



**SPECIAL PROVISIONS
FOR
ITS INFRASTRUCTURE INSTALLATION AND FIBER SPLICING**

**Johnson County
IM-080-6(488)242--13-52**

**Effective Date
September 20, 2022**

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150895.01 DESCRIPTION.

A. General.

1. The project consists of the reconstruction of the existing Interstate 80 and 1st Avenue Interchange in the City of Coralville in Johnson County. The reconstruction will impact the existing Iowa DOT and the Iowa Communications Network (ICN) fiber optic cable infrastructure within the interchange.
2. The infrastructure currently consists of an Iowa DOT ITS trunk fiber cable and an ICN trunk fiber cable in a duct bank running east to west along the south side of I-80 and around the south side of the interchange, crossing 1st Avenue south of the eastbound ramp terminal. Also, there is an ITS camera pole within the interchange. There is a splice handhole near the ramp terminal where local public agencies have spliced into the ITS fiber cable to access fibers allocated to them.
3. This part consists of the general provisions necessary when furnishing and installing the ITS Infrastructure and Fiber Splicing as described in the project plans and these special provisions.
4. This project involves supplying and installing conduit, handholes, tracer wire, and test stations. The 48 strand and 96 strand fiber optic cable will be procured by the Iowa DOT in advance of the project and installed by the Contractor. The 12 strand fiber optic cable provided and installed by the Contractor. The project includes the removal and re-installation of an ITS camera pole. The project also includes a limited-time cutover and splicing of fiber optic cable.

5. Figured dimensions on the plans shall be taken as correct but shall be checked by the Contractor before starting construction. Any errors, omissions, or discrepancies shall be brought to the attention of the Engineer and the Engineer's decision thereon shall be final. Correction of errors or omissions on the drawings or specifications may be made by the Iowa DOT when such correction is necessary for the proper execution of the work.
6. Coordinate work with the Iowa DOT and the following public agencies:
 - a. ICN.
 - b. City of Coralville.
 - c. City of Iowa City.
 - d. University of Iowa.
 - e. Johnson County.
7. Assign a responsible staff member that will work with the Iowa DOT on decisions regarding order of work and scheduling, and informing the public agencies as needed throughout the duration of the project.

B. Construction Sequence.

1. Advance Infrastructure Installation Stage.

The following fiber relocation construction elements shall commence as soon as practicable at the beginning of the interchange reconstruction project and shall be completed prior to the fiber line shutdown and cutover stage. Coordinate the performance of these elements with the other interchange construction staging.

- a. Survey and mark locations of each handhole and key points along the proposed trunk conduit route. Review route survey points with Engineer for concurrence.
- b. Directional bore and install trunk line conduit segments from Handhole HH1 through to Handhole HH9 locations per ITS Conduit Plan and Profile Sheets and ITS Infrastructure Sheets.
- c. Set Handholes HH1 through HH9.
- d. Obtain pre-procured trunk fiber optic cables from Iowa DOT facility and transport to project site. Perform on-reel testing of fiber optic cables.
- e. Install/pull the 48 strand and 96 strand fiber optic trunk cables through the trunk conduit from Handhole HH1 through to Handhole HH9.
- f. Immediately after the installation of the fiber cables, install temporary tracer wire conductor leads bonded to the fiber cable armor at Handholes HH1, HH5, and HH9 to facilitate locating the fiber line during interchange construction activities until permanent location test stations are installed in the next stage.
- g. Perform specified testing of fiber optic cables after installation.
- h. Protect and remove the existing ITS device cabinet, camera pole, and power-installed foundation. Store this equipment in a protected and secure location for re-installation by the Contractor.
- i. Excavate over the existing fiber duct bank at the indicated cut points near Handholes HH1 and HH9. Perform such excavations on the day just prior to the cutover stage to prepare for the fiber cutting.
- j. Excavate around Handhole HH1 and expose the existing fiber duct bank to facilitate rerouting of the existing duct bank conduits up into HH1 during the cutover stage. Perform such excavation on the day just prior to the cutover stage to prepare for the fiber cutting.

2. Fiber Line Shutdown and Cutover Stage.

- a. The installation of the new trunk conduit, handholes, and the installation and splicing cut-over of the trunk fiber optic cables must be completed by the end of Phase 2, Stage 1. Refer to the J Sheets for additional information regarding project staging. The anticipated date of the fiber optic cables splicing cut-over shall be coordinated with the Engineer, Iowa DOT ITS representative, and the ICN representative.

- b. The anticipated cut-over date shall be determined a minimum of 8 weeks in advance of the anticipated date to communicate the anticipated date to all the public agencies involved to allow them time to plan and perform interim modifications to their networks to discontinue use of the allocated fibers on the trunk cables. See list of public agencies above.
- c. As the anticipated date approaches, periodically inform the Iowa DOT and the public agencies of any change to the anticipated cut-over date. At 1 week prior to the cut-over date, coordinate with the public agencies and verify that all the agencies have completed their planned modifications to their fiber networks and have discontinued use of the allocated fibers on the existing trunk cables.
- d. On the day prior to the Cut-over Date, excavate over the existing fiber duct bank at the indicated cut points near Handholes HH1 and HH9.
- e. On the day prior to the Cut-over Date, excavate adjacent to Handhole HH1 and expose the existing fiber duct bank to facilitate rerouting of the existing duct bank conduits and trunk fiber cables up into HH1 during the cutover stage.
- f. All fiber splicing for the cut-over shall be performed and completed overnight in one night on the same night on the agreed upon and approved splicing date during the following time windows:
 - 1) For the eight-strand ICN fiber cable, the cut-over splicing must be completed in the time window of 0000 hours to 0600 hours (12:00 midnight to 6:00 am).
 - 2) For the ninety-six-strand ITS fiber cable, the cut-over splicing must be completed in the time window of 2200 hours to 0600 hours (10:00pm to 6:00 am).
- g. The overnight splicing work shall consist of:
 - 1) Handhole HH1.
 - a) Eight splices associated with the ICN cable.
 - b) Ninety-six splices associated with the ITS cable.
 - 2) Handhole HH9.
 - a) Eight splices associated with the ICN cable.
 - b) Ninety-six splices associated with the ITS cable.
- h. Provide and install the specified splice closures at Handholes HH1 and HH9.
- i. Provide and install the specified splice closure at Handhole HH5 and "mid-sheath" split and cut the armor jacket in preparation for fiber splicing during the final stage. Do not cut any tubes or splice any fibers at this location at this time.
- j. Perform specified testing of the fiber optic trunk cables after installation.
- k. Provide and install the specified test stations at Handholes HH1, HH5 and HH9.

3. Final Fiber and Infrastructure Stage

The following fiber relocation construction elements shall be performed in coordination with the staged construction of the new interchange. It shall be the responsibility of the Contractor to communicate and coordinate with the other construction activities to determine the appropriate time to perform/install these elements.

