SP-150663
(New)

SPECIAL PROVISIONS
FOR
ITS INFRASTRUCTURE INSTALLATION

Pottawattamie County
IM-029-3(184)53--13-78

Effective Date
August 18, 2020

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.

150663.01 DESCRIPTION.

A. General Requirements.

1. This part consists of the general provisions necessary when furnishing and installing the ITS Infrastructure and Fiber Optic Cable as described in the project plans and these special provisions.

2. This project involves installing cabinets, poles, and foundations; and supplying and installing conduit, attachments, handholes, fiber optic cabling, and tracer wire deemed necessary for an ITS Infrastructure installation designed for use with future proposed ITS fiber and device deployments and other uses planned by the Iowa DOT. The Iowa DOT plans to initiate separate contracts to terminate the fiber optic cable and place it in service (light the fiber network). Separate contracts will also be initiated to supply and install the cameras, sensors, and other ancillary equipment in or on the cabinets and poles, as well as other items required to provide a complete and functioning network of ITS devices.

3. The Contractor shall not take advantage of any apparent error, discrepancy or omission in the plans or specifications. Upon discovery of such an error, discrepancy or omission, the Contractor shall notify the Engineer immediately. The Engineer will then make such corrections or interpretations as necessary to fulfill the intent of the plans and specifications.

4. Materials or work described in words which, so applied, have known technical or trade meaning shall be held to refer to such recognized standards.

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 Engineer when such correction is necessary for the proper execution of the work.

6. The Contractor will need to coordinate with any other projects within the corridor. The Iowa DOT will assist in the coordination and scheduling of work. The Contractor for this project shall assign a responsible staff member that will work with the Iowa DOT on decisions regarding order of work and scheduling as needed throughout the duration of this project.

B. Related Specifications and Standards.

The work as detailed on the plans for the ITS Infrastructure Installation shall be completed in accordance with the plans, special provisions and all other contract documents. A requirement occurring in one is as binding as though occurring in all. The following documents are intended to be complementary and to describe and provide for a complete project.

- Specifications of the Underwriter's Laboratories, Inc.
- National Electric Code
- MUTCD
- American National Standards Institute, Telecommunications Industry Association, Electronic Industries Association (ANSI/TIA/EIA) latest editions.

C. Contractor's Responsibility.

1. Coordination with Utilities.

a. The Contractor is responsible for determining 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 by the Contractor of the starting construction date.

2. One Call Locating.

Until final written acceptance of the overall project by the Engineer and their locate partners, the Contractor shall provide all utility locates of the work performed under this contract when requested through One-Call services or by the Engineer. The Contractor shall perform any such locations within 48 hours of receiving notice that such locations are needed. The contractor should contact Iowa One-Call to get added to the Distribution List. For receiving notification requests only, Iowa One-Call can be reached at ialead@occinc.com.

3. Conduit Locations.

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

4. Material and Equipment Storage and Construction Site Access.

a. Contractor shall secure a designated material storage area for this project. Any request to store material in the right-of-way in order to complete the current work activity shall 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 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

5. Finishing Activities.

Upon completion of the work at each project area, thoroughly clean the site and restore it to a condition at least equal to 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.

D. Contractor Submissions.

1. Materials List.
The Engineer shall furnish a list of materials required for the project to each bidder with the proposal. 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, the Contractor shall 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 installation of conduit, handholes, device poles and footings, device cabinets, and electrical installations.
- **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.

C. Shop Drawings/Catalog Cuts.

1. Prior to construction and after approval of the Materials List, submit one electronic pdf file of the shop drawings or catalog cuts for the materials to the Iowa DOT for approval.

2. The Engineer shall review the shop drawings/catalog cuts for the purpose of assuring general conformance with the project design concept and contract documents.

3. Provide written notice of any deviations from the requirements of the plans or contract documents.

4. 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.

5. The Engineer shall provide approval before any materials are ordered.

D. Materials Procurement.

1. Shop drawings, specification data, and samples for acceptance testing (when requested) shall be submitted to the Iowa DOT for approval and/or selection prior to the placing of orders for any equipment and materials.

2. The Contractor shall order all materials requiring production lead time greater than 4 weeks within 5 business days of receiving the approved shop drawing(s).

3. The Contractor shall submit to the Engineer proof of material purchase order in electronic pdf format.

E. Warranty.

1. Transfer all required standard materials warranties on the date of final acceptance to the Iowa DOT.

2. Warranty periods shall not commence prior to final acceptance of the work.

E. Disruption to Existing Fiber Networks.

1. Planned Work Near Existing Fiber Networks.

a. The Contractor shall ensure continuous operation of the existing fiber networks and systems during construction of the project.

b. The Contractor shall 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 Iowa Communications Network (ICN). The Contractor shall provide a written request to the Iowa DOT and the respective parties for approval at least ten 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, the Contractor shall submit the work plan and schedule for approval by the Engineer. The work plan shall include all fiber strands and the parties possibly affected.

2. Allowable Working Hours.

a. The Contractor shall only access or disrupt existing fiber between Midnight and 6:00 AM on working days unless otherwise approved by the Engineer.

b. The Contractor shall be responsible for repairing, to Iowa DOT's satisfaction and at no cost to Iowa DOT, any damage the Contractor causes to the existing fiber networks and systems during the life of the project.

c. In the event of disruption the contractor shall simultaneously notify the Engineer and affected parties and immediately stop all work in progress and shall expend all of its 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.

d. The Contractor shall remain on site until the Iowa DOT notifies that the disrupted systems are fully operational. Unplanned disruptions lasting longer than a given duration shall result in the assessment of liquidated damages.

e. 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 $500.00 liquidated damages per 60 minutes, for each 60 minute period that the Contractor fails to restore the proper operation of an existing fiber-optic network element following an unplanned disruption lasting longer than 6 hours.

2) To authorize the Engineer to deduct these liquidated damages from any money due or coming due to the Contractor.

F. As-Built Documentation.

1. General.

a. As-built record drawings 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’s on-site representative.

2. GPS Data Recording Staking Assistance.

a. The Engineer's on-site representative will be responsible for collecting GPS data of all installations including, but not limited to: conduit routing and depth, handholes, device poles, device cabinets, and power supplies. All efforts will be made by the Engineer's on-site representative to coordinate with the Contractor and collect construction progress daily.

b. The Contractor shall be responsible to coordinate and assist the Engineer's on-site representative in this effort by staking, flagging or otherwise locating all installed features until such time that the GPS data can be collected.

150663.02 MATERIALS.

This Article consists of the material requirements necessary to complete construction of the ITS Infrastructure project, in place, as described in the contract documents.

A. General.

Supply only new materials from reputable suppliers and manufacturers approved by the Engineer. 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 UL-approved. Securely store and protect all materials delivered to the project site. Provide appropriate material quantities for testing or verification at no additional cost when requested by the Engineer.

B. 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 2% 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 -50ºF to +170ºF.

e. The handhole walls shall not deflect more than 0.024 inches per foot of length of box when installed and subject to an ASTM C-857 TIER 22 load.

f. Handholes shall meet ANSI/SCTE 77 standards and be verified by a registered third party and stamped by a registered Professional Engineer.

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.

i. The Engineer shall provide approval prior to use of any handholes satisfying the contract documents requirements for structural, physical, and chemical properties.

2. Test Stations.

a. Supply Rhino part TVTI78OB-EM9125-OR or approved equivalent test stations at all Type Fiber Vault handholes.

b. Test Stations shall be 78 inches tall above grade triangular flexible orange plastic marker with five separate access terminals 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 No. TVF78OO or approved equivalent markers at all 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.

C. Conduit.

1. Polyvinyl Chloride Conduit.
Polyvinyl chloride (PVC) conduit shall be gray rigid (e.g. Schedule 40) PVC meeting the requirements of NEMA TC-2, Type 2, and applicable UL Standards.

2. High Density Polyethylene (HDPE) Conduit.
a. High Density Polyethylene (HDPE) conduit shall be smooth wall orange in color.
b. Comply with ASTM F 2160 (conduit) and ASTM D 3350 (HDPE material), minimum SDR 13.5, and NEMA TC-7 EPEC-B standards.
c. Sequential foot markings printed on HDPE.
d. A custom message of stated material specifications that product meets shall be printed a minimum of every 10 feet.
e. Continuous reel or straight pieces to minimize splicing.
f. For dissimilar conduit connections provide an adhesive compatible with both materials.

D. Wire and Cable.

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

2. Power Wire.
Single conductor, stranded copper, Type XHHW, black colored jacket in sizes listed in the Contract Documents.

3. Grounding and Bonding.
a. Follow Article 4185.11 of the Standard Specifications and install quantity and size according to the plans. Ground shall be bonded to copper clad metal and driven electrodes using an exothermic weld.
b. Grounding wire for test stations shall be bare solid No. 6 AWG copper wire.

E. Fiber Optic Cable.

1. General.
a. The cable shall meet the latest applicable standard specifications by ANSI, EIA and TIA for the single-mode fiber cable of the size specified per the Plans.
b. All fiber-optic cable for installation on this project shall be provided by the Contractor.
c. The Contractor shall provide the Engineer the manufacturer's production test provided with the spool.
d. The Contractor shall provide the Iowa DOT with documentation of wasted cable.
e. 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.
f. The cable core shall be water blocked with dry water blocking materials to improve access and handling of individual tubes.
g. 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.
h. 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.

i. 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.

j. The optical fiber shall be manufactured by Corning, OFS or Draka.

k. The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

l. The jacket or sheath shall be free of holes, splits, and blisters.

m. 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.

n. The maximum pulling tension shall be 600 pounds during installation (short term) and 200 pounds installed (long term).

o. 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.

F. Device Cabinets.

1. Furnish all work, apparatus, and materials to construct and install the device cabinets designed to house the control equipment required for the planned ITS system.

2. DOT to provide ground mounted and pole mounted cabinets. Furnish all additional materials for complete cabinet installation of new stock only.

3. All concrete for foundations shall meet the requirements of Article 2403 of the Standard Specifications. Use Class C concrete for cabinet foundations and all other non-paving concrete construction.

G. Power Connections.

Power connections shall comply with the requirements of NEC, the contract documents and all generally accepted standards and requirements for the electrical components and power terminations in the individual power source.

H. Poles.

All ITS poles shall be provided by the Iowa DOT. The Contractor shall coordinate with the Engineer the time for the Contractor to accept the poles from the Iowa DOT Maintenance Garage in Council Bluffs, Iowa, and deliver the poles to the field for installation or to the Contractor's construction yard for storage.

I. Power Installed Foundation.

All power installed foundations shall be provided by the Iowa DOT. The Contractor shall coordinate with the Engineer the time for the Contractor to accept the power installed foundations from the

Iowa DOT Maintenance Garage in Council Bluffs, Iowa, and deliver the power installed foundations to the field for installation or to the Contractor's construction yard for storage.

J. Step-down Transformers.

1. Step-down transformers shall comply with the requirements of the contract documents and all generally accepted standards and requirements for the electrical components entering and exiting the transformer.

2. All step-down transformers shall be dry type, general purpose, factory assembled, air-cooled, single phase, with ratings as indicated on the plans.

3. Transformer winding shall be Aluminum.

4. Primary voltage shall be 240V stepped down to secondary voltage 120V.

5. Step-down transformers shall be UL listed and conform to the requirements of ANSI/National Fire Protection Association (NFPA).

6. Transformer enclosure shall be NEMA 3R compliant.

7. Step-down transformers shall be capable of mounting to side of cabinet without compromising cabinet structural integrity and such mounting shall be effectively sealed to prevent the entry of rain, dust, and dirt.

8. Transformers shall be capable of carrying a continuous 15% overload without exceeding 239°F rise in a 104°F ambient.

9. Provide grounding in accordance with the Standard Specifications.

150663.03 CONSTRUCTION.

This Article consists of the construction details necessary to complete construction of the ITS Infrastructure project, in place, as described in the contract documents.

A. General.

1. The Contractor shall stake, per the Iowa State Plane South coordinates provided in the plans, all handholes, fiber vault, cabinet, proposed conduit alignment (every 50 feet unless noted on the plans) and pole locations prior to construction and for approval by the Engineer. The Contractor shall expect some reasonable variation in location of the facilities shown due to unforeseen conflicts, changes in proposed work, installation difficulties, or other circumstances. 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.

2. 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. Handholes.

1. Install the type and size of handholes at the locations indicated in the contract documents.

2. Construct all Type Fiber Vault handholes as located by the Engineer.

3. Set top of all handholes to depths as indicated in the contract documents for different handhole

types and installation locations.

4. Install Portland cement concrete fine aggregate gradation No. 1 in the Standard Specifications Aggregate Gradation Table bedding to a depth of 1 foot below the handhole. The bedding shall extend 3 inches beyond the base of the handhole.

5. Conduit shall enter the handhole from the bottom and extend conduit ends between 4 and 6 inches above the aggregate bedding.

6. Side penetrations of the handholes are not permitted.

7. Terminate each tracer wire run in test stations at Handhole, Type Fiber Vault locations.

8. Install ground rods at all Type Fiber Vault handholes as indicated in the contract documents.

9. Plug all open conduit ends within the handhole in a manner acceptable to the Engineer.

10. Rodent proof all handholes to the satisfaction of the Engineer.

C. 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, pole, 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.** 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.
- **i.** Seal all conduit openings using an approved sealing compound (duct seal) at all conduit openings at the junction boxes handholes, poles, cabinets, and building entrances.
- **j.** Thread and cap with standard pipe caps all rigid steel conduit ends until installing wiring. Per Article 2523.03, N of the Standard Specifications replace caps with approved conduit bushing during and after wire installation.

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.

3. Conduit Splicing.

- **a.** Conduit shall be installed in continuous runs between handholes, foundations, and

structures unless otherwise directed by the Engineer.

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 watertight to 200 psi.

e. Conduit splicing is incidental to the connected items of work.

4. Facilities Protection.

a. The contractor is responsible for protecting and maintaining 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. Operate pneumatic or other mechanical tampers in accordance with the manufacturer's recommendations.

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 the applicable sections of the Standard Specifications.

7. 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.

8. 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.

D. Wire and Cable.

1. General.

a. All installations and connections shall comply with the contract documents and all generally accepted codes and standards.

b. Install cable connectors in accordance with Standard Road Plan RM-40 and the contract documents at the base of all breakaway poles, cabinets, or other installations for all non-low voltage installations unless otherwise directed by the Engineer. All costs associated with these connectors are incidental to the cost of the connected items of work.

c. Direct bury of wire and cable is not allowed.

d. All electrical and grounding cable shall comply with electrical and grounding testing required per Section 2523 of the Standard Specifications. The electrical and grounding testing shall be witnessed by the Engineer or Engineer's Representative. The contractor shall provide a 24 hour notice prior to testing. The contractor shall submit testing documentation prior to the end of the project.

e. 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, the Contractor shall:

- Splice tracer wire only in handholes to form a continuous network using splice kits listed for wet locations.
- 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 where individual cable run originated, where it ends, along with direction of the tracer wire in every test station and hand hole.
- 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.04 for labeling details.

3. Grounding/Bonding.

a. Ground all installations as indicated in the contract documents.

b. Installation and testing of grounds is incidental to the cost of the connected items of work.

c. Ground all installations in accordance with the requirements of NEC and Article 2523.03, M of the Standard Specifications. Supply and install additional grounding rods and equipment as necessary to satisfy such requirements at no additional cost to the Iowa DOT.

d. Tracer wire shall be connected to ground bars in all cabinet locations or ground rods if no ground bar exists at a cabinet location

E. Fiber Optic Cable.

1. General.

a. Remove fiber optic cable from the reel in a manner acceptable to the Manufacturer and Engineer.

b. Install fiber optic cable in existing conduit as indicated in the contract documents.

c. Direct bury of fiber optic cable is not allowed.

d. Do not twist or bend the fiber optic cable in excess of the limits recommended by the manufacturer.

e. 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.

f. Protect at all times all proposed cables, cable ends, and any exposed portions of fiber optic cable from damage including water intrusion.

g. 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.

h. By the end of the contract, the contractor shall supply the engineer with documented footage marks of the cable at the entry and exit of all structures.

2. Cable Installation.

a. All fiber optic cable shall be installed in conduits.

b. 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.

c. Dynamometers and breakaway pulling swings shall be used to ensure that the pulling line tension does not exceed 600 pounds.

d. 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.

e. Cables shall not be forced around sharp corners and precautions shall be taken during installation to prevent the cable from being kinked or crushed.

f. 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.

g. Pulling of the cable shall be hand assisted.

h. 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 and

bending radii.

i. 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.

j. 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.

k. No splices shall be allowed unless indicated by the plans or approved by the Iowa DOT.

l. Seal all conduit openings using an approved sealing compound (duct seal) at all conduit openings at the junction boxes handholes, poles, cabinets, and building entrances after cable installation.

3. Facilities Protection.

a. In the event it is suspected that cable damage has occurred by the Engineer prior to final acceptance, Contractor shall 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. Contractor shall 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. Contractor shall 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.

4. 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 inch by 36 inch by 36 inch – 60 feet
- Handhole, Fiber Vault – 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.

5. 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 No. 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.

F. Device Cabinets.

1. General.
a. Install cabinets in accordance with the contract documents and the manufacturer's recommendations.
b. Do not penetrate the top of any cabinets without prior authorization by the Engineer.
c. Do not allow screws used for mounting shelves or other mounting purposes to protrude beyond the outside wall of the cabinet.
d. All exterior connections shall be watertight.
e. Contact the Engineer a minimum of 1 week in advance to arrange a field review prior to placing the cabinets.

2. Mounting.
a. Orient cabinets as shown in the contract documents unless otherwise directed by the Engineer.
b. Ensure sufficient clamps, nuts, hardware, etc., as required for the specified mounting type, are furnished with each cabinet.
c. Seal all conduit openings in the device cabinet using duct plugs or as directed by the Engineer

2. Cabinet Foundations.
a. Install cabinet foundations in accordance with the contract documents and the manufacturer's recommendations.
b. All cabinet foundations shall include a concrete maintenance pad area that is cast and reinforced as a single unit with the cabinet foundation dimensioned as shown in the Contract Documents.
c. Prepare and submit for Engineer approval, design plans and details for all cabinet foundations at no additional cost to the Engineer.
d. Contact the Engineer a minimum of one week in advance to arrange a field review prior to placing the cabinet foundation.
e. Notify the Engineer immediately if an obstruction conflicts with a foundation. 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 foundation.
f. Construct all foundations as located by the Engineer. Securely rest all foundations on firm undisturbed ground and set level to the proper elevation.
g. Form the upper portion of all concrete foundations and for all instances where the excavation is irregular in shape to provide the proper dimensions. Forming materials shall be level and braced to avoid displacement, warping, or deflection from the specified pattern during construction and curing.
h. Install and secure anchor bolts, conduits, and reinforcement before concrete placement. Use a rigid template to position anchor bolts in accordance with the appropriate pattern. The center of the template and the center of the concrete base shall coincide unless otherwise directed by the Engineer.
i. Install a sufficient number of conduits sized as indicated in the contract documents. All conduits shall be located as indicated in the contract documents.
j. Place all concrete within 90 minutes of batching and consolidate using a high-frequency vibrator during construction.
k. Modification of a foundation after construction is not allowed.
l. Cover all anchor bolts to protect them against damage and to protect the public from possible injury until erecting.

m. Allow a minimum of seven calendar days curing of concrete foundations before setting cabinets.

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

G. Power Connections.

1. Install power connections in accordance with the contract documents and all NEC requirements.

2. Contractor shall coordinate installations in advance as noted on the contract documents.

3. Contractor shall provide all conduit, breaker enclosures, circuit breakers, wiring and accessories, neutral bars and accessories, ground bars and accessories, terminations and grounding in the power source.

4. Unless otherwise directed by the Engineer, the Contractor shall install the power connections as illustrated in the contract documents.

5. The Contractor is responsible for coordinating and scheduling all locally required inspections of electrical work prior to putting a location into service.

6. The Contractor shall coordinate with the Engineer and power provider to request that electrical service at a device location be initiated.

H. Poles.

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

2. Pole Erection.
a. Erect poles and securely bolt to the anchor plate blister or power installed foundation base plate such that the pole is vertical.
b. 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.

I. Power Installed Foundation.

1. General.
a. Install the power installed foundations in accordance with the contract documents and the manufacturer's recommendations.
b. Contact the Engineer a minimum of 1 week in advance to arrange a field review prior to placing the power installed foundation.
c. 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.

2. Installation Details.
a. Construct all power installed foundations as located by the Engineer and set level and to

the proper elevation.

b. Hand dig with shovel after power installed foundation is in place in order to install conduits into the provided conduit entrances.

c. Install a sufficient number of conduits sized as indicated in the contract documents. All conduits shall be located as indicated in the contract documents.

3. Improper Construction

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

J. Step-down Transformers.

1. Install step-down transformers in accordance with the contract documents, Local Utilities, and all NEC requirements. Locate and orient step-down transformers as shown in the plans.

2. Contractor shall coordinate installations in advance as noted on the Contract Documents.

3. The Contractor is responsible for coordinating and scheduling all locally required inspections of electrical work prior to putting a step-down transformer into service.

4. The Contractor shall coordinate with the Engineer and power provider to request that electrical service at a device location be initiated.

K. Removal Items.

Remove items as indicated on the plans. Unless otherwise specified on the plans, the removal items shall become the property of the Contractor. The Contractor is responsible for salvaging and/or disposal of the material. All costs incidental to the removal of these items shall be included in the respective pay items.

L. Fiber-Optic Cable Acceptance Testing.

1. Visually inspect fiber-optic cable prior to installation. Report any defects to Engineer.

2. 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. The contractor shall 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.

3. 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. The contractor shall 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.

4. 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.

5. Contractor shall 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.

6. All test equipment shall be factory certified within the last year. The Contractor shall provide copies of the certification ten days prior to testing.

7. 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. The Contractor shall submit test results in a format approved by the Engineer. Completed test forms on each fiber shall be handed over to the Engineer. Contractor shall 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.

8. OTDR testing shall use a launch 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.

150663.04 METHOD OF MEASUREMENT.

A. Handholes.
Measurement for all handholes shall be per each for the bid items Handhole, Type Fiber Vault; Handhole, Type 24"x36"x36"; and Handhole, Type I ITS.

B. Conduit.
Measurement for all conduit shall be per linear foot for the bid items Conduit, Furnish and Install, HPDE, 2 Inch; Conduit, Furnish and Install, HDPE, 2 Inch, Bored; and Conduit, Furnish and Install, RSC, 2 Inch.

C. Wire and Cable.
Measurement for all wire and cable shall be per linear foot for the bid items Cable, Furnish and Install, No. 6 AWG; Cable, Furnish and Install, No. 4 AWG; Cable, Furnish and Install, No. 2 AWG; and Cable, Furnish and Install, No. 10 Tracer Wire.

D. Fiber Optic Cable.
Measurement for all fiber optic cable shall be per linear foot for the bid item Cable, Furnish and Install, 12 Count SM Fiber Optic; Cable, Furnish and Install, 24 Count SM Fiber Optic; and Cable, 24 Count SM Fiber Optic, Install Only.

E. Device Cabinets.
Measurement for device cabinets shall be at the contract unit price per each for the bid items Cabinet, Ground Mount, Install Only and Cabinet, Pole Mount, Install Only.

F. Power Connections.
Measurement for all power connections shall be per each for the bid item Power Connection.

G. Poles.
Measurement for all steel poles shall be per each for the bid item Steel Pole 45 Foot, Install Only.

H. Power Installed Foundation.
Measurement and payment for power installed foundations shall be per each for the bid item Power Installed Foundation, Install Only.

I. Step-down Transformers.
Measurement for all step-down transformers shall be per each for the bid items Step-Down Transformer 3kVA and Step-Down Transformer 10kVA.

J. Removal.
Measurement for removals shall be per lump sum for the bid item Removal of ITS Devices and Infrastructure.

K. Fiber-Optic Cable Acceptance Testing.
Measurement for fiber optic acceptance testing shall be lump sum for the pay item Fiber Optic Acceptance Testing.

150663.05 BASIS OF PAYMENT.

A. Handholes.

1. Payment for all handholes shall be at the contract unit price per each for the bid items Handhole, Type Fiber Vault; Handhole, Type 24”x36”x36”; and Handhole, Type I ITS.

2. Payment is full compensation for:
- The furnishing and installation of all handholes,
- Including all surface excavations, repair or restoration of any nearby areas, concrete, proper water/moisture drainage materials, all necessary electric grounding materials and installation,
- Furnishing and installing all test stations at Handhole, Type Fiber Vault locations and all handhole markers at Handhole, Type 24”x36”x36” locations, and testing of the grounding rods.
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

B. Conduit.

1. Payment for all conduit shall be at the contract unit price per linear foot for the bid items Conduit, