable assembly.

The 24" x 36" communications vault and lid shall conform to the following specifications:

Cover:

Material: Polymer Concrete Nominal
Dimensions: 24" x 36" Single lid construction
Gasketed, Heavy Duty Lid with 2 Bolts.
Design/Test Load: 22,500/33,750 lbs. ANSI Tier: 22

Box:

Material: Polymer Concrete
Nominal Dimensions: 24" W x 36" L x 36" D
Open Bottom, Design/Test Load: 22,500/33,750 lbs. ANSI Tier: 22

The handhole lid shall be supplied with pull slots and stainless-steel security bolts and washers. The box shall be equipped with 12" cable racks to secure the fiber optic cable and splice closures off bottom of handhole. Handhole lid shall have a standard logo design stamped into the lid as directed by the Engineer.

The location of the handhole shall be excavated so that the top of the handhole is set flush with the sidewalk, paved surface, or ground line. When installed in earth shoulder away from the

pavement edge, the top surface of the handhole shall be 1" in. (25 mm) above the finished grade. The excavation shall be deep enough to accommodate the depth of the box and french drain.

The french drain shall be constructed underneath the proposed handhole according to Article 601.06 of the Standard Specifications and in accordance with Highway Standard 814006.

The conduits shall enter through the bottom of the vault. No conduits will be allowed to enter through the side wall of the vault. The Contractor shall install 6 inches of CA 5 or CA 7 in the bottom of the vault.

The Contractor shall submit testing reports to verify that the communications vaults and lids meet the requirements of ANSI Tier 22 loading.

A fiber optic marker shall be installed next to each communication vault.

The locating cable shall be continuous and accessible on the outside of each communication vault through the use of a locating cap that is installed on top of the fiber optic marker.

The Contractor shall utilize appropriate corrosion resistant hardware (stainless steel) and connections to the locating wire. The Contractor shall submit material and installation methods to the Department for review.

Basis of Payment: This work will be paid for at the contract unit price per EACH for COMMUNICATIONS VAULT, 24"x36", which shall be payment in full for all labor, equipment, and materials required to provide and install the equipment described above, complete.

COMMUNICATIONS VAULT, 48"X48"

This work shall be in accordance with Sections 814 and 1088 of the Standard Specifications, except as modified herein.

This work shall consist of furnishing and installing a communications vault constructed of polymer concrete stackable assembly.

The 48" x 48" communications vault and lid shall conform to the following specifications:

Cover:

Material: Polymer Concrete Nominal
Dimensions: 52 3/8" x 52 3/8" Split lid construction
Gasketed, Heavy Duty Lid with 2 Bolts per lid section.
Design/Test Load: 22,500/33,750 lbs. ANSI Tier: 22

Box:

Material: Polymer Concrete
Nominal Dimensions: 50 1/8" W x 50 1/8" L x 36" D
Open Bottom, equipped with flange beam to support split lid construction.
Design/Test Load: 22,500/33,750 lbs. ANSI Tier: 22

The 48" x 48" communications vault is shown in the plans as "large communication vault"

The handhole lid shall be supplied with pull slots and stainless-steel security bolts and washers. The box shall be equipped with 12" cable racks to secure the fiber optic cable and splice closures off bottom of handhole. Handhole lid shall have a standard logo design stamped into the lid as directed by the Engineer.

The location of the handhole shall be excavated so that the top of the handhole is set flush with the sidewalk, paved surface, or ground line. When installed in earth shoulder away from the pavement edge, the top surface of the handhole shall be 1" in. (25 mm) above the finished grade. The excavation shall be deep enough to accommodate the depth of the box and french drain.

The french drain shall be constructed underneath the proposed handhole according to Article 601.06 of the Standard Specifications and in accordance with Highway Standard 814006.

The conduits shall enter through the bottom of the vault. No conduits will be allowed to enter through the side wall of the vault. The Contractor shall install 6 inches of CA 5 or CA 7 in the bottom of the vault.

The Contractor shall submit testing reports to verify that the communications vaults and lids meet the requirements of ANSI Tier 22 loading.

A fiber optic marker shall be installed next to each communication vault.

The locating cable shall be continuous and accessible on the outside of each communication vault through the use of a locating cap that is installed on top of the fiber optic marker.

The Contractor shall utilize appropriate corrosion resistant hardware (stainless steel) and connections to the locating wire. The Contractor shall submit material and installation methods to the Department for review.

Basis of Payment: This work will be paid for at the contract unit price per EACH for COMMUNICATIONS VAULT, 48"x48", which shall be payment in full for all labor, equipment, and materials required to provide and install the equipment described above complete.

COMMUNICATIONS VAULT SPACING

The Contractor may submit a revised communication vault spacing plan to the Department for review and approval. Depending upon the fiber installation equipment used and the conduit reel sizes that are available, the communication vault spacing may be altered for optimum fiber installation. Optimum fiber installation essentially means continuous runs with no or minimal splice points unless otherwise shown on plans. However, the Department will still require that the Contractor install communication vaults at or near intersecting roadways.

Basis of Payment. This work will not be paid for separately but shall be included in the bid price for COMMUNICATIONS VAULT, of the size specified.

ROUTING, LAYOUT AND DOCUMENTATION

The Contractor shall layout and stake the proposed conduit route for review and approval by the Resident Engineer a minimum of one week in advance of anticipated construction or at a different time frame as approved by the Resident Engineer.

After the fiber optic cable plant has been installed, two (2) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

- Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.
- The Contractor shall locate the fiber optic cable in conduit every 100 feet using a GIS locating device that is accurate to the nearest foot. The Contractor shall provide a GIS based map of the route (including all communication vaults, junction boxes, and splice points) and a complete listing of all map coordinates in an electronic format. The format shall be compatible for viewing and importing into Arc GIS and Google Earth (kml or kmz). Each communication vault and fiber optic cable splice shall be numbered and clearly labeled when displayed in both software programs.
- Final copies of all approved test procedures.
- Complete performance data of the cable plant showing the losses at each terminal connector.
- Complete parts list including names of vendors.

Basis of Payment. This work will be paid for at the contract unit price per LUMP SUM for FIBER LAYOUT, which shall be payment in full for all labor, equipment, and materials required to complete the work described above complete.

FIBER OPTIC CABLE SPLICE

Description. This work shall consist of splicing two (2) fiber optic cables by means of fusion splicing with the number of fibers at locations as shown on the plans and as directed by the Engineer. No other splicing in the field shall be allowed without written direction from the Engineer. Fiber splicing in the field shall be done using in-ground splice closures as shown on the plans and/or as directed by the Engineer.

Two distinct type of fusion splices that are identified. A fiber optic cable splice and fiber optic cable splice mainline includes all fibers in the cable sheath. In a lateral fiber optic cable splice, the buffer tubes in the mainline fiber optic cable are dressed out, so those fibers designated on the plans can be accessed and fusion spliced or joined to the 12-fiber lateral single mode cables.

Materials. All fiber optic connection hardware (splice closures, organizers, cable end preparation tools, etc.) shall be compatible with the fiber optic cable manufacturers installation practices and procedures and shall be approved by the Engineer.

FIBER OPTIC SPLICE

(1) Loose Tube Dome Closure for 144 fiber count

(4) Splice Tray kit with 36 count splice blocks

FIBER OPTIC SPLICE - MAINLINE

- (1) Loose Tube Dome Closure for 144 fiber count
- (4) Splice Tray kit with 36 count splice blocks

FIBER OPTIC SPLICE – LATERAL:

- (1) Loose Tube Dome Closure
- (1) Splice Tray kit with 12 count splice blocks

Splice enclosures and splice trays shall meet the following minimum requirements as below.

Splice closures: All optical fiber splices in the field shall be contained within a splice closure. The closures provide storage for splices, fiber, and buffer tubes and restores the mechanical and environmental integrity of the fiber optic cable, encases the sheath opening in the cable, and organizes and stores optical fiber. All hinges and latching devices shall be stainless steel and the closure shall be airtight and prevent water intrusion. The splice closure shall be able to accommodate pressurization and the ability to be reentered without requiring specialized tools or equipment. The closure shall provide fiber and splice organizers including splice trays and strain relief. The splice closure shall be hermetically sealed to protect internal components from environmental hazards such as moisture, insects, and UV light.

The splice closure shall provide space for future expansion equal to 100% of the initial utilization. Fiber optic cable penetration end caps shall be provided to accommodate a minimum installation of two trunk fiber optic cables and two fiber optic drop cables. The closure end caps shall be factory-drilled to the proper diameter to accept and seal the fiber optic cable entries. The cable entry locations shall be able to accommodate an assortment of cables with outside diameters ranging from 0.45 inches to 0.55 inches, plus 10%, without jeopardizing the waterproof characteristics of the closure.

In addition, fiber optic splice closures shall meet the following requirements:

Mechanical
Resist compression deformation to a maximum of 400 pounds.
Withstand an impact energy to a maximum of 40 foot-pounds at 0°F.
Axial Tension: 100 pounds for 30 minutes.
Cable Torsion: ten 90-degree rotations.
Cable Flexing: ten 90-degree bends.
Environmental
Hydrostatic Pressure Head: Up to 70 kPa (10 pounds per square inch).
Withstand 40 freeze/thaw temperature cycles.
Ultraviolet resistant during a maximum 30-day exposure in compliance with the requirements detailed in the ASTM B 117 standard.
Chemical
Withstand a 90-day exposure to solutions of 3% sulfuric acid, 0.2 normal of sodium hydroxide, 10% Igepal®, kerosene, and be fungus resistant as required in the ASTM G21 standard.

Splice Trays: The splice trays shall be securely attached and accessible and provide sufficient storage for the fiber cable. The splice trays shall provide access to individual fibers without disrupting other fibers in the tray. The splice trays shall hold the buffer tubes rigidly in place and

provide protection for fusion splices. The Contractor shall ensure that the raceway accommodates the minimum bend radius of the fiber. The splice trays shall allow visible inspection of the fiber and include a cover with a locking mechanism to hold it in place.

Construction Requirements.

All optical fiber splicing shall be performed using the fusion splicing technique and according to the latest version of the manufacturer's cable installation procedures; industry accepted installation standards, codes, and practices; or as directed by the Engineer. A fusion splice machine shall be used to splice all optical fiber. All splicing equipment shall be cleaned and calibrated according to the manufacturer's recommendations prior to each splicing session at each location.

Where a fiber cable is to be accessed for lateral or drop signal insertion, only the buffer tube containing the fiber to be accessed shall be opened and only the actual fiber to be accessed shall be cut. If a fiber end is not intended for use, the fiber shall be cut to a length equal to that of the fiber to be used and neatly laid into the splice tray. Any fibers exposed during splicing shall be treated with a protective coating and placed in a protective sleeve or housing to protect the fiber from damage or contaminants.

All splicing shall be performed as shown on the plans. All splice locations must be identified in the Record Drawings.

Splicing Requirements

All fiber optic cable splices shall be performed using a fusion splicer. Mechanical splicing of fiber optics strands shall not be permitted. After completing a fusion splice, the Contractor shall protect all the fused fibers with the appropriate transparent single mode fiber optic heat shrink tube with stainless steel support rod. Once the splice has been completed and shrink been allowed to cool, all spliced fibers shall be neatly trained in splice trays housed in splice closures, splice enclosures, or termination panels.

Splicing shall be performed only at locations shown in the approved Cable-Pulling Plan. Any other splices shall be permitted only with the approval of the Engineer. Fiber optic splices at location shown on the plans will be paid for under separate pay items. Fiber optic splices and underground splice closures required for end-of-reel splices will not be paid for separately but shall be included cost of FIBER OPTIC CABLE. All splice locations shall be identified in the Record Drawings. **Cable runs which dead-end at a handhole or communications vault shall be dead ended in an underground splice closure.**

Slack Storage of Fiber Optic Cables

Included as a part of this item, slack fiber shall be supplied as necessary to allow splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored underground in handholes or in the raised base adapters of ground mounted cabinets in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be 100 feet for each cable at each splice location or communication vault, above or below ground. Fiber optic cable slack shall be 50 feet for each cable heavy duty handholes and access points, above or below ground, where splicing is not involved. If the innerduct is cut, the ends of the innerduct should extend beyond the first vertical rack, so they can be secured at that point. This slack shall be measured for payment.

Fiber optic cable shall be tagged inside handholes with yellow self-laminating fiber optic cable marker tag containing the text: "CAUTION - FIBER OPTIC CABLE."

The splice loss for a single mode fiber fusion splice shall not exceed a maximum bi-directional average of 0.1 dB per splice. Any splices that exceed allowable attenuation shall be repaired or replaced at no cost to the Illinois Department of Transportation.

Testing Requirements:

The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and un-terminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an optical time domain reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

Fibers which are not to be terminated shall be tested with a temporary fusion spliced pigtail fiber. **Mechanical splice or bare fiber adapters are not acceptable.**

The Contractor shall provide the date, time, and location of any tests required by this specification to the Engineer at least 5 working (7 calendar) days before performing the test. Included with the notification shall be a record drawing of the installed fiber optic cable system. The drawings shall indicate actual installed routing of the cable, the locations of splices, and locations of cable slack with slack quantities identified.

Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A certified technician using an optical time domain reflectometer (OTDR) and optical source/power meter shall conduct the installation test. The test equipment used shall have been calibrated within the year in accordance with manufacturer specifications and documentation, in form of a calibration certificate, shall be provided. The technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box, commonly known as a launch kit, shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers, bi-directionally.

All test results shall be provided on or the day following the test date. A copy of the test results on a CD ROM shall be submitted.

At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Project Engineer. The test documentation shall be submitted as (3) three CD ROM copies and shall include the following:

Cable & Fiber Identification:

• Cable ID	• Operator Name
• Fiber ID, incl. tube and fiber color	• Date & Time
• Pulse width (OTDR)	• Setup Parameters
• Cable Location -beginning and end point	• Range (OTDR)
• Wavelength	• Scale (OTDR)
• Refractory index (OTDR)	• Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR test results-including the raw test results file and the results in a .pdf format.
- Total fiber trace
- Measured length (cable marking)
- Total length (OTDR)
- Optical source/power meter total attenuation (dB/km)
- Splice loss/gain
- Events > 0.10 dB
- OTDR fiber trace viewer software details

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

A copy of the test equipment manufacturer's software to read the test files, OTDR, and power, shall be provided to IDOT. These results shall also be provided in tabular form. See sample below:

Sample OTDR Summary					
Cable Designation	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date:	<i>1/1/00</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)		
			1310 nm	1550 nm	
<i>1</i>	<i>Splice</i>	<i>23500 Ft.</i>	<i>.082</i>	<i>.078</i>	
<i>1</i>	<i>Splice</i>	<i>29000 Ft.</i>	<i>.075</i>	<i>.063</i>	
<i>2</i>	<i>Splice</i>	<i>29000 Ft.</i>	<i>.091</i>	<i>.082</i>	
<i>3</i>	<i>Splice</i>	<i>26000 Ft.</i>	<i>.072</i>	<i>.061</i>	
<i>3</i>	<i>Bend</i>	<i>27000 Ft.</i>	<i>.010</i>	<i>.009</i>	

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.4 dB/km at 1310 nm and 0.5 dB/km at 1550 nm. If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to the IDOT, both labor and materials.

Basis of Payment: This work shall be paid for at the contract unit price per EACH as follows:

FIBER OPTIC CABLE SPLICE shall consist of three (3) 12 fibers spliced, tested, and accepted by the Engineer on splices between the FIBER OPTIC CABLE, SINGLE MODE, ARMORED, 12 FIBERS and FIBER OPTIC CABLE, SINGLE MODE, ARMORED, 144 FIBERS as detailed in the plans.

FIBER OPTIC SPLICE – MAINLINE shall consist of 144 fibers spliced, tested, and accepted by the Engineer on splices between two (2) FIBER OPTIC CABLE IN CONDUIT, SINGLE MODE and/or ONE (1) FIBER OPTIC CABLE IN CONDUIT, SINGLE MODE AND ONE (1) HQ FIBER OPTIC CONNECTIVITY where required as detailed in the plans.

FIBER OPTIC SPLICE – LATERAL shall consist of 12 fibers spliced, tested, and accepted by the Engineer on splices between the FIBER OPTIC CABLE, SINGLE MODE, ARMORED, 12 FIBERS and FIBER OPTIC CABLE, SINGLE MODE, ARMORED, 144 FIBERS OR FIBER OPTIC CABLE, SINGLE MODE, ARMORED, 48 FIBERS as detailed in the plans.

All materials, labor, equipment, testing, and documentation required for fiber optic cable splicing shall be included and will not be paid separately. Payment shall not be made until the cable is installed, spliced, tested, and accepted by the Engineer in compliance with these special provisions.

FIBER OPTIC PATCH PANEL, RACK MOUNT

Description. This work shall consist of furnishing and installing a 19" fiber optic patch panel, splice housing, and associated connection hardware (e.g., bulkheads, cassettes, splice trays, splice sleeves, blank panels, bonding/grounding, etc.) in the communications cabinets, as shown on the plans and as directed by the Engineer, complete with all of the hardware and accessories required for the intended use of the equipment.

Materials. The Contractor shall provide a 19" fiber optic connector patch panel housing which shall be able to accept cassettes or termination panels. The Contractor shall also provide a 19" splice and storage module with splice trays to store excess fiber and splicing of individual pigtails. The pigtails shall be mounted on 12 port bulkhead sleeves using type LC optical connectors, unless otherwise approved by the Engineer. The housing and storage enclosure along with ancillary and accessory materials shall be equal to or exceed Corning Cable Systems Closet Connector Housing. Closet housings which shall accommodate up to 12 connector panels or approved equivalents for termination of 144 SM FO cable assembly shall be Part No. CCH-04U. Closet housings which shall accommodate up to 4 connector panels or approved equivalents for termination of up to 48 SM FO cable assembly shall be CCH-02U. All mounting hardware and cable management (strain relief brackets, routing clips/guides, documentation labels, etc.) shall be incidental.

Contractor shall provide for each patch panel a 4U or 2U vertical wall mount bracket to mount the fiber optic patch panel to the existing shelf in the existing traffic signal cabinet. Each vertical wall mount bracket shall come with all the necessary mounting hardware to attach the bracket to the shelf. The vertical wall mount bracket shall be equal to or exceed Tripp Lite Smart Rack in either a 2U or 4U version depending on the application.

The Contractor shall use type LC duplex adapters only, unless otherwise specified in the plans or as directed by the Engineer. The optical connectors shall comply with the following:

- All connectors shall be factory installed LC compatible connectors. Field installed connectors shall not be allowed.
- Maximum attenuation 0.4dB, typical 0.2dB.
- No more than 0.2dB increase in attenuation after 1000 insertions.
- Attenuation of all connectors will be checked and recorded at the time of installation with an insertion test minimum 5 times checked with an OTDR.
- Terminated fibers as shown on the plans shall be connectorized at each end as directed by the Engineer. Unterminated fibers shall be capped and coiled neatly in the splice tray.
- Applicable fiber strands, as shown on the plans, shall be terminated at a fiber patch panel. The Contractor shall coordinate with the Engineer before any fibers are connected to the IDOT network equipment. No additional terminations or splicing shall be done by the Contractor without direction from IDOT.
- Unused fibers will be protected with a plastic cap to eliminate dust and moisture.
- Termination shall be facilitated by splicing factory OEM pigtails on the end of the bare fiber utilizing the fusion splicing method. The maximum splice loss shall not be greater than 0.1 dB per event, as defined elsewhere in this document. The splice loss shall be tested at the time of splicing.
- Pigtails shall be a minimum of (20) twenty feet in length, unless otherwise approved by the Engineer.

All connectors shall comply with the TIA/EIA -568-A and TIA/EIA-604 standards, as applicable, and are tested according to the Telcordia/Bellcore GR326-CORE standard. When tested according to the TIA and EIA's Fiber Optic Test Procedure (FOTP)-171 (TIA/EIA-455-171), ensure that the connectors test to an average insertion loss of less than or equal to 0.4 dB.

Pre-terminated Connector Assemblies (Pigtails): Pre-terminated cable assemblies shall consist of 12-strand fiber optic cable with factory-installed and tested connectors on both ends of the cable. Each strand of the pre-terminated cable assembly shall not exceed a maximum attenuation 0.4dB. The pre-terminated cable assembly shall be cut in half and fusion spliced to the bulkhead sleeves within the rack mounted connector panel housing. All buffer tubes and fibers shall be appropriately protected once the attachment of pre-terminated connector assemblies is complete. In addition, the pigtails shall comply with the following:

- The pigtails shall consist of a section of single fiber, jacketed cable equipped with optical connectors at both ends.
- The factory installed connector furnished as part of the pigtail shall meet or exceed the requirements for approved connectors specified herein. The fiber portion of each pigtail shall have optical properties identical to the optical cable furnished under the contract.

Construction Requirements.

The Contractor shall install the fiber optic patch panel along with associated hardware including any ancillary material items required for properly installing the fiber optic patch panel and splice housing within the 19" equipment rack at communication cabinets as shown on the plans and as directed by the Engineer. All cables shall be neatly dressed, labeled, and fastened to the corresponding equipment with the appropriate hardware. Tie wraps are not permitted. Hook and loop bundling straps shall be used for cable management. In addition, the Contractor shall also supply and install the necessary material to properly ground and bond the equipment in accordance with the NEC telecommunications industry standards (ANSI/TIA/BICSI/IEEE) and manufacturer requirements.

Prior to inspection, testing, and connecting fiber optic jumpers or patch cables to the bulkheads within the fiber optic patch panel, all LC connectors require proper cleaning using lens grade and lint free tissues and a 98% isopropyl alcohol cleaning solution, unless another method and material is approved by the Engineer. Rubbing alcohol and medical wipes shall not be used and are not appropriate, as both may contain oil or water and which leave residue. The Contractor shall wipe each connector twice, with a moistened and dry tissue area, and failure to wipe the connector immediately with the dry tissue area will result in needing to redo the entire process.

Testing

The Contractor shall submit detailed test procedures for approval by the Engineer. All fibers (terminated and un-terminated) shall be tested bi-directionally at both 1310 nm and 1550 nm with both an optical time domain reflectometer (OTDR) and a power meter with an optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

Fibers which are not to be terminated shall be tested with a temporary fusion spliced pigtail fiber.
Mechanical splice or bare fiber adapters are not acceptable.

The Contractor shall provide the date, time, and location of any tests required by this specification to the Engineer at least 5 working (7 calendar) days before performing the test. Included with the notification shall be a record drawing of the installed fiber optic cable system. The drawings shall indicate actual installed routing of the cable, the locations of splices, and locations of cable slack with slack quantities identified.

Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers for continuity, events above 0.1 dB, and total attenuation of the cable. The test procedure shall be as follows:

A certified technician utilizing an optical time domain reflectometer (OTDR) and optical source/power meter shall conduct the installation test. The test equipment used shall have been calibrated within the year. Documentation shall be provided. The technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box, commonly known as a launch kit, shall be used to connect the OTDR to the fiber optic cable under test at both the launch and receive ends. The tests shall be conducted at 1310 and 1550 nm for all fibers, bi-directionally.

All test results shall be provided on or the day following the test date. A copy of the test results on a CD ROM shall be submitted.

At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Project Engineer. The test documentation shall be submitted as (3) three CD ROM copies and shall include the following:

Cable & Fiber Identification:

• Cable ID	• Operator Name
• Fiber ID, including tube and fiber color	• Date & Time
• Pulse width (OTDR)	• Setup Parameters
• Cable Location -beginning and end point	• Range (OTDR)
• Wavelength	• Scale (OTDR)
• Refractory index (OTDR)	• Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR test results-including the raw test results file and the results in a .pdf format.
- Total fiber trace
- Measured length (cable marking)
- Total length (OTDR)
- Optical source/power meter total attenuation (dB/km)
- Splice loss/gain
- Events> 0.10 dB
- OTDR fiber trace viewer software details

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

A copy of the test equipment manufacturer's software to read the test files, OTDR, and power shall be provided to IDOT. These results shall also be provided in tabular form. See sample below:

Sample OTDR Summary					
Cable Designation	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>	Date:	<i>1/1/00</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)	1310 nm	1550 nm
<i>1</i>	<i>Termination</i>	<i>23500 Ft.</i>	<i>.082</i>	<i>.078</i>	
<i>1</i>	<i>Termination</i>	<i>29000 Ft.</i>	<i>.075</i>	<i>.063</i>	
<i>2</i>	<i>Termination</i>	<i>29000 Ft.</i>	<i>.091</i>	<i>.082</i>	
<i>3</i>	<i>Termination</i>	<i>26000 Ft.</i>	<i>.072</i>	<i>.061</i>	
<i>3</i>	<i>Bend</i>	<i>27000 Ft.</i>	<i>.010</i>	<i>.009</i>	

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.4 dB/km at 1310 nm and 0.5 dB/km at 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to IDOT, both labor and materials.

Basis of Payment: This work shall be paid for at the contract unit price per EACH as follows:

FIBER OPTIC PATCH PANEL, 144 PORT, RACK MOUNT, which shall be payment in full for all labor, equipment, materials, and documentation required to provide and install the equipment described above complete. Payment shall not be made until the panel is installed, terminated, and tested by the Contractor and accepted by the Engineer.

FIBER OPTIC PATCH PANEL, 48 PORT, RACK MOUNT, which shall be payment in full for all labor, equipment, materials, and documentation required to provide and install the equipment described above complete. Payment shall not be made until the panel is installed, terminated, and tested by the Contractor and accepted by the Engineer.

FIBER OPTIC CABLE IN CONDUIT, SINGLE MODE

This work shall be in accordance with Sections 801, 864, 871, 873, and 1076 of the Standard Specifications, except as modified herein.

All fibers shall be fusion spliced and terminated as shown in plan details. All terminated fibers shall be clearly labeled. Fibers not being used shall be labeled "spare".

All ancillary components required to complete the fiber optic cable plant, including but not limited to moisture and water sealants, cable caps, fan-out kits, boots, cable trays, etc., shall be supplied under this pay item and will not be paid for separately. These items shall be submitted to the Department for approval.

The fiber optic cable shall be clearly marked in each vault and cabinet with a brightly colored (orange or yellow) weather resistant label securely attached to the cable.

The weather resistant self-laminating fiber optic cable marker tag shall contain the text: "CAUTION - FIBER OPTIC CABLE."

Materials

The single-mode, fiber optic cable shall incorporate a loose, buffer-tube design. The cable shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1999 for a single sheathed, armored cable and shall be new, unused, and of current design and manufacture.

Single mode optical fibers shall comply with EIA/TIA 492-CAAA, except otherwise note herein.

Fiber optic cable buffer tubes and strands shall be color coded per EIA/TIA-598-B

Fiber optic cable shall be a single jacket cable assembly with a corrugated steel armor system.

Fiber optic cable shall have identification and date marking every 2 feet indented, embossed, and surface printed the entire length of the cable. The identification shall indicate it's an optical cable, manufacturer's trade name, hand set symbol if the cable is suitable for direct burial, sequential length numbered, and cable ends sealed to prevent moisture entry.

The cable shall utilize either a water blocking gel or a dry block tape.

Experience Requirements

Personnel involved in the installation, splicing, and testing of the fiber optic cables shall meet the following requirements:

A minimum of three (3) years' experience in the installation of fiber optic cables, including splicing, terminating, and testing single mode fibers. Install two systems where fiber optic cables are outdoors in conduit and where the systems have been in continuous satisfactory operation for at least two years. The Contractor shall submit photographs or other supporting documents as proof and the names, addresses, and telephone numbers of the operating personnel who can be contacted regarding the installed fiber optic systems.

One fiber optic cable system (which may be one of the two in the preceding paragraph) which the Contractor can arrange for demonstration to the Department representatives and the Engineer.

Installers shall be familiar with the cable manufacturer's recommended procedures for installing the cable. This shall include knowledge of splicing procedures and equipment being used on this project and knowledge of all hardware such as breakout (furcation) kits and splice closures. The Contractor shall submit documented procedures to the Engineer for approval and to be used by Construction inspectors.

Personnel involved in testing shall have been trained, by the manufacturer of the fiber optic cable test equipment to be used, in fiber optic cable testing procedures. Proof of this training shall be submitted to the Engineer for approval. In addition, the Contractor shall submit documentation of the testing procedures for approval by the Engineer.

Installation in Raceways

Preinstall Integrity Test: To check and confirm the integrity of the existing conduit and ensure it is airtight and free of obstruction, the Contractor shall pressurize the duct prior to actual cable installation by installing a small amount of lubricant into the duct and blowing a foam carrier of sufficient size through the conduit run using the required material and equipment (e.g., hydraulic power system, air compressor, conduit couplers, foam carrier, etc.). All unused ducts shall be capped with blow string left in place.

Installation Plan: Prior to installation, the Contractor shall provide a cable-installation plan. The plan shall include the following information:

1. Identify where each cable will enter the underground system and the direction of each install
2. Identify locations where the cable is pulled out of a communications vault, coiled in a figure eight, and installed back into the communications vault
3. The plan shall address the physical protection of the cable during installation and during periods of downtime.
4. Identify the location of slack storage locations
5. Identify the locations of splices
6. Identify distances between fiber access points and crossings

The cable-installation plan shall be provided to the Engineer and shall be approved prior to the start of installation. The Engineer's approval shall be for the operation for IDOT and does not include an endorsement of the proposed construction methods or procedures. The Contractor is responsible for the technical adequacy of the proposed construction methods and installation procedure.

Blowing: Fiber optic cable blowing is the most efficient and safe means of installing fiber optic cable. To minimize the exposure of the backbone cable and to facilitate the longer lengths of the fiber optic cable, the Contractor shall use a "blown cable" (pneumatically assisted) technique to place the fiber optic cable. Either the high airspeed blowing (HASS) method or the piston method shall be used. When using the HASS method, the volume of air passing through the conduit shall not exceed 600 cubic feet per minute or the conduit manufacturer's recommended air volume, whichever is more restrictive. When using the piston method, the volume of air passing through the conduit shall not exceed 300 cubic feet per minute or the conduit manufacturer's recommended air volume, whichever is more restrictive. A compressed air cooler shall be used when ambient air temperatures reach 90°F or more.

During cable installation operations, the Contractor shall ensure that the minimum bending of the cable is maintained during the unreeling and install operations. Unless specified otherwise by the fiber optic cable manufacturer, the outside bend radius of the cable during installation shall be no less than 20 times the outside diameter of the fiber optic cable. Entry guide chutes shall be used to guide the cable into the communications vault conduit ports where applicable. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the cable manufacturers specifically approve the array.

Where figure-eight techniques are used during cable installation, the cable shall be handled manually and stored on the ground. The cable shall be placed on tarps to prevent damage from gravel, rocks, or other abrasive surfaces. Tarps should also be used in muddy conditions to keep the cable clean. Enough area to accommodate the cable length to be stored and sufficient personnel to maintain the required minimum-bending diameter as well as avoid kinking or otherwise damaging the cable shall be provided. If the cable has been figure-eighted in preparation for a forward feed, the figure-eight must be flipped over to access the outside cable end. Sufficient personnel shall be provided to avoid kinking the cable as the figure-eight is flipped over. When removing the cable from the figure-eight, use care to avoid kinking the cable and violating the minimum-bending diameter. Power assisted or figure-eight eliminator equipment, which is used to eliminate manual figure-eight procedures, shall not be used unless specifically allowed by the cable manufacturer in writing and approved by the Engineer.

Standard electronic controls shall be used during installation in order to monitor the cable blowing system and display the cable and tractor drive speeds, so installation can be immediately stopped for problematic situations such as cable slippage or stoppage, over- speed, a duct blockage detected, etc. in an attempt to potentially prevent cable damage during installation.

Factory and Cable Reel Testing: Factory test results shall be performed prior to shipping the fiber optic cable and results submitted by the Contractor. In addition and prior to installation, the fiber optic cable shall then be OTDR tested on the reel by the Contractor to verify that no strands were damaged during shipment, the cable has the proper length, and the measured attenuation matches the cable datasheet.

Testing Requirements:

Testing shall be in accordance with Article 801.13

The Contractor shall submit detailed test procedures for approval by the Engineer. All continuous fiber runs shall be tested bi-directionally at both 1310 nm and 1550 nm with a power meter and

optical source. For testing, intermediate breakout fibers may be concatenated and tested end-to-end. Any discrepancies between the measured results and these specifications will be resolved to the satisfaction of the Engineer.

The Contractor shall provide the date, time, and location of any tests required by this specification to the Engineer at least 5 days before performing the test. Upon completion of the cable installation, splicing, and termination, the Contractor shall test all fibers in each link for continuity and attenuation. The test procedure shall be as follows:

A certified technician using an optical time domain reflectometer (OTDR) and optical source/power meter shall conduct the installation test. The test equipment used shall have been calibrated within the year in accordance with manufacturer specifications and documentation in form of calibration certificate shall be provided. The technician is directed to conduct the test using the standard operating procedures defined by the manufacturer of the test equipment. All fibers installed shall be tested in both directions.

A fiber ring or fiber box, commonly known as a launch kit, shall be used to connect the OTDR to the fiber optic cable under test at the launch end. The tests shall be conducted at 1310 and 1550 nm for all fibers, bi-directionally.

All test results shall be provided on or the day following the test date. A copy of the test results on a CD ROM shall be submitted.

At the completion of the test, the Contractor shall provide copies of the documentation of the test results to the Project Engineer. The test documentation shall be submitted as (3) three CD ROM copies and shall include the following:

Cable & Fiber Identification:

• Cable ID	• Operator Name
• Fiber ID, including tube and fiber color	• Date & Time
• Pulse width (OTDR)	• Setup Parameters
• Cable Location -beginning and end point	• Range (OTDR)
• Wavelength	• Scale (OTDR)
• Refractory index (OTDR)	• Setup Option chosen to pass OTDR "dead zone"

Test Results shall include:

- OTDR test results-including the raw test results file and the results in a .pdf format.
- Total fiber trace
- Measured length (cable marking)
- Total length (OTDR)
- Optical source/power meter total attenuation (dB/km)
- Splice loss/gain
- Events > 0.10 dB
- OTDR fiber trace viewer software details

Sample Power Meter Tabulation:

Power Meter Measurements (dB)									
Location		Fiber No.	Cable Length (km)	A to B		B to A		Bidirectional Average	
A	B			1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm
		1							
		2							
Maximum Loss									
Minimum Loss									

A copy of the test equipment manufacturer's software to read the test files, OTDR, and power shall be provided to IDOT. These results shall also be provided in tabular form. See sample below:

Sample OTDR Summary						
Cable Designation	<i>TCF-IK-03</i>	OTDR Location:	<i>Pump Sta. 67</i>		Date:	<i>1/1/00</i>
Fiber Number	Event Type	Event Location	Event Loss (dB)	1310 nm	1550 nm	
<i>1</i>	<i>Splice</i>	<i>23500 Ft.</i>	<i>.082</i>	<i>.078</i>		
<i>1</i>	<i>Splice</i>	<i>29000 Ft.</i>	<i>.075</i>	<i>.063</i>		
<i>2</i>	<i>Splice</i>	<i>29000 Ft.</i>	<i>.091</i>	<i>.082</i>		
<i>3</i>	<i>Splice</i>	<i>26000 Ft.</i>	<i>.072</i>	<i>.061</i>		
<i>3</i>	<i>Bend</i>	<i>27000 Ft.</i>	<i>.010</i>	<i>.009</i>		

The following shall be the criteria for the acceptance of the cable:

The test results shall show that the dB/km loss does not exceed +3% of the factory test or 1% of the cable's published production loss. However, no event shall exceed 0.10 dB. If any event is detected above 0.10 dB, the Contractor shall replace or repair the fiber including that event point.

The total loss of the cable (dB), less events, shall not exceed the manufacturer's production specifications as follows: 0.4 dB/km at 1310 nm and 0.5 dB/km at 1550 nm.

If the total loss exceeds these specifications, the Contractor shall replace or repair the cable run at the no additional cost to IDOT, both labor and materials.

At the completion of the test, the Contractor shall provide two copies of documentation of the test results to the Engineer. The test documentation shall be bound and shall include the following:

- Cable & Fiber Identification: Cable ID
- Cable Location - beginning and end point
- Fiber ID, including tube and fiber color
- Operator Name
- Date & Time Setup

Parameters Wavelength
Pulse width (OTDR)
Refractory index (OTDR)
Range (OTDR)
Scale (OTDR)
Setup Option chosen to pass OTDR “dead zone”

Test Results:

Optical Source/Power Meter

Total Attenuation (dB/km)

These results shall be provided in tabular form.

Elevated attenuation due to exceeding the pulling tension during installation shall require the replacement of the cable run at the Contractor's expense, including labor and materials.

The Contractor shall label the destination of each trunk cable onto the cable tag in each handhole and termination panel.

Slack Storage of Fiber Optic Cables.

Included as a part of this item, slack fiber shall be supplied as necessary to allow splicing the fiber optic cables in a controlled environment, such as a splicing van or tent. After splicing has been completed, the slack fiber shall be stored underground in handholes or in the raised base adapters of ground mounted cabinets in accordance with the fiber optic cable manufacturer's guidelines. Fiber optic cable slack shall be 100 feet for each cable at each splice location or communication vault, above or below ground. Fiber optic cable slack shall be 50 feet for each cable communication vaults, heavy duty handholes, and access points, above or below ground, where splicing is not involved. If the innerduct is cut, the ends of the innerduct should extend beyond the first vertical rack so they can be secured at that point. This slack shall be measured for payment.

A waterproof simplex fiber optic split plug with bushing assembly of appropriate size or approved equivalent shall be installed around the fiberoptic cable to seal around the ducts for the conduit(s) entering all communication vaults and is included as part of the fiber optic cable pay item and will not be paid for separately

Basis of Payment: This work will be paid for at the contract unit price per FOOT for FIBER OPTIC CABLE 12 FIBERS, SINGLE MODE, FIBER OPTIC CABLE 48 FIBERS, SINGLE MODE or FIBER OPTIC CABLE 144 FIBERS, SINGLE MODE and shall be payment in full for all labor, equipment, and materials required to provide, install, terminate, splice, and test the fiber optic cable described above complete.

FIBER OPTIC UTILITY MARKER

This work shall be in accordance with the applicable Articles of Sections 810 and 1088 of the Standard Specifications with the following modifications:

Fiber optic utility marker shall be furnished in orange color and incorporate a premium UV inhibitor package to resist harmful effects to the sun. The post shall be capable of withstanding multiple directional impacts and provide a long lasting and extremely durable product requiring little field maintenance. The post shall have a minimum 0.20" wall thickness and shall stand up straight in all weather conditions and self-right to straight upon impact. Top of post hat shall be removable, partially flattened, and transition to round to afford 360-degree visibility. The post materials shall include an anchor, test plate, a non-mechanical flexible joint, fiber optic innerduct split plugs, and a round delineator post.

The Contractor shall furnish and install fiber optic cable markers at each communication vault and every 500 feet along roadways and interchanges. Sign panels shall be non-reflective, 18" (L) x 18" (W), and shall be in accordance with Sections 1090, 1091, and 1092 of the Standard Specifications.

The marker shall have a six-foot tall, 3-1/2" diameter post (white), and orange slide over poly-dome marker (3-1/2" OOD, 16" length) containing the following text: "Warning – Fiber Optic Cable", "IDOT District 9 (618) 549-2171".

The marker shall be designed to self-erect after vehicle impact. Marker installation should be adequate so that marker cannot be pulled out or removed manually.

The Contractor shall submit catalog cut sheets for signs and markers for review by the Department prior to ordering materials.

Contractor shall furnish the Department with fifty additional complete markers to be used for maintenance and repair.

Markers shall be installed so that all lengths of installed fiber optic cables in new conduit have a minimum of one marker. A minimum of two markers shall be installed along each fiber optic cable path in new conduit so that one forward and one behind are always visible. A marker shall be installed at each point along the fiber optic cable path where a 45-degree or greater change in direction occurs. Markers shall be installed at a maximum of 24 inches lateral displacement from the actual placement of the conduit and fiber optic cabling and shall be installed no later than 3 days following the installation of conduit that contains fiber optic cables or of direct buried fiber optic cables. The Contractor shall safeguard the conduit and cables during the installation of the markers and remove and replace any conduit or cables that are damaged during marker installation at no additional cost to the Department.

Test plate (terminal board) shall be preconfigured 11-hole terminal board easily accessible by removing the cap from the fiber optic marker. The ground wire and fiber cable shields shall be extended from the communications vault and terminated on the test plate. The fiber cable shields shall be labeled as shown in the plans. The label material shall be weather resistant, and the markings shall be non-fading.

The Contractor shall furnish and install all materials required for marker installation. The Contractor shall restore the ground to its original condition including topsoil, sand, concrete, or other required materials and dispose of surplus materials.

Basis of Payment:, This work will be paid for at the contract unit price per EACH for FIBER OPTIC UTILITY MARKER, which price shall be payment in full for all labor, materials, and equipment required and as detailed in this special.

HQ FIBER OPTIC CONNECTIVITY

Description

This work shall consist of furnishing and installing fiber optic patch cable(s) and small form-factor pluggable (SFP) transceiver(s) at the IDOT District 9 office for the purpose of establishing Layer 3 connectivity between the existing Layer 3 network switch at the IDOT District 9 office and the proposed Layer 3 network switch being installed in the traffic signal cabinet at the Reed Station Road traffic signal cabinet.

The transceiver(s) shall be plugged into the port(s) shown below, and the fiber optic jumper(s) shall be installed between the ports on the fiber optic patch panel and the network switch as shown below and as directed by the Engineer.

Material

The Contractor shall furnish and install the following:

Small Form-Factor Plug (SFP) transceiver

Primary backbone communications

The small form-factor plug (SFP) transceiver shall be Cisco SFP-10G-LR or approved equivalent. The SFP shall be capable of 10 Gbps communications speed and able to communicate a distance of up to 10 kilometers (6.21 miles). If the distance of the fiber backbone cable is longer than 10 kilometers (6.21 miles), then a Cisco SFP-10G-ER or approved equivalent shall be used.

The Contractor shall verify the distance between the 2 end points using a OTDR to confirm that the correct SFP is purchased and installed.

The SFP transceiver shall be installed on port 30 (TE/G port 6) of the switch and as directed by the Engineer.

Single Mode Fiber Optic Patch Cable

The single mode fiber optic patch cable, duplex, LC to LC connectors shall be Corning part number 040402R5120003M or approved equivalent. The cable shall be factory terminated, and factory test result(s) shall be included as part of the submittal. The Contractor shall perform a continuity test prior to the installation of the cable(s) to ensure that the cable(s) was not damaged during transport.

The single mode fiber optic patch cable shall be installed between FPP ports 109-110 (K1-K2) and port 30 (TE/G port 6) of the switch and as directed by the Engineer.

Construction Requirements

A pre-installation site visit to the IDOT District 9 building shall be conducted by the Contractor along with the Engineer a minimum of two (2) weeks in advance of the Contractor ordering the material and scheduling the associated work for the purpose of planning and inspecting the work to be completed at this site.

The installation of the single mode fiber optic patch cable shall be in accordance with and installed per manufacturer's installation guidelines and recommendations, which shall not exceed the cable bending radius both during installation and once completed. The fiber optic patch cables shall be neatly dressed, labeled, and fastened to the equipment rack with the appropriate hardware. Tie wraps are not permitted, and all equipment and cables shall be labeled.

The Contractor shall confirm with the Engineer and the IDOT District 9 Office that a 10Gbps network link has been established between the 2 end switches once all installation is complete.

Basis of Payment. This work will be paid for at the contract unit price per LUMP SUM for HQ FIBER OPTIC CONNECTIVITY, which shall be payment in full for all hardware, labor, equipment, and materials required to meet all the requirements described above complete.

ETHERNET MANAGE SWITCH

Description

This work shall consist of furnishing, configuring, installing, and testing network communications equipment and associated infrastructure (e.g., power supply(ies), SFP modules, etc.) in the existing or proposed traffic signal cabinet(s) as shown in the plans and as designated by the Engineer, complete with all the hardware and accessories required for the intended use of the equipment.

Material

The Layer 3 ethernet network switch communications equipment or approved equal and ancillary materials shall be provided as depicted in the table below and as shown on the plans. The ethernet switch with power supply(ies) shall be installed within the equipment rack and connected to other equipment using the small form-factor pluggable (SFP) transceiver modules noted and the copper ports within the switch as shown on the plans and as directed by the Engineer. The Contractor shall also provide all equipment and items listed including any ancillary material (fiber optic cable jumpers, ethernet patch cables, connectors, mounting hardware, labels, cable ties, equipment grounding connection, etc.) required for successfully connecting between the ethernet network communications equipment, switches, and fiber optic termination panels without the use of adapters or gender changer ("gender benders") at each identified location and as shown on the plans. In addition, the Contractor shall supply one (1) spare fiber optic cable jumper and

ethernet patch cable with the required connector type and of appropriate length per each ethernet switch shown below as well.

Network Switch:

The network switch shall be Antaira LMX-2828G-10G-SFP or approved equivalent. The network switch shall be a 28-Port Industrial Gigabit Managed Ethernet Switch, with at least sixteen (16) 100/1000 SFP Slots, eight (8) Gigabit Combo Ports (10/100/1000Tx RJ45 and 8*100/1000 SFP Slots), and Four (4) 10G SFP Slots. The network switch shall come with the appropriate power supply and mounting hardware.

In addition the switch shall be capable of the following requirements:

- Network redundancy: RSTP
- Layer 3 routing protocols: RIP, OSPF, and Static Routing Table
- Supports VRRP protocol
- Configuration: Web Console, Telnet, CLI Command
- IGMP for multicast traffic filtering
- QoS (IEEE 802.1p)
- IEEE802.1Q VLAN for easy network planning
- IEEE802.1X, SNMP v1/v2/v3
- Capable of providing local syslog information
- Link aggregation for more throughput
- Support port mirroring for online diagnostic
- Minimum of 3-Year warranty

Small Form-Factor Plug (SFP) transceiver:

The Contractor shall install two (2) different types of SFPs as described below. One (1) type shall be 10 Gigabits per second (Gbps) capable and shall be used for primary Layer 3 communications between the Layer 3 switches. The other type shall be 1 Gbps capable and shall be used to communicate with the intersection switches. The number of SFPs of each type shall be installed in the ports in each switch per the description below.

Primary backbone communications

The small form-factor plug (SFP) transceiver shall be Cisco SFP-10G-LR or approved equivalent. The SFP shall be capable of 10 Gbps communications speed and able to communicate a distance up to 10 kilometers (6.21 miles). If the distance of the fiber backbone cable is longer than 10 kilometers (6.21 miles), then a Cisco SFP-10G-ER or approved equivalent shall be used.

The Contractor shall verify the distance between the 2 end points using a OTDR to confirm that the correct SFP is purchased and installed.

At the Reed Station Road traffic signal cabinet, two (2) SFP transceivers shall be installed on ports 25 and 26 of the switch and as directed by the Engineer. At the I-57 traffic signal cabinet, three (3) SFP transceivers shall be installed on ports 25, 26, and 27 of the switches. At the IL 37 traffic signal cabinet, two (2) SFP transceivers shall be installed on ports 25 and 26 of the switch and as directed by the Engineer.

Intersection communications

The small form-factor plug (SFP) transceiver shall be Cisco GLC-LH-SMD= or approved equivalent. The SFP shall be capable of 1 Gbps communications speed and able to communicate a distance up to 10 kilometers (6.21 miles). If the distance of the cable is longer than 10 kilometers (6.21 miles), then a Cisco GLC-EX-SMD= or approved equivalent shall be used.

The Contractor shall verify the distance between the 2 end points using a OTDR to confirm that the correct SFP is purchased and installed.

At the Reed Station Road, I-57, and IL 37 traffic signal cabinet, four (4) SFP transceivers shall be installed on ports 1, 2, 9, and 10 of each manage switch and as directed by the Engineer.

Single Mode Fiber Optic Patch Cable

The single mode fiber optic patch cable, duplex, LC to LC connectors shall be Corning part number 040402R5120003M or approved equivalent. The cable shall be at least 3 meters long and factory terminated, and the factory test result(s) shall be included as part of the submittal. The Contractor shall perform a continuity test prior to the installation of the cable(s) to ensure that the cable(s) was not damaged during transport.

The single mode patch cables shall be installed between the fiber patch panel (FPP) and switch SFP port(s) as detailed in the table below and proposed splice at Reed Road handhole detail or as directed by the Engineer:

FAP ROUTE 331/ FAI ROUTE 57 (IL 13/ I-57)
SECTION D9 TRAFFIC SIGNAL 2021-1
JACKSON AND WILLIAMSON COUNTIES
CONTRACT NO. 78879

LOCATION	FPP (WEST) PORT	FPP (EAST) PORT	FPP (DMS) PORT	SWITCH SFP PORT	SFP Type	
Reed Station Road	1-2 (Intersections)			9	1 Gbps	
	7-8 (Intersections)			17		
		1-2 (Intersections)			10	1 Gbps
		7-8 (Intersections)			18	
	1-2 (Backbone)			33	10 Gbps	
		1-2 (Backbone)		34		
I-57	97-98			9	1 Gbps	
	103-104			17		
		97-98		10	1 Gbps	
		103-104		18		
	109-110			33	10 Gbps	
		109-110		34		
				1-2	25	1 Gbps
IL 37	97-98			9	1 Gbps	
	103-104			17		
		97-98			10	1 Gbps
		103-104			18	
	109-110			33	10 Gbps	

Construction Requirements

The Contractor shall procure the switches and power supplies as described above. Once all units are ready for programming, the Contractor shall provide notification to the Engineer and IDOT D9 to schedule the programming and/or configuration of the equipment by IDOT's network integrator. At least thirty (30) days prior to the scheduled field installation, the Contractor shall label the switches for the appropriate sites and drop it off at the location as directed by the Engineer and IDOT for programming.

Once programming has been completed, the Contractor shall pick up the equipment and shall locate shelf space or another suitable mounting location in the traffic signal cabinets or as identified on the plans. The Contractor shall secure the switch and power supply as appropriate and approved by the Engineer in accordance with the manufacturer's installation requirements. The equipment shall be permanently and securely mounted, and all corresponding power and communications cables shall be neatly dressed, labeled, and fastened to the equipment rack with the appropriate hardware. Tie wraps are not permitted. The Contractor shall perform all network switch and corresponding communications equipment connections in the presence of the Engineer.

When all equipment is installed and connected, the Contractor shall test and demonstrate the performance of the installed network communications equipment to ensure that data is being transmitted to the IDOT building.

All equipment shall be warranted and guaranteed against defects and failure in design and materials for a minimum of three (3) years from the date of delivery, as recorded by the Engineer. The warranty period shall not begin until the date the Engineer issues and records final acceptance of all materials listed above. The Contractor shall transfer all manufacturer warranty information to the Engineer prior to final acceptance notification by the Engineer. In the event that a manufacturers standard warranty does not cover the entire period of the warranty required by IDOT, the Contractor shall procure and furnish to IDOT an extended manufacturer's warranty or provide its own warranty covering the additional time.

The Contractor shall submit the warranty terms as part of the submittals for each material item. The warranty shall provide that, in the event of malfunction during the warranty period, the defective system component shall be replaced with a new component by the Contractor or their representative within five (5) working days. Any component that, in the opinion of the Engineer, fails three (3) times prior to the expiration of the warranty will be judged as unsuitable and shall be replaced by the Contractor or representative with a new component of the same type at no additional cost or expense to IDOT. The unsuitable component shall be permanently removed from the project by the Contractor.

Basis of Payment. This work will be paid for at the contract unit price per EACH for ETHERNET MANAGE SWITCH, which shall be payment in full for all labor, equipment, and materials required to provide and install the equipment described above complete.

ETHERNET SWITCH

Description

This work shall include supplying, installing, configuring, and powering ethernet switches at locations designated in the plans and as directed by the Engineer for the purpose of interfacing with fiber optic network(s).

The Contractor shall procure all the switches and power supplies. Once all units are ready for programming, the Contractor shall provide notification to the Engineer and IDOT D9 to schedule the programming and/or configuration of the equipment by IDOT's network integrator. At least thirty (30) days prior to the scheduled field installation, the Contractor shall label the switches for the appropriate sites and drop it off at the location as directed by the Engineer and IDOT for programming.

Once programming has been completed, the Contractor shall pick up the equipment and shall locate shelf space or another suitable mounting location in the traffic signal cabinets or as identified on the plans. The Contractor shall secure the switch and power supply as appropriate and approved by the Engineer in accordance with the manufacturer's installation requirements. The equipment shall be permanently and securely mounted, and all corresponding power and communications cables shall be neatly dressed, labeled, and fastened to the equipment rack with

the appropriate hardware. Tie wraps are not permitted. The Contractor shall perform all network switch and corresponding communications equipment connections in the presence of the Engineer.

The Contractor shall install all necessary patch cords, optical transceivers, connectors, power supplies, communication transformers, or auxiliary equipment necessary to complete the communication circuits at full functional potential. The Contractor shall connect the switch to the field devices as indicated on the plans.

When all equipment is installed and connected, the Contractor shall test and demonstrate the performance of the installed network communications equipment to ensure that data is being transmitted to the IDOT building.

The Ethernet Switch shall meet the following material specifications:

1. Overall switch station capacity and flexibility: Managed Gigabit Ethernet switch with 7 10/100BaseT(X) ports and 3 10/100/1000BaseT(X) or 100/1000BaseSFP combo ports, with -40 to 75°C operating temperature. In addition, the switch shall include a SFP module with 2 1000BaseLX port with LC connector for 10 km transmission, with -40 to 85°C operating temperature. The SFP module shall be fully compatible with the SFPs furnished and installed as part of ethernet manage switch provided at the IDOT District 9 building to ensure communications to equipment in field cabinets”
2. Cabling options: The switch shall be able to utilize a variety of connecting interfaces including 10/100Base(T)X, 10/100/1000Base(T)X, and 1000BaseSX/LX/LHX/ZX (LC connector).
3. Port configuration options: Port configurations shall be accessible via a standard web browser without requiring special vendor software. Port configuration changes shall be possible by personnel without special IT training. The configuration can be done via a console UI, telnet connection, or command line interface. All T(X) ports shall provide cable autocross capability.

The Ethernet Switch shall be compatible with following network and software requirements:

1. Networking and Software: The Ethernet switches shall be IEEE802.3/802.3u/802.3ab/802.3z/802.3x/802.1D-2004/802.1w/802.1s/802.1Q/802.1p/802.1X/802.3ad compliant. The switch shall support the following standards and software interfaces:
 - a. Redundant fast/gigabit ethernet ring capability
 - b. IGMP snooping and GMRP for filtering multicast traffic from industrial ethernet protocols
 - c. Supports IEEE 802.1Q VLAN and GVRP protocol to ease network planning
 - d. Supports QoS-IEEE 802.1p/1Q and TOS/DiffServ to increase determinism
 - e. Supports 802.3ad, LACP for optimum bandwidth utilization
 - f. Supports TACACS+, SNMPv3, IEEE 802.1X, HTTPS, and SSH to enhance network security
 - g. Support EtherNet/IP, PROFINET, and Modbus/TCP protocols for device management and monitoring
 - h. SNMPv1/v2c/v3 for different levels of network management security
 - i. Bandwidth management to prevent unpredictable network status
 - j. Lock port for authorized MAC address access only

- k. Port mirroring for online debugging
 - l. Automatic warning by exception through e-mail, relay output
 - m. Digital inputs to integrate a sensor and alarm with an IP network
 - n. Automatic recovery of connected device IP addresses
 - o. Line-swap fast recovery
2. Port trunking for flexible network connection: maximum of four trunk groups for all gigabit ports with maximum of 8 trunk ports for each trunk group shall be available. The user shall be able to either choose the type of the trunk group to be "Static" or "LACP."
 3. IP Addressing Approach Options: IP addresses shall be set over the network using BootP/DHCP. The user shall have the capability to disable BootP or DHCP network based IP address changes. In addition, the switch shall support both a serial port and web page-based manual (static) addressing approach.
 4. Ethernet packet transfer accuracy and capacity: The switch shall be capable of forwarding valid ethernet frames using the store and forward method or equivalent method, and the address table shall have a maximum capacity of 8192 addresses.
 5. Quality of service functions enhance determinism: The switches shall be able to read IEEE 802.1Q VLAN priority tags and support a minimum of a low, normal, medium, and high priority buffer. High priority messages shall be able to process before low priority messages. It also shall support QoS-IEEE 802.1p/1Q and TOS/DiffServ.
 6. SNMP Traps: The switches shall support sending SNMP messages to maximum 2 SNMP "Trap" server, and the SNMP traps IP addresses shall be settable through a web browser interface.
 7. Multicast message control for filtering multicast traffic: The switches shall be able to support IEEE 802.1D-1998 GMRP (GARP Multicast Registration Protocol) and IGMP (Internet Group Management Protocol).
 8. Port access control enhances user authentication: The switches shall support IEEE 802.1X and static port lock for port-base access control.
 9. Accessible IP Settings: It shall allow the user to add or remove "Legal" remote host IP addresses to prevent unauthorized access. Access to switch shall be controlled by IP address. That is, if a host's IP address is in the accessible IP table, then the host shall be allowed access to the switch.
 10. Additional network and software requirements shall be met:
 - a. IEEE 802.1X, HTTPS, and SSH to enhance network security
 - b. Bandwidth management prevents unpredictable network status
 - c. Port mirroring for online debugging
 - d. Automatic warning by exception through email and relay output
 - e. Digital inputs to integrate sensors and alarms with IP networks
 - f. Automatic recovery of connected device's IP addresses
 - g. Line-swap fast recovery
 - h. Support EDS-SNMP OPC Server Pro
 - i. Software based IEEE 1588 PTP (Precision Time Protocol) for precise time synchronization of networks
 - j. DHCP Option 82 for IP address assignment with different policies
 - k. Modbus/TCP / EtherNet/IP / PROFINET industrial ethernet protocols supported
 - l. Supports LLDP (Link Layer Discovery Protocol)
 - m. Turbo Ring™ and Turbo Chain™ (< 20ms recovery time for fast Ethernet ports and < 50 ms recovery time for Gigabit Ethernet ports at full load) and STP/RSTP (IEEE 802.1w/D)

The Ethernet Switch shall meet the following general installation requirements:

1. Mounting: The switch shall be DIN-Rail or wall mountable
2. Power supply: Low voltage ranges: 12/24/48 VDC (9.6-60 VDC). In addition, a provision shall be made such that the loss of a power supply may be user configurable to trigger a hardware (i.e. relay contact), SNMP, e-mail, and web page alarms.
3. Environmental specifications: Temperature & humidity - The switch shall have operating temperature ranges of -10 to 60°C or -40 to 75°C. In addition, the switch shall be rated to withstand a maximum continuous operating humidity of 95% without condensation.
4. Electronical Noise Immunity: The switch will conform to the IEC61000-4-2 to 4-8 series of noise specifications as specified below:
 - IEC 61000-4-2 Electrostatic Discharge: Criterion A
 - IEC 61000-4-3 Radiated Noise Immunity: Criterion A
 - IEC 61000-4-4 Fast Transient (Burst) Withstand: Criterion A
 - IEC 61000-4-5 Surge Voltage: Criterion A
 - IEC 61000-4-6 Conducted Noise Interference: Criterion A
 - IEC 61000-4-8 Electromagnetic Field withstand: Criterion A
 - IEC 61000-4-12
 - IEC 61000-4-29
5. Shock & Vibration: The operating shock rating shall conform to IEC60068-2-27 and withstand a 15 g, 11 ms duration, and 18 shocks. In addition, the operating vibration spec shall conform to IEC60068-2-6 (Criterion 3) at 1 mm, 2 Hz - 13.2 Hz, 90 min.; 0.7g, 13.2 Hz - 100 Hz, 90 min.; 3.5 mm, 3 Hz - 9 Hz, 10 cycles, 1 octave/min.; 1g, 9 Hz - 150 Hz, 10 cycles, 1 octave/min.
6. Switch shall be compliant with IEC 62443-4-2.

The Ethernet Switch shall meet the following hardware-based diagnostics and user interfaces requirements:

1. Alarm contact: The switch shall contain an alarm contact that can be configured via standard web browser to annunciate the drop out of either or both power supply inputs and/or to annunciate the active link status of any combination of ports. A Fault LED will be provided to indicate the status of the alarm contact.
2. LED Indications
3. Diagnostic display for internal switch status
4. Serial Port: The switch shall include a USB serial port that can be accessed by computers with hyper terminal or equivalent capability. The serial console connection manner shall require a short USB cable applied to connect the switch to a PC's USB port.

The Ethernet switch shall meet the following security requirements:

1. Port Disable: unused ports shall be able to be disabled to prevent unauthorized access.
2. It shall support IEEE 802.1X and SSL to enhance network security.
3. Switch configuration password protection
4. https/SSL

The Ethernet switch shall have following communication redundancy:

1. The switch shall be able to detect and compensate for the failure of another switch, cable disruption, or hardware failure of one or more ports.
2. IEEE standards based redundancy, including IEEE 802.1D/W spanning tree Turbo Ring: Gigabit Ethernet redundant ring capability (Turbo Ring V2: recovery time <20ms for fast

Ethernet ports; < 50 ms for Gigabit Ethernet ports). Ring coupling function to integrate different Turbo Ring for distributed application.

3. Turbo Chain function for a multiple-ring architecture (recovery time <20ms for fast Ethernet ports; <50 ms for Gigabit Ethernet ports)

The Ethernet switch shall be compatible with following software suite that assists with installation, operation, maintenance, and diagnostics of the existing network:

1. The switch must be compliant with a mass configuration tool:
 - a. The tool must contain a security wizard for convenient setup of security-related parameters.
 - b. The tool must allow for topology analysis to eliminate manual setting errors
 - c. The tool must contain a configuration overview for efficient management
2. The switch shall be compliant with network management software (NMS).
 - a. The NMS must allow for auto-discovery of network devices and physical connections.
 - b. The NMS must allow for event playback for quick troubleshooting
 - c. The NMS must allow for color-coded VLAN/IGMP groups and other visualized network data.
 - d. The NMS must allow for a security view for the security status of network devices.
 - e. The NMS must support a mobile app for remote monitoring and notification.
3. The switch must be compliant with a stand-alone data collection tool to take network snapshots for quick troubleshooting.
 - a. The collection tool must allow for the ability to compare network and device data and then highlight the differences.

Basis of Payment. This work will be paid for at the contract unit price per EACH for ETHERNET SWITCH, which price shall be payment in full for all labor, materials, and equipment required and as detailed in this special provision.

DRILL EXISTING FOUNDATION

This work shall consist of drilling all the proper sized holes at a specified foundation to complete conduit installation in accordance with Section 879. Each hole drilled will be considered as a unit. The method for drilling shall be approved by the Engineer to prevent the signal cabinet components from being covered/damaged from concrete debris/dust.

This work will be paid for at the contract unit price per EACH for DRILL EXISTING FOUNDATION, and no additional compensation will be allowed.

POTHOLING UNDERGROUND UTILITIES

Description

This item shall consist of the process of exposing and determining the location of existing underground utilities to avoid “blind” or obtrusive bores. This process is commonly referred to as potholing.

The Contractor shall pothole all underground utilities within project limits to the frequency as directed by the Engineer. Prior to exposing any utilities, the Contractor shall locate all applicable existing utilities as required by JULIE law and obtain any permits or approvals for access required to perform the work. The Contractor shall also establish traffic control if required by the Engineer according to applicable traffic control standards.

Methods and Equipment

The Contractor shall provide 6” diameter minimum potholes by an approved method, either hand dug or machine dug, at the frequency and locations specified by the Engineer. All proposed utility crossings shall be exposed and potholed beyond the depth of the Contractor’s excavation of work at that location for both inspection and verification of vertical utility clearances. The Contractor shall submit any surveyed elevation data to the Engineer to be included in the As-Built plans.

Construction Requirements

The Contractor shall make efforts to protect all open potholes during construction activities. The Contractor shall notify the Engineer immediately if any utility is damaged during construction or if any utility conflicts with the proposed work.

Backfilling Requirements

All potholes made from utility exploration shall be pumped dry, and any mud or loose material within the space removed before backfilling. The potholes shall be backfilled as follows.

1. For potholes made within 2 ft (600 mm) of pavement, curb, gutter, curb and gutter, or stabilized shoulder, the potholes shall be backfilled with controlled low-strength material (CLSM) according to Articles 593.01, 593.02, 593.03, and 593.04.
2. For potholes made within 2 ft (600 mm) of sidewalk or aggregate surfaces, the potholes shall be backfilled with porous granular material according to Articles 207.01, 207.02, and 207.03.
3. All other potholes shall be backfilled with select material. The select material shall be from excavation or borrow, free from large or frozen lumps, clods, or rock, and meeting the approval of the Engineer. The material shall be placed in lifts not exceeding 8 in. (200mm) in depth, loose measurement, and compacted to the satisfaction of the Engineer.

Removal and replacement of existing sidewalk, pavement, and islands only for utility locating purposes will not be paid for separately but shall be included in the contract bid price for POTHOLING.

Method of Measurement

Measurement for payment will be each per pothole as indicated or as agreed upon, directed by, or approved by the Engineer. Multiple potholes made to obtain the location of a singular utility facility to be crossed at the same location will be measured as EACH per pothole per facility.

Basis of payment. This work will be paid for at the contract unit price per EACH for POTHOLING as measured from the existing ground surface to the top of the exposed utility. This price includes all labor, equipment, and incidentals associated with the excavation including any survey, backfilling, or patching.

CONTRACT GUARANTEE

The Contractor shall guarantee all electrical equipment, apparatus, materials, and workmanship provided under the contract for a period of six (6) months after the date of final inspection according to Article 801.14. All instruction sheets required to be furnished by the manufacturer for materials and supplies and for operations shall be delivered to the Engineer prior to the acceptance of the project, with the following warranties and guarantees:

1. The manufacturer's standard written warranty for each piece of electrical equipment or apparatus furnished under the contract.
2. The Contractor's written guarantee that, for a period of six (6) months after the date of final inspection of the project, all necessary repairs to or replacement of said warranted equipment or apparatus shall be made by the Contractor at no cost to the Department.
3. The Contractor's written guarantee for satisfactory operation of all electrical systems furnished and constructed under the contract for a period of 6 months after final inspection of the project.
4. Subject to the requirements of Article 107.30, the Contractor will be required to locate the fiber optic cable as needed throughout the project limits until the date of final acceptance. No additional compensation will be provided for this work.

AS-BUILT DOCUMENTATION

The Contractor shall locate all new conduit and communication vaults every 100 feet using a GIS locating device that is accurate to the nearest foot.

The Contractor shall provide a GIS based map of the conduit route and a complete listing of all of map coordinates in an electronic format (Google Earth KML or KMZ shape file).

Basis of Payment. This work will not be paid for separately but shall be included in the contract bid price for UNDERGROUND CONDUIT, COILABLE NONMETTALIC CONDUIT.

TRAFFIC SIGNAL SYSTEM SHUTDOWN

Before the any traffic signal shutdown, both District 9 Bureau of Operations and the local police department shall be notified 48 hours in advance. The police department shall also be given the anticipated duration of the shutdown.

The existing system may be shut down for one (1) working day to switch over to the new traffic signal cabinet. During the shutdown, the Contractor shall maintain flashing red lights at each intersection. The Contractor shall also provide and erect stop signs while signals are in the red flashing mode.

At all intersections where the signal cabinets are to be modified and the controller replaced, the Contractor shall install as much of the fiber optic equipment as possible with the signals in operation before switching over to red flash to keep the shutdown to a minimum.

BLENDED FINELY DIVIDED MINERALS (BDE)

Effective: April 1, 2021

Revise the second paragraph of Article 1010.01 of the Standard Specifications to read:

“Different sources or types of finely divided minerals shall not be mixed or used alternately in the same item of construction, except as a blended finely divided mineral product according to Article 1010.06.”

Add the following article to Section 1010 of the Standard Specifications:

“1010.06 Blended Finely Divided Minerals. Blended finely divided minerals shall be the product resulting from the blending or intergrinding of two or three finely divided minerals. Blended finely divided minerals shall be according to ASTM C 1697, except as follows.

- (a) Blending shall be accomplished by mechanically or pneumatically intermixing the constituent finely divided minerals into a uniform mixture that is then discharged into a silo for storage or tanker for transportation.
- (b) The blended finely divided mineral product will be classified according to its predominant constituent or the manufacturer’s designation and shall meet the chemical requirements of its classification. The other finely divided mineral constituent(s) will not be required to conform to their individual standards.”

COMPENSABLE DELAY COSTS (BDE)

Effective: June 2, 2017

Revised: April 1, 2019

Revise Article 107.40(b) of the Standard Specifications to read:

“(b) Compensation. Compensation will not be allowed for delays, inconveniences, or damages sustained by the Contractor from conflicts with facilities not meeting the above definition; or if a conflict with a utility in an unanticipated location does not cause a shutdown of the work or a documentable reduction in the rate of progress exceeding the limits set herein. The provisions of Article 104.03 notwithstanding, compensation for delays caused by a utility in an unanticipated location will be paid according to the provisions of this Article governing minor and major delays or reduced rate of production which are defined as follows.

- (1) Minor Delay. A minor delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two hours, but not to exceed two weeks.

- (2) Major Delay. A major delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two weeks.
- (3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the rate of production on the work in conflict with the utility in an unanticipated location decreases by more than 25 percent and lasts longer than seven calendar days.”

Revise Article 107.40(c) of the Standard Specifications to read:

“(c) Payment. Payment for Minor, Major, and Reduced Rate of Production Delays will be made as follows.

- (1) Minor Delay. Labor idled which cannot be used on other work will be paid for according to Article 109.04(b)(1) and (2) for the time between start of the delay and the minimum remaining hours in the work shift required by the prevailing practice in the area.

Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).

- (2) Major Delay. Labor will be the same as for a minor delay.

Equipment will be the same as for a minor delay, except Contractor-owned equipment will be limited to two weeks plus the cost of move-out to either the Contractor’s yard or another job and the cost to re-mobilize, whichever is less. Rental equipment may be paid for longer than two weeks provided the Contractor presents adequate support to the Department (including lease agreement) to show retaining equipment on the job is the most economical course to follow and in the public interest.

- (3) Reduced Rate of Production Delay. The Contractor will be compensated for the reduced productivity for labor and equipment time in excess of the 25 percent threshold for that portion of the delay in excess of seven calendar days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Payment for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be determined according to Article 109.13.”

Revise Article 108.04(b) of the Standard Specifications to read:

“(b) No working day will be charged under the following conditions.

- (1) When adverse weather prevents work on the controlling item.
- (2) When job conditions due to recent weather prevent work on the controlling item.

- (3) When conduct or lack of conduct by the Department or its consultants, representatives, officers, agents, or employees; delay by the Department in making the site available; or delay in furnishing any items required to be furnished to the Contractor by the Department prevents work on the controlling item.
- (4) When delays caused by utility or railroad adjustments prevent work on the controlling item.
- (5) When strikes, lock-outs, extraordinary delays in transportation, or inability to procure critical materials prevent work on the controlling item, as long as these delays are not due to any fault of the Contractor.
- (6) When any condition over which the Contractor has no control prevents work on the controlling item.”

Revise Article 109.09(f) of the Standard Specifications to read:

“(f) Basis of Payment. After resolution of a claim in favor of the Contractor, any adjustment in time required for the work will be made according to Section 108. Any adjustment in the costs to be paid will be made for direct labor, direct materials, direct equipment, direct jobsite overhead, direct offsite overhead, and other direct costs allowed by the resolution. Adjustments in costs will not be made for interest charges, loss of anticipated profit, undocumented loss of efficiency, home office overhead and unabsorbed overhead other than as allowed by Article 109.13, lost opportunity, preparation of claim expenses and other consequential indirect costs regardless of method of calculation.

The above Basis of Payment is an essential element of the contract and the claim cost recovery of the Contractor shall be so limited.”

Add the following to Section 109 of the Standard Specifications.

“**109.13 Payment for Contract Delay.** Compensation for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be allowed when such costs result from a delay meeting the criteria in the following table.

Contract Type	Cause of Delay	Length of Delay
Working Days	Article 108.04(b)(3) or Article 108.04(b)(4)	No working days have been charged for two consecutive weeks.
Completion Date	Article 108.08(b)(1) or Article 108.08(b)(7)	The Contractor has been granted a minimum two week extension of contract time, according to Article 108.08.

Payment for each of the various costs will be according to the following.

- (a) Escalated Material and/or Labor Costs. When the delay causes work, which would have otherwise been completed, to be done after material and/or labor costs have increased, such increases will be paid. Payment for escalated material costs will be limited to the

increased costs substantiated by documentation furnished by the Contractor. Payment for escalated labor costs will be limited to those items in Article 109.04(b)(1) and (2), except the 35 percent and 10 percent additives will not be permitted.

(b) Extended Project Overhead. For the duration of the delay, payment for extended project overhead will be paid as follows.

(1) Direct Jobsite and Offsite Overhead. Payment for documented direct jobsite overhead and documented direct offsite overhead, including onsite supervisory and administrative personnel, will be allowed according to the following table.

Original Contract Amount	Supervisory and Administrative Personnel
Up to \$5,000,000	One Project Superintendent
Over \$ 5,000,000 - up to \$25,000,000	One Project Manager, One Project Superintendent or Engineer, and One Clerk
Over \$25,000,000 - up to \$50,000,000	One Project Manager, One Project Superintendent, One Engineer, and One Clerk
Over \$50,000,000	One Project Manager, Two Project Superintendents, One Engineer, and One Clerk

(2) Home Office and Unabsorbed Overhead. Payment for home office and unabsorbed overhead will be calculated as 8 percent of the total delay cost.

(c) Extended Traffic Control. Traffic control required for an extended period of time due to the delay will be paid for according to Article 109.04.

When an extended traffic control adjustment is paid under this provision, an adjusted unit price as provided for in Article 701.20(a) for increase or decrease in the value of work by more than ten percent will not be paid.

Upon payment for a contract delay under this provision, the Contractor shall assign subrogation rights to the Department for the Department’s efforts of recovery from any other party for monies paid by the Department as a result of any claim under this provision. The Contractor shall fully cooperate with the Department in its efforts to recover from another party any money paid to the Contractor for delay damages under this provision.”

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (BDE)

Effective: September 1, 2000

Revised: March 2, 2019

FEDERAL OBLIGATION. The Department of Transportation, as a recipient of federal financial assistance, is required to take all necessary and reasonable steps to ensure nondiscrimination in the award and administration of contracts. Consequently, the federal regulatory provisions of 49 CFR Part 26 apply to this contract concerning the utilization of disadvantaged business enterprises. For the purposes of this Special Provision, a disadvantaged business enterprise (DBE) means a business certified by the Department in accordance with the requirements of 49 CFR Part 26 and listed in the Illinois Unified Certification Program (IL UCP) DBE Directory.

STATE OBLIGATION. This Special Provision will also be used by the Department to satisfy the requirements of the Business Enterprise for Minorities, Females, and Persons with Disabilities Act, 30 ILCS 575. When this Special Provision is used to satisfy state law requirements on 100 percent state-funded contracts, the federal government has no involvement in such contracts (not a federal-aid contract) and no responsibility to oversee the implementation of this Special Provision by the Department on those contracts. DBE participation on 100 percent state-funded contracts will not be credited toward fulfilling the Department's annual overall DBE goal required by the US Department of Transportation to comply with the federal DBE program requirements.

CONTRACTOR ASSURANCE. The Contractor makes the following assurance and agrees to include the assurance in each subcontract the Contractor signs with a subcontractor.

The Contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of contracts funded in whole or in part with federal or state funds. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (a) Withholding progress payments;
- (b) Assessing sanctions;
- (c) Liquidated damages; and/or
- (d) Disqualifying the Contractor from future bidding as non-responsible.

OVERALL GOAL SET FOR THE DEPARTMENT. As a requirement of compliance with 49 CFR Part 26, the Department has set an overall goal for DBE participation in its federally assisted contracts. That goal applies to all federal-aid funds the Department will expend in its federally assisted contracts for the subject reporting fiscal year. The Department is required to make a good faith effort to achieve the overall goal. The dollar amount paid to all approved DBE companies performing work called for in this contract is eligible to be credited toward fulfillment of the Department's overall goal.

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. The determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates, in the absence of unlawful discrimination and in an arena of fair and open competition, DBE companies can be expected to perform **0.00%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work. A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set for in this Special Provision:

- (a) The bidder documents enough DBE participation has been obtained to meet the goal or,
- (b) The bidder documents a good faith effort has been made to meet the goal, even though the effort did not succeed in obtaining enough DBE participation to meet the goal.

DBE LOCATOR REFERENCES. Bidders shall consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217) 785-4611, or by visiting the Department's website at:
<http://www.idot.illinois.gov/doing-business/certifications/disadvantaged-business-enterprise-certification/il-ucp-directory/index>.

BIDDING PROCEDURES. Compliance with this Special Provision is a material bidding requirement and failure of the bidder to comply will render the bid not responsive.

The bidder shall submit a DBE Utilization Plan (form SBE 2026), and a DBE Participation Statement (form SBE 2025) for each DBE company proposed for the performance of work to achieve the contract goal, with the bid. If the Utilization Plan indicates the contract goal will not be met, documentation of good faith efforts shall also be submitted. The documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor is selected over a DBE for work on the contract. The required forms and documentation must be submitted as a single .pdf file using the "Integrated Contractor Exchange (iCX)" application within the Department's "EBids System".

The Department will not accept a Utilization Plan if it does not meet the bidding procedures set forth herein and the bid will be declared not responsive. In the event the bid is declared not responsive, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty and may deny authorization to bid the project if re-advertised for bids.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan is approved. All information submitted by the bidder must be complete, accurate and adequately document enough DBE participation has been obtained or document the good faith efforts of the bidder, in the event enough DBE participation has not been obtained, before the Department will commit to the performance of the contract by the bidder. The Utilization Plan will be approved by the Department if the Utilization Plan documents sufficient commercially useful DBE work to meet the contract goal or the bidder submits sufficient documentation of a good faith effort to meet the contract goal pursuant to 49 CFR Part 26, Appendix A. This means the bidder must show that all necessary and reasonable steps were taken to achieve the contract goal. Necessary and reasonable steps are those which, by their scope, intensity and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not successful. The Department will consider the quality, quantity, and intensity of the kinds of efforts the bidder has made. Mere *pro forma* efforts, in other words efforts done as a matter of form, are not good faith efforts; rather, the bidder is expected to have taken genuine efforts that would be reasonably expected of a bidder actively and aggressively trying to obtain DBE participation sufficient to meet the contract goal.

- (a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases and will be considered by the Department.
 - (1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.
 - (2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Contractor might otherwise prefer to perform these work items with its own forces.
 - (3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
 - (4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected

for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.

- b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable. In accordance with the above Bidding Procedures, the documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.
- (5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
 - (6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
 - (7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.
 - (8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.
- (b) If the Department determines the bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided it is otherwise eligible for award. If the Department determines the bidder has failed to meet the requirements of this Special Provision or that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification will also include a statement of reasons for the adverse determination. If the Utilization Plan is not approved because it is deficient as a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no more than a five calendar day period to cure the deficiency.

- (c) The bidder may request administrative reconsideration of an adverse determination by emailing the Department at "DOT.DBE.UP@illinois.gov" within the five calendar days after the receipt of the notification of the determination. The determination shall become final if a request is not made on or before the fifth calendar day. A request may provide additional written documentation or argument concerning the issues raised in the determination statement of reasons, provided the documentation and arguments address efforts made prior to submitting the bid. The request will be reviewed by the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person to consider all issues of documentation and whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for reconsideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

CALCULATING DBE PARTICIPATION. The Utilization Plan values represent work anticipated to be performed and paid for upon satisfactory completion. The Department is only able to count toward the achievement of the overall goal and the contract goal the value of payments made for the work actually performed by DBE companies. In addition, a DBE must perform a commercially useful function on the contract to be counted. A commercially useful function is generally performed when the DBE is responsible for the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The Department and Contractor are governed by the provisions of 49 CFR Part 26.55(c) on questions of commercially useful functions as it affects the work. Specific counting guidelines are provided in 49 CFR Part 26.55, the provisions of which govern over the summary contained herein.

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.
- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.
- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:

- (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
- (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission is receives as a result of the lease arrangement.

(e) DBE as a material supplier:

- (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.
- (2) 100 percent goal credit for the cost of materials of supplies obtained from a DBE manufacturer.
- (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a DBE regular dealer or DBE manufacturer.

CONTRACT COMPLIANCE. Compliance with this Special Provision is an essential part of the contract. The Department is prohibited by federal regulations from crediting the participation of a DBE included in the Utilization Plan toward either the contract goal or the Department's overall goal until the amount to be applied toward the goals has been paid to the DBE. The following administrative procedures and remedies govern the compliance by the Contractor with the contractual obligations established by the Utilization Plan. After approval of the Utilization Plan and award of the contract, the Utilization Plan and individual DBE Participation Statements become part of the contract. If the Contractor did not succeed in obtaining enough DBE participation to achieve the advertised contract goal, and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of DBE work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the amended contract goal. All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the DBE Participation Commitment Statement.

- (a) NO AMENDMENT. No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be emailed to the Department at DOT.DB.E.UP@illinois.gov.
- (b) CHANGES TO WORK. Any deviation from the DBE condition-of-award or contract plans, specifications, or special provisions must be approved, in writing, by the Department as provided elsewhere in the Contract. The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract. Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of

Subcontractor, Department form BC 260A or AER 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, a new Request for Approval of Subcontractor will not be required. However, the Contractor must document efforts to assure the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.

- (c) SUBCONTRACT. The Contractor must provide copies of DBE subcontracts to the Department upon request. Subcontractors shall ensure that all lower tier subcontracts or agreements with DBEs to supply labor or materials be performed in accordance with this Special Provision.
- (d) ALTERNATIVE WORK METHODS. In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals. Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:
- (1) The replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award; or
 - (2) The DBE is aware its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
 - (3) The DBE is not capable of performing the replacement work or has declined to perform the work at a reasonable competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.
- (e) TERMINATION AND REPLACEMENT PROCEDURES. The Contractor shall not terminate or replace a DBE listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in this Special Provision. The Contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the Contractor obtains the Department's written consent as provided in subsection (a) of this part. Unless Department consent is provided for termination of a DBE subcontractor, the Contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the DBE in the Utilization Plan.

As stated above, the Contractor shall not terminate or replace a DBE subcontractor listed in the approved Utilization Plan without prior written consent. This includes, but is not limited to, instances in which the Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Written consent will be granted only if the Bureau of Small Business Enterprises agrees, for reasons stated in its concurrence document, that the Contractor

has good cause to terminate or replace the DBE firm. Before transmitting to the Bureau of Small Business Enterprises any request to terminate and/or substitute a DBE subcontractor, the Contractor shall give notice in writing to the DBE subcontractor, with a copy to the Bureau, of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor shall give the DBE five days to respond to the Contractor's notice. The DBE so notified shall advise the Bureau and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Bureau should not approve the Contractor's action. If required in a particular case as a matter of public necessity, the Bureau may provide a response period shorter than five days.

For purposes of this paragraph, good cause includes the following circumstances:

- (1) The listed DBE subcontractor fails or refuses to execute a written contract;
- (2) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the Contractor;
- (3) The listed DBE subcontractor fails or refuses to meet the Contractor's reasonable, nondiscriminatory bond requirements;
- (4) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (5) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1200 or applicable state law.
- (6) The Contractor has determined the listed DBE subcontractor is not a responsible contractor;
- (7) The listed DBE subcontractor voluntarily withdraws from the projects and provides written notice to the Contractor of its withdrawal;
- (8) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (9) A DBE owner dies or becomes disabled with the result that the listed DBE subcontractor is unable to complete its work on the contract;
- (10) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the Contractor can self-perform the work for which the DBE contractor was engaged or so that the Contractor can substitute another DBE or non-DBE contractor after contract award.

When a DBE is terminated or fails to complete its work on the Contract for any reason, the Contractor shall make a good faith effort to find another DBE to substitute for the original DBE to perform at least the same amount of work under the contract as the terminated DBE to the extent needed to meet the established Contract goal. The good faith efforts shall be documented by the Contractor. If the Department requests documentation under this provision, the Contractor shall submit the documentation within seven days, which may be extended for an additional seven days if necessary at the request of the Contractor. The Department will provide a written determination to the Contractor stating whether or not good faith efforts have been demonstrated.

- (f) FINAL PAYMENT. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than 30 calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Resident Engineer. If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the DBE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (h) of this part.
- (g) ENFORCEMENT. The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.
- (h) RECONSIDERATION. Notwithstanding any other provision of the contract, including but not limited to Article 109.09 of the Standard Specifications, the Contractor may request administrative reconsideration of a decision to deduct the amount of the goal not achieved as liquidated damages. A request to reconsider shall be delivered to the Contract Compliance Section and shall be handled and considered in the same manner as set forth in paragraph (c) of "Good Faith Effort Procedures" of this Special Provision, except a final decision that a good faith effort was not made during contract performance to achieve the goal agreed to in the Utilization Plan shall be the final administrative decision of the Department. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.

ILLINOIS WORKS APPRENTICESHIP INITIATIVE – STATE FUNDED CONTRACTS (BDE)

Effective: June 2, 2021

Revised: September 2, 2021

Illinois Works Jobs Program Act (30 ILCS 559/20-1 et seq.). For contracts having an awarded contract value of \$500,000 or more, the Contractor shall comply with the Illinois Works Apprenticeship Initiative (30 ILCS 559/20-20 to 20-25) and all applicable administrative rules. The goal of the Illinois Apprenticeship Works Initiative is that apprentices will perform either 10% of the total labor hours actually worked in each prevailing wage classification or 10% of the estimated labor hours in each prevailing wage classification, whichever is less. The Contractor may seek from the Department of Commerce and Economic Opportunity (DCEO) a waiver or reduction of this goal in certain circumstances pursuant to 30 ILCS 559/20-20(b). The Contractor shall ensure compliance during the term of the contract and will be required to report on and certify its compliance. An apprentice use plan, apprentice hours, and a compliance certification shall be submitted to the Engineer on forms provided by the Department and/or DCEO.

PORTLAND CEMENT CONCRETE – HAUL TIME (BDE)

Effective: July 1, 2020

Revise Article 1020.11(a)(7) of the Standard Specifications to read:

“(7) Haul Time. Haul time shall begin when the delivery ticket is stamped. The delivery ticket shall be stamped no later than five minutes after the addition of the mixing water to the cement, or after the addition of the cement to the aggregate when the combined aggregates contain free moisture in excess of two percent by weight (mass). If more than one batch is required for charging a truck using a stationary mixer, the time of haul shall start with mixing of the first batch. Haul time shall end when the truck is emptied for incorporation of the concrete into the work. The maximum haul time shall be as follows.

Concrete Temperature at Point of Discharge, °F (°C)	Maximum Haul Time ^{1/} (minutes)	
	Truck Mixer or Truck Agitator	Nonagitator Truck
50 - 64 (10 - 17.5)	90	45
> 64 (> 17.5) - without retarder	60	30
> 64 (> 17.5) - with retarder	90	45

1/ To encourage start-up testing for mix adjustments at the plant, the first two trucks will be allowed an additional 15 minutes haul time whenever such testing is performed.

For a mixture which is not mixed on the jobsite, a delivery ticket shall be required for each load. The following information shall be recorded on each delivery ticket: (1) ticket number; (2) name of producer and plant location; (3) contract number; (4) name of Contractor; (5) stamped date and time batched; (6) truck number; (7) quantity batched; (8) amount of admixture(s) in the batch; (9) amount of water in the batch; and (10) Department mix design number.

For concrete mixed in jobsite stationary mixers, the above delivery ticket may be waived, but a method of verifying the haul time shall be established to the satisfaction of the Engineer.”

RAILROAD PROTECTIVE LIABILITY INSURANCE (BDE)

Effective: December 1, 1986

Revised: January 1, 2022

Description. Railroad Protective Liability and Property Damage Liability Insurance shall be carried according to Article 107.11 of the Standard Specifications. A separate policy is required for each railroad unless otherwise noted.

NAMED INSURED & ADDRESS	NUMBER & SPEED OF PASSENGER TRAINS	NUMBER & SPEED OF FREIGHT TRAINS
Burlington Northern Sante Fe 80-44th Ave. NE Minneppolis, Minnesota	0 @ 1 mph	20 @ 1 to 49 mph
Class 1 RR (Y or N): Y DOT/AAR No.: 979131K RR Division: Springfield	RR Mile Post: 178.91 RR Sub-Division: Beardstown	
For Freight/Passenger Information Contact: Jacob Rzewnicki For Insurance Information Contact: Jacob Rzewnicki		Phone: 913-551-4275 Phone: 913-551-4275

Union Pacific Railroad 100 N. Broadway, Suite 1500 St. Louis, MO. 63102	0 @ 1 mph	4 @ 5 to 49 mph
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Class 1 RR (Y or N): Y

DOT/AAR No.: 167650U
RR Division: Saint Louis

RR Mile Post: 315.86
RR Sub-Division: Marion

For Freight/Passenger Information Contact: John Plebanek
For Insurance Information Contact: John Plebanek

Phone: (414) 294-8685
Phone: (414) 294-8685

Basis of Payment. Providing Railroad Protective Liability and Property Damage Liability Insurance will be paid for at the contract unit price per Lump Sum for RAILROAD PROTECTIVE LIABILITY INSURANCE.

SPEED DISPLAY TRAILER (BDE)

Effective: April 2, 2014

Revised: January 1, 2022

Revise the last paragraph of Article 701.11 of the Standard Specifications to read:

“When not being utilized to inform and direct traffic, sign trailers, speed display trailers, arrow boards, and portable changeable message boards shall be treated as nonoperating equipment.”

Add the following to Article 701.15 of the Standard Specifications:

“(m) Speed Display Trailer. A speed display trailer is used to enhance safety of the traveling public and workers in work zones by alerting drivers of their speed, thus deterring them from driving above the posted work zone speed limit.”

Add the following to Article 701.20 of the Standard Specifications:

“(k) When speed display trailers are shown on the Standard, this work will not be paid for separately but shall be considered as included in the cost of the Standard.

For all other speed display trailers, this work will be paid for at the contract unit price per calendar month or fraction thereof for each trailer as SPEED DISPLAY TRAILER.”

Add the following to Article 1106.02 of the Standard Specifications:

“(o) Speed Display Trailer. The speed display trailer shall consist of a LED speed indicator display with self-contained, one-direction radar mounted on an orange see-through trailer. The height of the display and radar shall be such that it will function and be visible when located behind concrete barrier.

The speed measurement shall be by radar and provide a minimum detection distance of 1000 ft (300 m). The radar shall have an accuracy of ± 1 mile per hour.

The speed indicator display shall face approaching traffic and shall have a sign legend of “YOUR SPEED” immediately above or below the speed display. The sign letters shall be between 5 and 8 in. (125 and 200 mm) in height. The digital speed display shall show two

digits (00 to 99) in mph. The color of the changeable message legend shall be a yellow legend on a black background. The minimum height of the numerals shall be 18 in. (450 mm), and the nominal legibility distance shall be at least 750 ft (250 m).

The speed indicator display shall be equipped with a violation alert that flashes the displayed detected speed when the work zone posted speed limit is exceeded. The speed indicator shall have a maximum speed cutoff. On roadway facilities with a normal posted speed limit greater than or equal to 45 mph, the detected speeds of vehicles traveling more than 25 mph over the work zone speed limit shall not be displayed. On facilities with normal posted speed limit of less than 45 mph, the detected speeds of vehicles traveling more than 15 mph over the work zone speeds limit shall not be displayed. On any roadway facility if detected speeds are less than 25 mph, they shall not be displayed. The display shall include automatic dimming for nighttime operation.

The speed indicator measurement and display functions shall be equipped with the power supply capable of providing 24 hours of uninterrupted service.”

SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)

Effective: April 2, 2018

Add the following to Section 109 of the Standard Specifications.

“109.14 Subcontractor and Disadvantaged Business Enterprise Payment Reporting.
The Contractor shall report all payments made to the following parties:

- (a) first tier subcontractors;
- (b) lower tier subcontractors affecting disadvantaged business enterprise (DBE) goal credit;
- (c) material suppliers or trucking firms that are part of the Contractor’s submitted DBE utilization plan.

The report shall be made through the Department’s on-line subcontractor payment reporting system within 21 days of making the payment.”

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: November 2, 2017

Revised: April 1, 2019

Replace the second paragraph of Article 109.12 of the Standard Specifications with the following:

“This mobilization payment shall be made at least seven days prior to the subcontractor starting work. The amount paid shall be at the following percentage of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor’s work.

Value of Subcontract Reported on Form BC 260A	Mobilization Percentage
Less than \$10,000	25%
\$10,000 to less than \$20,000	20%
\$20,000 to less than \$40,000	18%
\$40,000 to less than \$60,000	16%
\$60,000 to less than \$80,000	14%
\$80,000 to less than \$100,000	12%
\$100,000 to less than \$250,000	10%
\$250,000 to less than \$500,000	9%
\$500,000 to \$750,000	8%
Over \$750,000	7%”

SUBMISSION OF PAYROLL RECORDS (BDE)

Effective: April 1, 2021

Revise Item 3 of Section IV of Check Sheet #5 of the Recurring Special Provisions to read:

- “3. Submission of Payroll Records. The Contractor and each subcontractor shall, no later than the 15th day of each calendar month, file a certified payroll for the immediately preceding month to the Illinois Department of Labor (IDOL) through the Illinois Prevailing Wage Portal in compliance with the State Prevailing Wage Act (820 ILCS 130). The portal can be found on the IDOL website at <https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Prevailing-Wage-Portal.aspx>. Payrolls shall be submitted in the format prescribed by the IDOL.”

TRAFFIC SPOTTERS (BDE)

Effective: January 1, 2019

Revise Article 701.13 of the Standard Specifications to read:

“701.13 Flaggers and Spotters. Flaggers shall be certified by an agency approved by the Department. While on the job site, each flagger shall have in his/her possession a current driver’s license and a current flagger certification I.D. card. For non-drivers, the Illinois Identification Card issued by the Secretary of State will meet the requirement for a current driver’s license. This certification requirement may be waived by the Engineer for emergency situations that arise due to actions beyond the Contractor’s control where flagging is needed to maintain safe traffic control on a temporary basis. Spotters are defined as certified flaggers that provide support to workers by monitoring traffic.

Flaggers and spotters shall be stationed to the satisfaction of the Engineer and be equipped with a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 or ANSI/ISEA 107-2010 for Conspicuity Class 2 garments. Flaggers shall be equipped with a stop/slow traffic control sign. Spotters shall be equipped with a loud warning device. The warning sound shall be identifiable by workers so they can take evasive action when necessary. Other types of garments may be substituted for the vest as long as the garments have a manufacturer’s tag identifying them as meeting the ANSI Class 2 requirement. The longitudinal placement of the flagger may be increased up to 100 ft (30 m) from that shown on the plans to improve the visibility of the flagger. Flaggers shall not encroach on the open lane of traffic unless traffic has been stopped. Spotters shall not encroach on the open lane of traffic, nor interact with or control the flow of traffic.

For nighttime flagging, flaggers shall be illuminated by an overhead light source providing a minimum vertical illuminance of 10 fc (108 lux) measured 1 ft (300 mm) out from the flagger’s chest. The bottom of any luminaire shall be a minimum of 10 ft (3 m) above the pavement. Luminaire(s) shall be shielded to minimize glare to approaching traffic and trespass light to adjoining properties. Nighttime flaggers shall be equipped with fluorescent orange or fluorescent orange and fluorescent yellow/green apparel meeting the requirements of ANSI/ISEA 107-2004 or ANSI/ISEA 107-2010 for Conspicuity Class 3 garments.

Flaggers and spotters shall be provided per the traffic control plan and as follows.

- (a) Two-Lane Highways. Two flaggers will be required for each separate operation where two-way traffic is maintained over one lane of pavement. Work operations controlled by flaggers shall be no more than 1 mile (1600 m) in length. Flaggers shall be in sight of each other or in direct communication at all times. Direct communication shall be obtained by using portable two-way radios or walkie-talkies.

The Engineer will determine when a side road or entrance shall be closed to traffic. A flagger will be required at each side road or entrance remaining open to traffic within the

operation where two-way traffic is maintained on one lane of pavement. The flagger shall be positioned as shown on the plans or as directed by the Engineer.

- (b) Multi-Lane Highways. At all times where traffic is restricted to less than the normal number of lanes on a multilane pavement with a posted speed limit greater than 40 mph and the workers are present, but not separated from the traffic by physical barriers, a flagger or spotter shall be furnished as shown on the plans. Flaggers shall warn and direct traffic. Spotters shall monitor traffic conditions and warn workers of errant approaching vehicles or other hazardous conditions as they occur. One flagger will be required for each separate activity of an operation that requires frequent encroachment in a lane open to traffic. One spotter will be required for each separate activity with workers near the edge of the open lane or with their backs facing traffic.

Flaggers will not be required when no work is being performed, unless there is a lane closure on two-lane, two-way pavement.”

WEEKLY DBE TRUCKING REPORTS (BDE)

Effective: June 2, 2012

Revised: November 1, 2021

The Contractor shall submit a weekly report of Disadvantaged Business Enterprise (DBE) trucks hired by the Contractor or subcontractors (i.e. not owned by the Contractor or subcontractors) that are used for DBE goal credit.

The report shall be submitted to the Engineer on Department form “SBE 723” within ten business days following the reporting period. The reporting period shall be Sunday through Saturday for each week reportable trucking activities occur.

Any costs associated with providing weekly DBE trucking reports shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

WORK ZONE TRAFFIC CONTROL DEVICES (BDE)

Effective: March 2, 2020

Add the following to Article 701.03 of the Standard Specifications:

“(q) Temporary Sign Supports1106.02”

Revise the third paragraph of Article 701.14 of the Standard Specifications to read:

“For temporary sign supports, the Contractor shall provide a FHWA eligibility letter for each device used on the contract. The letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device. The signs shall be supported within 20 degrees of vertical. Weights used to stabilize signs shall be attached to the sign support per the manufacturer’s specifications.”

Revise the first paragraph of Article 701.15 of the Standard Specifications to read:

“701.15 Traffic Control Devices. For devices that must meet crashworthiness standards, the Contractor shall provide a manufacturer’s self-certification or a FHWA eligibility letter for each Category 1 device and a FHWA eligibility letter for each Category 2 and Category 3 device used on the contract. The self-certification or letter shall provide information for the set-up and use of the device as well as a detailed drawing of the device.”

Revise the first six paragraphs of Article 1106.02 of the Standard Specifications to read:

“1106.02 Devices. Work zone traffic control devices and combinations of devices shall meet crashworthiness standards for their respective categories. The categories are as follows.

Category 1 includes small, lightweight, channelizing and delineating devices that have been in common use for many years and are known to be crashworthy by crash testing of similar devices or years of demonstrable safe performance. These include cones, tubular markers, plastic drums, and delineators, with no attachments (e.g. lights). Category 1 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 1 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2024.

Category 2 includes devices that are not expected to produce significant vehicular velocity change but may otherwise be hazardous. These include vertical panels with lights, barricades, temporary sign supports, and Category 1 devices with attachments (e.g. drums with lights). Category 2 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 2 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2024.

Category 3 includes devices that are expected to cause significant velocity changes or other potentially harmful reactions to impacting vehicles. These include crash cushions (impact attenuators), truck mounted attenuators, and other devices not meeting the definitions of Category 1 or 2. Category 3 devices manufactured after December 31, 2019 shall be MASH-16 compliant. Category 3 devices manufactured on or before December 31, 2019, and compliant with NCHRP 350 or MASH 2009, may be used on contracts let before December 31, 2029. Category 3 devices shall be crash tested for Test Level 3 or the test level specified.

Category 4 includes portable or trailer-mounted devices such as arrow boards, changeable message signs, temporary traffic signals, and area lighting supports. It is preferable for Category 4 devices manufactured after December 31, 2019 to be MASH-16 compliant; however, there are currently no crash tested devices in this category, so it remains exempt from the NCHRP 350 or MASH compliance requirement.

For each type of device, when no more than one MASH-16 compliant is available, an NCHRP 350 or MASH-2009 compliant device may be used, even if manufactured after December 31, 2019.”

Revise Articles 1106.02(g), 1106.02(k), and 1106.02(l) to read:

“(g) Truck Mounted/Trailer Mounted Attenuators. The attenuator shall be approved for use at Test Level 3. Test Level 2 may be used for normal posted speeds less than or equal to 45 mph.

(k) Temporary Water Filled Barrier. The water filled barrier shall be a lightweight plastic shell designed to accept water ballast and be on the Department’s qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings.

(l) Movable Traffic Barrier. The movable traffic barrier shall be on the Department’s qualified product list.

Shop drawings shall be furnished by the manufacturer and shall indicate the deflection of the barrier as determined by acceptance testing; the configuration of the barrier in that test; and the vehicle weight, velocity, and angle of impact of the deflection test. The Engineer shall be provided one copy of the shop drawings. The barrier shall be capable of being moved on and off the roadway on a daily basis.”

WORKING DAYS (BDE)

Effective: January 1, 2002

The Contractor shall complete the work within **110** working days.

REVISIONS TO THE ILLINOIS PREVAILING WAGE RATES

The Prevailing rates of wages are included in the Contract proposals which are subject to Check Sheet #5 of the Supplemental Specifications and Recurring Special Provisions. The rates have been ascertained and certified by the Illinois Department of Labor for the locality in which the work is to be performed and for each craft or type of work or mechanic needed to execute the work of the Contract. As required by Prevailing Wage Act (820 ILCS 130/0.01, et seq.) and Check Sheet #5 of the Contract, not less than the rates of wages ascertained by the Illinois Department of Labor and as revised during the performance of a Contract shall be paid to all laborers, workers and mechanics performing work under the Contract. Post the scale of wages in a prominent and easily accessible place at the site of work.

If the Illinois Department of Labor revises the prevailing rates of wages to be paid as listed in the specification of rates, the contractor shall post the revised rates of wages and shall pay not less than the revised rates of wages. Current wage rate information shall be obtained by visiting the Illinois Department of Labor web site at <http://www.state.il.us/agency/idol/> or by calling 312-793-2814. It is the responsibility of the contractor to review the rates applicable to the work of the contract at regular intervals in order to insure the timely payment of current rates. Provision of this information to the contractor by means of the Illinois Department of Labor web site satisfies the notification of revisions by the Department to the contractor pursuant to the Act, and the contractor agrees that no additional notice is required. The contractor shall notify each of its subcontractors of the revised rates of wages.