- a. Trench or directional bore, as applicable, and install the fiber conduit segments from Handhole HH5 through to Handhole HH15 locations per ITS Infrastructure Sheets.
- b. Set Handholes HH6 through HH15.
- c. Install Camera Pole P01, Device Cabinet CAB01, and install conduit from pole back to HH15.
- d. Perform on-reel testing of 12 strand fiber optic drop cable.
- e. Install/pull the 12 strand fiber optic drop cable and tracer wire through the conduit from Handhole HH5 through to the device cabinet.
 - 1) NOTE: The traffic signal system at the interchange will utilize this same conduit for routing of the traffic signal system's 24 strand fiber optic interconnect cable. Communicate with the traffic signal contractor to coordinate simultaneous pulling of the fiber optic cables through the conduit.
- f. Perform specified testing of fiber optic cable after installation.
- g. Perform fiber splicing of the drop cable to the ITS trunk cable at Handhole HH5. The splicing consists of four splices between ITS drop cable and ITS trunk cable.

- h. Complete any remaining specified and incidental items to complete the fiber optic cable and ITS installation.

C. Related Specifications and Standards.

The work as detailed on the plans for the ITS Infrastructure Installation shall be completed in accordance with the contract documents, special provisions, and the documents listed below.

- NEC, latest edition adopted by the State of Iowa.
- Telecommunications Industry Association/Electronic Industries Association (TIA/EIA) latest editions.

D. Contractor's Responsibility.

1. Coordination with Other DOT Projects

- a. Coordinate work with the contractor(s) working on other Iowa DOT projects in the vicinity. The known projects are shown in the table below.

Project	Description
IM-080-6(489)243--13-52	Bridge Replacement
IM-080-6(495)243--13-52	RCB Culvert New - Pedestrian

- b. Provide to the Engineer any requests to perform work during the dates of special events a minimum of 5 calendar days prior to the event. The decision of the Engineer regarding a request will be final.
- c. Comply with any special provisions and limitations identified in the contract documents.

2. Coordination with Utilities

- a. Determine the exact location and elevation of all public utilities in proximity to any construction work and shall conduct all activities to ensure that public utilities are not disturbed or damaged.
- b. The Contractor is fully liable for all expenses incurred as a result of failing to obtain required clearances, location of utilities, and any damage to utilities caused by construction.
- c. Utility companies whose facilities are shown on the plans or known to be within the construction limits shall be notified of the construction start date.

3. Material and Equipment Storage and Construction Site Access

- a. Secure a designated material storage area for this project. Any request to store material in the right-of-way to complete the current work activity must be approved by the Engineer.
- b. Construction equipment may be stored within the right-of-way during non-working hours if it is outside of the roadway preferred clear zone, as far from the traveled way as practical and as approved by the Engineer. No equipment shall be stored at the toe of any roadway slope.
- c. No worker vehicles will be allowed to park in or access a job site directly from an Interstate or Freeway facility. Access to the job site for both workers and materials shall only be via interchanges or intersecting roadways unless otherwise approved by the Engineer. Worker vehicles shall be parked off-site or at a location acceptable to the Engineer.
- d. No open holes or mounds of dirt shall be left unprotected during non-working hours.

4. One Call Locating.

Until final acceptance, provide all utility locates of the work performed under this contract when requested through One-Call services or by the Engineer. Perform any such locations within 48 hours of receiving notice that such locations are needed.

5. Conduit Locations.

Prior to final acceptance, meet with the Engineer to demonstrate the locate system is working properly throughout the entire locate system.

6. Finishing Activities

Upon completion of the work at each project area, thoroughly clean the site and restore it to a condition equal to or better than that existing prior to construction. Project area is defined as the approximate area disturbed during a normal week of work. During and after completion, employ appropriate measures for erosion control, where applicable. Seed and fertilize work areas upon completion of work in accordance with the contract documents.

E. Disruption to Existing Fiber Networks.

1. Planned Work Near Existing Fiber Networks.

- a. Ensure continuous operation of the existing fiber networks and systems during construction of the project.
- b. Do not work on splicing, disconnecting, and/or in any way disrupting normal operation of the existing fiber networks or systems without approval from all affected parties. Parties include the Iowa DOT and the ICN. Provide a written request to the Engineer and the respective parties for approval at least 10 calendar days before work is done near an existing fiber network or equipment. A copy of the written request shall be submitted to the Engineer in all cases. In addition to the written request, submit the work plan and schedule for approval by the Engineer. The work plan shall include all fiber strands and the parties possibly affected.
- c. Disruptions to the existing systems shall only occur between midnight and 6:00 AM on working days unless otherwise approved by the Engineer.

2. Unplanned Disruption.

- a. Repair to ICN's satisfaction and at no cost to Iowa DOT, any damage to the existing fiber networks and systems during the life of the project. If not repaired in a timely manner, any costs incurred by the Iowa DOT to restore the disruption will be charged to the Contractor.
- b. In the event of disruption, simultaneously notify the Engineer and affected parties' representative. Immediately stop all work in progress and expend all efforts to restore the disrupted system(s) and/or correct the problem causing the disruption. The notice shall include the type of facility damaged and the extent of the damage.
- c. Remain on site until the ICN confirms that the disrupted systems are fully operational. Unplanned disruptions shall result in the assessment of liquidated damages.
- d. The Contractor will not be granted an extension of time for delays caused by repairing disrupted systems.

3. Liquidated Damages.

- a. Unplanned disruptions to the existing fiber-optic network will result in impacts to the traveling public, increase fuel consumption, vehicle operating costs, pollution, and time needed for Iowa DOT administration, engineering, inspection, and supervision, and other inconveniences and harm far in excess of those resulting from delay of most projects.
- b. Accordingly, the Contractor agrees:
 - 1) To pay \$250.00 liquidated damages per 15 minutes, for each 15 minute period that the Contractor fails to restore the proper operation of an existing fiber-optic network element following an unplanned disruption.
 - 2) To authorize the Engineer to deduct these liquidated damages from any money due or coming due to the Contractor.

F. Contractor Submissions.

1. Materials List.

Complete and submit one electronic pdf file of the materials list within 14 calendar days after award of the project contract. Include the name of the materials, supplier and catalog number of each item listed.

2. Construction Schedule.

- a. Within 30 days after award of contract or before the construction kickoff meeting, submit to the Engineer one electronic pdf file of the detailed construction schedule including dates of commencement for each major work item, duration of each major work item and completion of each major work item on each segment of the proposed construction.
 - b. Major items of work to be included on the schedule are:
 - Duration of material procurement
 - installation of conduit, handholes, and fiber optic cable.
 - Fiber splicing dates (approved by ICN).
 - Duration of fiber testing required and submission of test reports.
 - c. Upon acceptance of the schedule, the Contractor will be expected to adhere to these dates as proposed unless modified with the approval of the Engineer.
 - d. Submittal and approval of the proposed construction schedule by the Engineer is required before the Contractor can commence construction activities.
 - e. Work shall not be performed that may result in an unplanned network disruption during the ICN moratorium. Request moratorium dates from the ICN Network Operations Center (NOC) at ICNServicedesk@iowa.gov or 515-725-4400.
- 3. Shop Drawings.**
- a. After approval of the Equipment and Materials List and before any items are ordered, the Shop Drawings shall be submitted for approval according to Article 1105.03 of the Standard Specifications.
 - b. The Engineer will review the shop drawings/catalog cuts for the purpose of assuring general conformance with the project design concept and contract documents. The Engineer will provide approval or rejection of shop drawings within 14 calendar days of the submission. Re-submit the shop drawings for approval within 7 days of the Engineer's rejection.
 - c. Provide written notice of any deviations from the requirements of the contract documents.
 - d. Engineer's approval of shop drawings/catalog cuts does not relieve the Contractor of responsibility for providing satisfactory materials complying with the contract documents. Errors not detected during review do not authorize the Contractor to proceed in error.
 - e. Order all materials requiring production lead time greater than 4 weeks within 7 calendar days of receiving the approved shop drawing(s). Submit to the Engineer proof of material purchase order in electronic PDF format.
- 4. Warranty.**
- a. Transfer all required standard materials warranties on the date of final acceptance to the Iowa DOT.
 - b. Warranty periods shall not commence prior to final acceptance of the work.

G. Final Acceptance.

1. The successful bidder shall perform all the obligations under the contract before the final acceptance of the project by Iowa DOT. Completion of the work will be the date of approval and work acceptance on "Statement of Completion and Final Acceptance of Work" (Form 830435) by the Iowa DOT.
2. Final acceptance shall not constitute acceptance of any unauthorized or non-compliant work or material. Iowa DOT shall not be barred from requiring the successful bidder to remove, replace, repair, or dispose of any work or material that is defective, unauthorized or that otherwise fails to comply with the contract documents or from recovering damages for any such work or material. Final acceptance shall not relieve the successful bidder of any obligations and/or responsibilities relating to warranty requirements designated in the contract documents.

H. As-Built Documentation.

1. **General.**

- a. As-built record plans will be the responsibility of, and completed by, the Engineer. As such, it will be the responsibility of the Engineer to coordinate directly with the Contractor to ensure that a master record set of the plans is maintained throughout construction to document all installations and any deviations from the design shown in the contract documents.
- b. It is the responsibility of the Contractor to maintain written records of daily construction progress, areas worked, and quantities installed to aid in the completeness of as-constructed documentation by the Engineer.

2. GPS Data Recording Staking Assistance.

- a. The Engineer will be responsible for collecting GPS data of all installations including, but not limited to conduit routing and handholes. All efforts will be made by the Engineer to coordinate with the Contractor and collect daily construction progress.
- b. Coordinate and assist the Engineer in this effort by staking, flagging or otherwise locating all installed features until such time that the GPS data can be collected

150895.02 MATERIALS.

A. General.

Provide any items, equipment, or materials not specifically addressed in the contract documents but required to provide a complete and functional installation. The level of quality shall be consistent with other specified items. All miscellaneous electrical equipment and materials shall be listed for its specific application.

B. ITS Construction Survey.

1. Lath.

Provide wood lath that is approximately 3/8 inch thick by 1 1/2 inches wide by 48 inches long.

2. Survey Equipment.

Utilize survey equipment with a level of accuracy that will result in less than 6 inches of error horizontally.

C. Wire and Cable.

1. Tracer Wire.

- a. Single conductor copper clad steel, No. 10 AWG with orange colored jacket.
- b. Use a Tracer-Lock Connector (#TL-LUG-SS) or approved equivalent on all mainline and lateral connections.

2. Grounding/Bonding.

Ground all installations using a No. 6 AWG copper, non-insulated wire bonded to copper clad metal, driven electrodes using an exothermic weld.

D. Fiber-Optic Cable.

1. General.

- a. The cable shall meet the latest applicable standard specifications by American National Standards Institute (ANSI), Electronic Industries Association (EIA) and Telecommunications Industries Association (TIA) for the single-mode fiber cable of the size specified per the Plans.
- b. Provide the Engineer the manufacturer's production test provided with the spool.
- c. The buffer tubes shall be compatible with standard hardware and shall have 12 fibers per tube, the fibers shall not adhere to the inside of the buffer tube, each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B "Optical Fiber Cable Color Coding" and be colored with ultraviolet (UV) curable ink.

- d. The cable core shall be water blocked with dry water blocking materials to improve access and handling of individual tubes.
 - e. The cables shall be designed for point-to-point applications as well as mid-span access and provide a high-level of protection for fiber installed in the outside plant environment.
 - f. The optical fiber shall be fully capable of handling existing and legacy single-mode applications which traditionally operate in the 1310 nm and 1550 nm regions and shall also be designed to operate the full-spectrum from 1260 nm to 1625 nm for optical transmission.
 - g. The optical fiber shall be designed to provide optimum performance from 1260 nm to 1625 nm intended for 16 channel Course Wavelength Division Multiplexing applications.
 - h. The optical fiber shall be manufactured by Corning, OFS or Draka.
 - i. The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.
 - j. The jacket or sheath shall be free of holes, splits, and blisters.
 - k. Cable jackets shall be marked with the manufacturer's name, month, and year of manufacturer, sequential foot markings, the symbol for communication cable as required by Section 350G of the National Electrical Safety Code (NESC), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more coextruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.
 - l. The maximum pulling tension shall be 600 pounds during installation (short term) and 200 pounds installed (long term).
 - m. The shipping, storage, and operating temperature range of the cable shall be -40°C to +70°C. The installation temperature range of the cable shall be -30°C to +70°C.
- 2. Single-Mode Fiber-Optic OSP Cable – Dielectric Loose Tube.**
- a. Fiber-optic, single-mode, graded loose tube dielectric cable constructed with industry standard 3 mm buffer tubes stranded around a central strength member.
 - b. Single-mode, dispersion-unshifted fiber meeting ITUT G.652D requirements.
 - c. Cables shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.3 mm. Jacketing material shall be applied directly over cable core and water swellable tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.
 - d. The cable jacket shall contain no metal elements and shall be of a consistent thickness

E. Handholes.

1. General.

- a. Supply handholes constructed of epoxy or polyester resin mortar with woven glass fiber reinforcement and an appropriate aggregate dimensioned as indicated in the contract documents.
- b. Handhole materials shall not support combustion when tested in accordance with "Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position" ASTM D-635.
- c. Water absorption shall not exceed two percent of the original weight of material under test conditions per "Standard Test Method for Water Absorption of Plastics" ASTM D-570.
- d. The handhole shall be functional without failure throughout a temperature range of -50°F to +170°F.
- e. The handhole walls shall not deflect more than 0.24 inches per foot of length of box when installed and subject to an ASTM C-857 TIER 22 load.
- f. Handholes shall meet or exceed ANSI/SCTE 77 "Specification for Underground Enclosure Integrity" requirements.
- g. Handhole lid strength shall be tested to 33,750 pounds (Tier 22).
- h. Handhole lids shall be labeled as indicated in the plans or as directed by the Engineer.

2. Test Stations.

- a. Supply Rhino part TVT178OB-EM9125-OR or approved equivalent test stations at all Type IV handholes.
- b. Test Stations shall be 78 inch triangular flexible orange plastic marker with five separate access terminals, isolation lever, and set screw to hold terminal concealment cap on.
- c. Place custom warning decals on all sides, the Engineer shall provide prior approval of decals.

3. Fiber Marker.

- a. Supply Rhino Part# TVF78OO or approved equivalent markers at 24 inch by 36 inch by 36 inch handhole locations noted in the plans.
- b. Markers shall be 78 inch, orange, polyester resin with reinforcing fibers, and remain flexible from -40°F to +140°F.
- c. Place custom warning decals on all sides, the Engineer shall provide prior approval of decals.

F. High Density Polyethylene Conduit.

1. High Density Polyethylene (HDPE) conduit shall be smooth wall ORANGE in color.
2. Comply with ASTM F 2160 (conduit) and ASTM D 3350 (HDPE material), minimum SDR 13.5 or 11 as specified on the construction drawings.
3. Sequential foot markings printed on HDPE.
4. Continuous reel or straight pieces to minimize splicing.
5. For dissimilar conduit connections provide an adhesive compatible with both materials.
6. Provide and install pull tape in every conduit run. Pull tape shall be clearly marked with durable, sequential footage markings and shall have a minimum proper tensile strength of 600 pounds.

G. Outside Plant (OSP) Fiber Splice Closures.

1. Environmental protection of cable and splices designed for water submersion, underground installation and splicing in handholes.
2. Shall be compatible with all sizes of fiber cables used on this project and large enough to accommodate the number of splices plus 10%.
3. The closures shall be a dome type manufactured from a high-density polyethylene or approved equivalent nonmetallic material with the following properties:
 - Cable entry shall be manufactured of similar material to the dome body and seal the closure with re-usable compressed gel cable sealing components that accommodate a wide range of cable sizes.
 - Closures shall be re-enterable and re-sealable without the need for specialized tools or equipment or any additional parts.
 - No encapsulated materials shall be allowed.
 - Be provisioned for a minimum of six cable entries.
 - Hinging splicing trays that provide controlled access to splices and slack storage.
 - Splice and storage compartments accessible via a removable dome-clamp system.
4. Allow for the storage of at least eight unopened buffer tubes.
5. Shall contain all splice trays, storage, splice sleeves, organizing materials, and any other incidental materials required to complete.

6. Splice Closures shall be:
 - a. CommScope Model FOSC450-C6-6-NT-0-C0V for applications involving 96-strand fiber optic cable.
 - b. CommScope Model FOSC450-A4-4-NT-0-A1V for applications involving 48-strand fiber optic cable.
7. Splice trays shall be:
 - a. CommScope Model FOSC-ACC-A-TRAY-12 Tray with 12 Fusion Splice Holder.
 - b. CommScope Model FOSC-ACC-B-TRAY-24 Tray with 24 Fusion Splice Holder.
8. It is recommended that splice sleeves are CommScope Model SMOUV.
9. Seal plugs shall be CommScope Model FAK-MULDRP.
10. After splicing is complete, the fiber optic cable and closure shall be flash tested for leaks.

150895.03 CONSTRUCTION.

A. General.

Stake per coordinates provided in the plans, all handholes and proposed conduit alignment a minimum of 1 week prior to construction and for approval by the Engineer. The Engineer shall authorize any changes in location in writing before performing the installation. No additional compensation shall be provided for additional work associated with or resulting from unauthorized changes to the contract documents.

B. ITS Construction Survey

1. General.

ITS construction survey includes personnel, equipment, and supplies required for fiber optic line and ITS construction surveying and staking necessary for construction of the project as shown in the contract documents.

2. Documentation.

Format the survey work documentation in a manner acceptable to the Engineer. Ensure documentation is sufficient to prove means and methods used to transfer design intent to construction stakes. Check tie-ins with existing roadways, structures, and utilities prior to staking; notify the Engineer if discrepancies are found.

3. Qualifications.

Perform ITS construction survey directly by or under responsible charge of a Professional Land Surveyor licensed in the State of Iowa.

4. Construction

a. The Iowa DOT will stake permanent ROW corners per Section 2526 of the Standard Specifications. Fill the gaps along the permanent ROW between pins every 100 feet per Section 2526 of the Standard Specifications.

b. Place stakes at the following locations and label with item being staked:

- Handholes
- Conduit and/or cable alignment direction changes
- Transitions from plow to bore or bore to plow
- At locations requiring specific depths to avoid existing or future facilities
- A minimum of 100 feet apart along plowed conduit
- A minimum of 25 feet apart along bored conduit
- At other locations as noted within the contract documents

- c. On stakes marking bore locations, label with required minimum conduit depth below existing grade.

C. Wire and Cable.

1. General.

- a. All installations and connections shall comply with the contract documents and all generally accepted codes and standards.
- b. The Engineer shall resolve all conflicts.

2. Tracer Wire.

- a. Install, splice, and test for continuity tracer wire in all conduit installations as indicated on the contract documents.
- b. Where new tracer wire is installed:
 - Splice tracer wire only in handholes to form a continuous network using splice kits listed for wet locations.
 - Leave 5 foot coil of tracer wire in all Type IV handholes.
 - Test all tracer wire for continuity, with approval by the Engineer, prior to final acceptance.
- c. Labeling Requirement
 - Place tags on all tracer wire identifying the direction of the tracer wire at every test station.
 - Tracer wire tags shall be self-laminating polyester material.
 - Tracer wire tags shall have black text with a white background.
 - Tracer wire tags shall be Panduit part number S075X150YAJ or approved equal.
 - See plan sheet U.03 for labeling details.

3. Grounding/Bonding.

- a. Ground all installations as indicated in the contract documents.
- b. Installation of grounds is incidental to the cost of the connected items of work.
- c. Ground all installations in accordance with the requirements of NEC. Supply and install additional grounding rods and equipment as necessary to satisfy such requirements at no additional cost to the Contracting Authority.

D. Fiber-Optic Cable Installation.

1. General.

- a. The following fiber-optic cable shall be provided and installed by the Contractor.
 - 12 strand fiber optic cable, Single-Mode, OSP Cable, Single Dielectric, Loose Tube type, 12 fibers per tube.
- b. The following fiber-optic cable shall be provided by the Iowa DOT and installed by the Contractor. This fiber cable can be picked up from the Iowa DOT Ames Central Complex. Contact Jason Dale (515-239-1995) to make arrangements to pick up the fiber cable.
 - 48 strand fiber optic cable, Single-Mode, OSP Cable, Single Armored, Loose Tube type, 12 fibers per tube.
 - 96 strand fiber optic cable, Single-Mode, OSP Cable, Single Armored, Loose Tube type, 12 fibers per tube.
- c. Provide the Engineer with documentation of wasted cable.
- d. The maximum pulling tension shall be 600 pounds during installation (short term) and 200 pounds installed (long term).
- e. The shipping, storage, and operating temperature range of the cable shall be -40°C to +70°C. The installation temperature range of the cable shall be -30°C to +70°C.
- f. Remove fiber-optic cable from the reel in a manner acceptable to the manufacturer and Engineer.

- g.** Do not twist or bend the fiber-optic cable in excess of the limits recommended by the manufacturer.
- h.** As the cable is fed into the duct and conduit system, use a manufacturer approved water-based cable lubricant for all fiber-optic cable installations.
- i.** Protect at all times all proposed cables, cable ends, and any exposed portions of fiber-optic cable from damage including water intrusion.
- j.** Any existing pull tape or tracer wire that is used as a pull rope for fiber-optic cable installation shall be replaced in kind. The cost of any tracer wire or pull tape replacement shall be subsidiary to the fiber-optic cable installation.

2. Fiber-Optic Cable Testing.

- a.** Visually inspect fiber-optic cable prior to installation. Report any defects to Engineer.
- b.** Pre-installation (on-reel), all strands of fiber shall be tested (uni-directional) with an Optical Time Domain Reflectometer (OTDR) at 1310 nm and 1550 nm to verify attenuation, continuity and length of the cable. Measured length by the OTDR shall match manufacturer cable foot markings plus manufacturer provided helicity. Perform all tests in the presence of the Engineer and provide the Engineer with up to two copies of any software required for viewing electronic files of the OTDR traces. Fiber test results submitted to the Engineer that exceed the max attenuation loss specification will be identified as Out of Specification.
- c.** Post installation, all strands of fiber shall be tested (uni-directional) with an Optical Time Domain Reflectometer (OTDR) at 1310 nm and 1550 nm to verify attenuation, continuity and length of the cable. Measured length by the OTDR shall match manufacturer cable foot markings plus manufacturer provided helicity. Measured post installation length shall match pre-installation (on-reel) length +/- 50 feet for each strand. Perform all tests in the presence of the Engineer and provide the Engineer with up to two copies of any software required for viewing electronic files of the OTDR traces. Fiber test results submitted to the Engineer that exceed the max attenuation loss specification will be identified as Out of Specification.
- d.** The fiber-optic cable is to have a maximum attenuation of 0.4 dB/km at 1310 nm and 0.3 dB/km at 1550 nm when measured with an OTDR. Fiber test results submitted to the Engineer that exceed the max attenuation loss specification will be identified as Out of Specification.
- e.** Replace, as directed by the Engineer, any defect discovered during final acceptance at no additional cost to the Iowa DOT. Consider a defect to be any cable with an OTDR measured length that differs from the actual cable footage, excluding manufacturer's helicity.
- f.** All test equipment shall be factory certified within the last year. Provide copies of the certification ten days prior to testing.
- g.** Test results will be recorded on a form supplied by the Contractor, with data compiled in PDF format through the meter manufacturer's software. No additional alteration using software from the Contractor beyond the meter manufacturer's software will be allowed. Submit test results in a format approved by the Engineer. Completed test forms on each fiber shall be handed over to the Engineer. Also provide native test (electronic version) with no alterations and meter software for viewing of fiber traces. At a minimum, test results shall show the following:
 - Cable and fiber identification (as approved by Iowa DOT).
 - Operator Name.
 - Date and Time.
 - Setup and test parameters including wavelength, pulse width, range, scale and ambient temperature.
- h.** OTDR testing shall use a launch and receiving cable. Each cable shall be a minimum 1000 meters, or greater than the dead zone for the OTDR used for this test, whichever is larger.

3. Fiber-Optic Cable Installation.

- a.** A suitable cable feeding method shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it into the duct.

- b. Dynamometers and breakaway pulling swings shall be used to ensure that the pulling line tension does not exceed 600 pounds.
 - c. The mechanical stress placed on a cable during installation shall not be such that the cable is twisted or stretched. A pulling eye and swivel shall be attached to the cable and used to install the cable through the duct conduit system to prevent the cable from twisting.
 - d. Cables shall not be forced around sharp corners and precautions shall be taken during installation to prevent the cable from being kinked or crushed.
 - e. Minimum bending radius during installation shall not be less than 20 times the outside diameter of the cable or as recommended by the manufacturer, whichever is greater.
 - f. Pulling of the cable shall be hand assisted.
 - g. Iowa DOT approved installation methods include Pulling, High Air Speed Blowing, Air-Assist, Push/Pull Installation, and Air Blown Cable. Installation shall comply with all manufacturers' recommendations for cable installation including pulling tensions, bending radii, and methods, including use of rollers.
 - h. The cable shall be carefully inspected for jacket defects. If defects are noticed, the pulling operation shall be stopped immediately, and the Engineer notified. The Engineer shall make a determination of acceptability or shall reject the cable.
 - i. The fiber cable shall be installed in continuous runs as marked on the plans. End of reel splices or butt splices not shown in the plans shall be pre-approved by the Engineer and are incidental to the cost of the installation of the cable. If approved, the end of reel or butt splices shall be performed in existing splice vaults as shown on the plans. The cost associated with the end of reel or butt splices including splice closures, storage baskets, splice trays, protective sleeves, and all accessories shall be included in their respective items and shall not result in additional cost to Iowa DOT.
 - j. No splices shall be allowed unless indicated by the plans or approved by the Iowa DOT.
 - k. Seal all conduit openings using ETCO duct plugs or approved equal, or as directed by the Engineer, at all conduit openings at the junction boxes and handholes after cable installation.
- 4. Facilities Protection.**
- a. In the event it is suspected that cable damage has occurred prior to final acceptance, Test the cable with an OTDR within 72 hours after notification and submit a copy of the OTDR test to the Engineer upon completion.
 - b. Replace or repair, as directed by the Engineer, any damage occurring before final acceptance at no additional cost to the Iowa DOT. Perform any repairs or replacements as soon as reasonably possible unless otherwise approved by the Engineer.
 - c. Repair or replace any defect in the installed cable at no additional cost to the Iowa DOT. Consider a defect to be any condition resulting in a negative or adverse effect on current or future operations of the completed fiber-optic communication system as determined by the Engineer.
 - d. Any existing wiring that is damaged during fiber-optic cable installation shall be replaced or repaired, as directed by the Engineer, at no additional cost to the Iowa DOT.
- 5. Slack Coils.**
- a. Sufficient slack shall be left at each end of the cable to allow proper cable splicing and termination. The minimum slack amount shall be as follows or as indicated in the plans:
 - Handhole, 24 inches by 36 inches by 36 inches – 60 feet
 - Handhole, Type IV – 150 feet
 - b. Storage of slack cable in handholes shall be neatly coiled. The slack coils shall be bound at a minimum of three points around the coil perimeter.
 - c. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames and terminals.
 - d. For storage purposes, the minimum bending radius shall not be less than ten times the outside diameter of the cable or as recommended by the manufacturer, whichever is greater.

6. Cable Identification.

- a. Place tags on all fiber-optic cable identifying the owner and direction of the cable.
- b. Tags shall be used to label fiber optic cable in every cabinet, handhole, and building termination.
- c. Tags shall be self-laminating vinyl material.
- d. Tags shall be Panduit part number PST-FO or approved equal.
- e. Tags shall clearly identify where each individual cable run originated and where it ends (handhole to handhole, handhole to cabinet, handhole to building, etc.). Include mileposts for handholes.
- f. Handwritten tags are not allowed.
- g. Tags shall use indelible ink or etching which does not fade in sunlight, or in buried or underground applications.
- h. Tags shall be of a material that does not become brittle or deteriorate for a period of 20 years due to moisture, sunlight, soil minerals, chemicals or other environmental elements.
- i. Engineer shall approve tag content before installation.
- j. For fiber installations with joint Iowa DOT/other agency (or entity) use where the fiber will be owned by the other agency (or entity), install typical identifiers and/or markings for that fiber.
- k. See NI-Sheets for labeling details.

E. Handholes.

1. Install the type and size of handholes at the locations indicated in the contract documents.
2. Set top of all handholes to depths as indicated in the contract documents for different handhole types and installation locations.
3. Install coarse aggregate bedding below the handhole as identified in the contract documents.
4. Conduit shall enter the handhole from the bottom and extend conduit ends between 4 and 6 inches above the aggregate bedding.
5. Side penetrations of the handholes are not permitted.
6. Terminate each tracer wire run in test stations at Handhole, Type IV locations.
7. Install ground rods at all Type IV handholes and as indicated in the contract documents.
8. Plug all open conduit ends within the handhole in a manner acceptable to the Engineer.
9. Rodent proof all handholes to the satisfaction of the Engineer.
10. Conduit entrance into junction boxes shall be through slip holes. Conduit shall fasten to the box using sealing type locknuts.

F. Conduit.

1. General.

- a. Follow all general guidelines covering the construction of buried conduit.
- b. Install conduit by plowing, jacking, pushing, boring, or other approved methods within the public right-of-way and in a manner that minimizes atypical damage from construction operations.
- c. The minimum bending radius of HDPE conduit shall be the larger of 20 times the outside diameter or the HDPE manufacturer's recommendations for minimum bending radius.

- d. Open trench installation is only permitted within 25 feet of any handhole, structure, or other similar improvements, and any other requested locations approved by the Engineer.
 - e. At the discretion of the Engineer, verify the integrity of the conduit structure in a manner acceptable to the Engineer.
 - f. Tunneling under the pavement or water jetting shall not be permitted.
 - g. No excavations are permitted to cross any roadways or any other paved or other similarly improved areas. At these locations, install conduits by boring method unless otherwise directed or approved in writing by the Engineer. Where indicated in the Contract Document and at all roadway and stream crossings, install conduit sections with external protection as specified herein.
 - h. No direct-buried cable is allowed.
 - i. Unless otherwise indicated in the contract documents, installation of Schedule 40 PVC conduit or approved alternative is allowed only in open trench runs or when approved by the Engineer.
 - j. Seal all conduit openings using ETCO duct plugs or approved equal, or as directed by the Engineer, at all conduit openings at the junction boxes, handholes, and building entrances.
 - k. Thread and cap all rigid steel conduit ends with standard conduit caps until wiring is installed. Before wiring is installed, replace caps with threaded insulating bushing in accordance with Article 2523.03, N of the Standard Specifications.
- 2. Installation Clearances.**
- a. Depth of all bores shall be a minimum of 48 inches unless otherwise specified in the plans.
 - b. Maintain the typical offsets from referenced locations as shown in the plans.
 - c. Maintain the minimum depth throughout the length of all conduit installations.
 - d. Maintain a minimum of 2 feet of separation when underground conduits parallel an existing facility.
 - e. Maintain a minimum of 2 feet vertical separation when crossing existing utilities.
- 3. Conduit Splicing.**
- a. Install conduit with minimal splices between handholes and structures as shown on contract documents.
 - b. All mechanically joined conduit splices shall use compression couplings designed for underground placement and blown-in fiber installation.
 - c. Butt fusion welding and solvent welding of conduits will not be allowed.
 - d. All conduit splices shall be designed to be watertight to 200 psi.
 - e. Conduit splicing is incidental to the connected items of work.
- 4. Facilities Protection.**
- a. Protecting and maintain the conduit throughout construction and until final acceptance.
 - b. To avoid possible damage to buried conduit from exposure to traffic, livestock and other hazards, complete trenching of laterals, trenching around culverts, construction of aerial inserts and similar operations as soon as practicable behind all segment installations.
 - c. If more than 48 hours lag is expected behind a segment installation, install additional protective measures acceptable to the Engineer.
- 5. Backfilling.**
- a. Backfill trenches and other excavations in lifts of 6 inches or less in compacted depth. Compact each layer thoroughly before placing subsequent layers.
 - b. Remove all cinders, broken concrete, or other hard or abrasive materials in the backfill material before commencing backfilling operations.
 - c. Remove and dispose of surplus and unsuitable materials upon completion of the backfilling operations in the area.
 - d. Place and carefully hand tamp backfill under and around the structures in lifts not to exceed 4 inches in loose thickness. Use a suitably sized mechanical tamper for all areas inaccessible to rollers.

- e. Perform operations in a manner that minimizes soil erosion and employs appropriate storm water pollution prevention measures during all construction operations.
- f. Maintain work areas in a neat, clean, and orderly condition at all times.
- g. Upon completion of conduit/cable placing operations and any other work in an area, remove all debris, materials, tools, and equipment from the area and restore the disturbed area(s) to original or better condition within 24 hours or as soon as practicable as determined by the Engineer. Backfill all excavations and grade all disturbed areas during the restoration process.
- h. Remove and dispose of rock and debris excavated and remaining after backfilling as directed by the Engineer.

6. Surface Restoration.

- a. Replace or reconstruct features removed as a part of the work, such as sidewalks, driveways, curbs, roadway pavement, unpaved areas, or any other items.
- b. Immediately repair or replace any unauthorized disturbance or damage. Replace improved landscaping, lawns, scrubs, and hedge removed or damaged during construction in a manner acceptable to the Engineer. Re-sod damaged lawns using like grasses.
- c. Complete restoration according to the applicable sections of the Standard Specifications.

7. Multiple Duct Installation.

Install multiple ducts, in continuity, at locations indicated in the contract documents unless authorized in writing by the Engineer.

8. Plowing.

- a. Use equipment and construction methods subject to the approval of the Engineer that cause minimal displacement of the soil.
- b. Furnish competent supervision at all times at the site of plowing operations to assure compliance with the contract documents.
- c. The equipment shall be capable of extending the plow in order to maintain the required minimum depths under all terrain conditions.
- d. The reel carrier shall be of adequate size and be configured so that the reel sizes being used can be safely handled.
- e. Avoid damaging any paved surfaces, ditches, or other similar surface features. Immediately repair any damage to such features to the satisfaction of the Engineer.
- f. Perform plowing in accordance with standard industry practices using a prime mover with hydrostatic type steering and a vibratory plow. The design of the plowshare shall be such that the buried conduit passing through the plow shall not bind and shall not be bent in a radius less than 20 times the outside diameter of the conduit and maintains the structural integrity of the conduit. The feed chute shall have a removable gate for the purpose of inspection and to allow the conduit to be removed from or inserted into the feed chute at any intermediate point between splice locations. The conduit path inside the feed chute shall have low friction surfaces and be free of burrs and sharp edges to prevent damage to the conduit as it passes through. Smooth any welds before use. Internal guide rollers shall not be used. Exercise care during the plowing operation to avoid conduit damage. Feed the conduit into the ground through the plow loose and at no tension.
- g. Excavate as needed start and finish pits and pits at points of intersection in advance of plowing. Expose ends of casings and crossings of foreign utilities before the start of plowing operations for a conduit segment. Exercise care in the use of trenching and excavating tools and equipment to avoid damaging installed and intersecting conduits or other facilities.
- h. Restore plow furrowed areas to conform to the surrounding terrain using a rubber-tired tractor or heavy truck or a vibratory roller having a weight of 3 tons and a drum width between 4 and 6 feet or by other suitable means approved by the Iowa DOT.

9. Conduit In Trench.

- a. Use equipment and construction methods subject to the approval of the Engineer that cause minimal displacement of the soil.
- b. Excavate open trench straight as practicable. Shape the trench to be smooth, free from any sharp edges, and clear of debris and loose rock. Excavate only gradual grade changes.
- c. Do not leave trenches unattended at any time or open during non-working hours unless approved in writing by the Engineer. Install barriers or other protective measures to prevent livestock or persons from falling into an open trench when appropriate.
- d. Notify the Engineer immediately if solid rock is encountered at any location. Excavate rock trenches using a rock saw or other suitable equipment. The excavation, backfill, and road crossings in solid rock areas shall conform to the requirements stated above unless specifically exempted in this section.
- e. Rock excavation shall be considered extra work and shall be paid as a separate cost item. Obtain approval from the Engineer before commencing any rock excavation.

10. Bored Crossings.

- a. Use equipment and construction methods subject to the approval of the Engineer that cause minimal displacement of the soil.
- b. Bore all crossings beneath roadways, streets, other paved surfaces, railroads, or other structure in accordance with requirements and regulations of the authority having jurisdiction and as directed in the contract documents.
- c. Limit bore hole sizes to the outside diameter of the conduit being placed.
- d. Locate bore pits a minimum of 2 feet from the edge of pavement or shoulder unless otherwise directed by the Engineer.

G. ITS Pole / Foundation / Device Cabinet.

1. Existing ITS Structure Removal.

- a. Remove, store, and re-install the existing ITS pole, device cabinet, and power installed foundation. Refer to the plans.
- b. Protect and maintain the operation of the existing ITS installation for as long as practicable to facilitate Iowa DOT traffic monitoring during the beginning of interchange construction.
- c. Contact the Iowa DOT Traffic Operations Bureau 3 weeks in advance of when the Contractor requires the removal of the existing ITS installation. Traffic Operations Bureau contact:
 Jason Dale
 Office: 515-239-1995
 Mobile: 515-291-4675
 e-mail: Jason.Dale@iowadot.us
- d. During this time, the Iowa DOT will have their ITS equipment maintenance contractor remove the camera, antenna, and other electronic components from the structure prior to removal of the ITS structure by the Contractor.
- e. Notify the Resident Engineer one day in advance of the actual removal of the structure.
- f. On the scheduled date, coordinate with the roadway lighting contractor to decommission the electric power feed circuit to the existing ITS structure.
- g. Remove the ITS pole, cabinet, and power installed foundation, and shall transport and store these components in a secure location. The device cabinet shall be stored in a location out of the weather elements. Clean any earth debris from the foundation prior to storage.

2. Foundation Re-installation.

- a. **General.**
 - 1) Contact the Engineer a minimum of 1 week in advance to arrange a field review prior to placing the power installed foundation.
 - 2) Install the power installed foundation in accordance with the contract documents.

- 3) Notify the Engineer immediately if an obstruction conflicts with a proposed power installed foundation location. The Engineer is responsible for relocating or determining another effective means of supporting the structure to eliminate the conflict. Payment shall not be made for re-work or extra work as the result of an unauthorized relocation of a power installed foundation.

b. Installation Details.

- 1) Install foundation as located by the Engineer and set level and to the proper elevation.
- 2) Hand dig with shovel after power installed foundation is in place to install conduits into the provided conduit entrances.
- 3) Install the number of conduits sized as indicated in the contract documents. All conduits shall be located as indicated in the contract documents.

c. Improper Construction.

Remove and reconstruct, at no additional cost to the Engineer, all power installed foundations improperly constructed or with improperly installed anchor bolts, conduit, or any other foundations components as determined by the Engineer.

3. ITS Pole Re-installation.

a. General.

- 1) If pole has structural damage do not erect and notify Engineer.
- 2) Repair any surface damage to galvanized components using a zinc-rich paint acceptable to the Engineer.

b. Pole Erection.

- 1) Erect pole and securely bolt to the power installed foundation base plate such that the pole is vertical to the centerline of the nearest adjacent major roadway.
- 2) Provide new anchor bolts, nuts, and washers of the size and type of the original ones.
- 3) Use leveling nuts on each anchor bolt installed below the pole flange. Adjust the pole's vertical position by adjusting both the upper and lower nuts.

4. Device Cabinet Re-installation

a. General.

- 1) Install cabinet in accordance with the contract documents.
- 2) Do not penetrate the top of cabinet without prior authorization by the Engineer.
- 3) All exterior connections shall be watertight.
- 4) Contact the Engineer a minimum of 1 week in advance to arrange a field review prior to placing the cabinet.

b. Mounting.

- 1) Orient cabinet as shown in the contract documents unless otherwise directed by the Engineer.
- 2) Ensure sufficient clamps, nuts, hardware, etc., as required for the mounting type, are furnished.
- 3) Seal all conduit openings in the device cabinet using ETCO duct plugs or as directed by the Engineer.
- 4) Install grounding as shown in the contract documents.

H. Fiber Optic Cable Splicing, Accessories, and Hardware.

1. Fusion Splices.

- a. Shall be used to splice all continuous fiber runs in splice closures and factory terminated connector pigtails.
- b. Shall only be allowed in the splice closures and locations as shown on the plans.
- c. Maximum attenuation per splice as estimated by the fusion splicer shall not exceed 0.02dB. Any splice exceeding 0.02 dB at the time of splicing shall be re-spliced.
- d. Splice shall provide three axis core alignment using light injection and loss measurement techniques.
- e. No mechanical splices of fiber cable will be allowed.

- f. All fusion splice equipment shall be factory serviced within the last year. The successful bidder shall provide copies of factory service 10 days prior to splicing.
- g. Maintain on site at all times all materials necessary to immediately make temporary and/or permanent repairs to active fiber damaged during the course of work, including availability of additional splicing equipment.

2. Splicing Requirements.

- a. Successful bidder shall obtain approval from the ICN Network Operations Center (NOC) prior to any splicing work.
- b. Maintenance windows for splicing are restricted to Monday through Thursday from midnight to 6am.
- c. Complete cable cuts (insertion splice locations) require 8 weeks minimum notice to the ICN NOC. Splicing work at insertion splice locations shall be separated by a minimum of two weeks.
- d. Multiple maintenance windows per week may be scheduled for splicing that does not impact ICN traffic depending on NOC approval.
- e. Only one splicing crew is allowed per night. Multiple locations may be spliced in the same night. Successful bidder shall notify ICN NOC prior to splicing and upon completion of splicing before moving to the next location.
- f. Prior to splicing, the successful bidder shall notify the following:
 - ICN NOC
 - Iowa DOT Maintenance Contractor
 - Iowa DOT Traffic Management Center (TMC)
 - Other public agencies as listed earlier in this document.

150895.04 METHOD OF MEASUREMENT.

A. ITS Construction Survey.

Lump sum item. No measurement will be made.

B. Wire and Cable.

Measurement shall be per linear foot for the item Tracer Wire.

C. Fiber-Optic Cable Installation.

- 1. Measurement for the installation of each fiber-optic cable type shall be per linear foot for the following items:
 - a. Provide/Install Dielectric F.O. Cable, 12 SM
 - b. Install Armored F.O. Cable, 48 SM
 - c. Install Armored F.O. Cable, 96 SM
- 2. Fiber-optic cable length is calculated from plan dimensions as the linear, one-way length of new and existing conduits plus slack loops and splicing lead lengths in handholes, and riser lead length in pole(s). No allowance has been added to this quantity.

D. Fiber Optic Cable Acceptance Testing

Lump sum item. No measurement will be made.

E. Handholes.

Measurement for all handholes shall be per each for the items Handhole, 24"x36"x36", Handhole, Type IV, Test Station, and Fiber Marker.

F. Conduit.

- 1. Measurement for all conduits shall be per linear foot for the items 2" HDPE Conduit, Plowed and 2" HDPE Conduit, Bored.

2. Conduit length is calculated from plan dimensions as the linear, one-way length of new conduits. No allowance has been added to this quantity.

3. Measurement shall be per linear foot for the item Pull Tape.

G. Remove and Reinstall Power Installed Foundation

Measurement shall be per each for the item Remove and Reinstall Power Installed Foundation.

H. Remove and Reinstall ITS Steel Pole

Measurement shall be per each for the item Remove and Reinstall ITS Steel Pole.

I. Remove and Reinstall Device Cabinet, Pole Mount

Measurement shall be per each for the item Remove and Reinstall ITS Steel Pole.

J. Fiber Optic Cable Splicing, Accessories, and Hardware

1. Measurement shall be per each for the item Expose, Cut, and Pull Back 100 ft of Fiber Optic Cable.

2. Measurement shall be per each for the item Fiber Optic Splice Closure (w/ Storage Baskets).

3. Measurement shall be per each for the item Fiber Optic Splice (w/ Protector Sleeves).

4. Measurement shall be per each for the item Fiber Optic Termination.

5. Measurement shall be per each for the item Fiber Optic 12 Splice Tray.

6. Measurement shall be per each for the item Fiber Optic 24 Splice Tray.

150895.05 BASIS OF PAYMENT.

A. ITS Construction Survey.

Payment will be at the contract lump sum price for ITS Construction Survey. Payment is full compensation for staking and re-staking.

B. Wire and Cable.

1. Payment will be the contract unit price per linear foot for Tracer Wire.

2. Payment is full compensation for:

- a. The furnishing and installation of all wire and cable,
- b. Including the proper installation of the wire and cable into existing conduit and new conduit systems, supply and installation of splices and connectors, and slack, coiled, or stored wire or cables, and
- c. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.
- d. Prior to final acceptance, meet with the Engineer to demonstrate the locate system is working properly throughout the entire locate system.

C. Fiber Optic Cable Installation.

1. Payment for the installation of each fiber-optic cable type will be the contract unit price per linear foot for the following items:

- a. Provide/Install Dielectric F.O. Cable, 12 SM
- b. Install Armored F.O. Cable, 48 SM
- c. Install Armored F.O. Cable, 96 SM

2. Payment is full compensation for:
 - a. Installation of all cables per the contract documents,
 - b. Furnishing all materials, labor, tools, consumable items and other incidental items necessary to meet the requirements of the contract documents.

D. Fiber Optic Cable Testing

1. Payment will be at the contract lump sum price for Fiber Optic Cable Testing. Payment is full compensation for the following items:
 - a. Providing all necessary and calibrated test equipment and associated connection devices to perform the tests.
 - b. Performing fiber optic cable performance tests on all installed fibers and associated splices/terminations.
 - c. Providing a report documenting all tests performed and the results of the tests.
 - d. Providing As-Built Record Drawings of the complete ITS installation.

E. Handholes.

1. Payment for all handholes will be at the contract unit price per each for the items Handhole, 24"x36"x36", Handhole, Type IV, Test Station, and Fiber Marker.
2. Payment is full compensation for:
 - a. The furnishing and installation of all handholes,
 - b. Including all surface excavations, repair or restoration of any nearby areas, concrete, proper water/moisture drainage materials, all necessary electric grounding materials and installation,
 - c. Furnishing and installing all test stations at Handhole, Type IV locations,
 - d. Furnishing and installing all fiber markers at Handhole 24"x36"x36" locations, and
 - e. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

F. Conduit.

1. Payment for all conduits will be at the contract unit price per linear foot for the items 2" HDPE Conduit, Plowed and 2" HDPE Conduit, Bored.
2. Payment is full compensation for:
 - a. The furnishing and installation of all conduits per the contract documents,
 - b. Including all surface excavations or surface preparation work, repair or restoration of any disturbed areas to pre-construction conditions, proper water/moisture drainage materials,
 - c. Conduit mounting on new or existing infrastructure, and
 - d. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.
3. Payment for all pull tape will be at the contract unit price per linear foot, including furnishing and installation.

G. Remove and Reinstall Power Installed Foundation

1. Payment for Remove and Reinstall Power Installed Foundation will be at the contract unit price per each.
2. Payment is full compensation for:
 - a. Removal of the existing foundation,
 - b. Cleaning, protection and storage of the foundation,
 - c. Reinstallation of the foundation, and

- d. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

H. Remove and Reinstall ITS Steel Pole

1. Payment for Remove and Reinstall ITS Steel Pole will be at the contract unit price per each.
2. Payment is full compensation for:
 - a. Removal of the existing pole,
 - b. Protection and storage of the pole,
 - c. Reinstallation of the pole, and
 - d. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

I. Remove and Reinstall Device Cabinet, Pole Mount

1. Payment for Remove and Reinstall Device Cabinet will be at the contract unit price per each.
2. Payment is full compensation for:
 - a. Removal of the existing device cabinet,
 - b. Protection and weatherproof storage of the device cabinet,
 - c. Reinstallation of the device cabinet, and
 - d. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

J. Fiber Optic Cable Splicing, Accessories, and Hardware

1. Payment for Expose, Cut, and Pull Back 100 ft of Fiber Optic Cable will be at the contract unit price per each. Payment is full compensation for:
 - a. Excavation, necessary shoring, exposure of existing conduit duct bank,
 - b. Cutting of existing conduits and fiber cables,
 - c. Rerouting of conduits and fiber cables into new handhole,
 - d. Backfill, compaction, site restoration, and
 - e. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.
2. Payment will be the contract unit price per each for the following items:
 - a. Fiber Optic Splice Closure (w/ Storage Baskets).
 - b. Fiber Optic Splice (w/ Protector Sleeves).
 - c. Fiber Optic Termination.
 - d. Fiber Optic 12 Splice Tray.
 - e. Fiber Optic 24 Splice Tray.
3. Payment for each of these items is full compensation for furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

ADDITIONAL BIDDING ATTACHMENTS**3.01. Equipment and Materials List for Submittal Requirements.**

DESCRIPTION	MANUFACTURER	CATALOG NUMBER
HANDHOLE, TYPE IV		
HANDHOLE, 24"x36"x36"		
TEST STATION		
FIBER MARKER		
GROUND RODS		
EXOTHERMIC WELDING KIT		
#6 AWG COPPER CABLE		
TRACER WIRE		
TRACER WIRE SPLICE KIT		
DUCT PLUGS		
HDPE CONDUIT		
SCH 80 HDPE CONDUIT		
CONDUIT SPLICE KIT		
DUCT PLUGS		
DUCT SEAL		
12 SM DIELECTRIC FIBER OPTIC CABLE		
OTDR METER WITH CALIBRATION CERTIFICATE FROM MANUFACTURER WITHIN LAST YEAR		
FUSION SPLICER WITH CALIBRATION CERTIFICATE FROM MANUFACTURER WITHIN LAST YEAR		
FIBER OPTIC SPLICE CLOSURE		
FIBER OPTIC SPLICE TRAY		

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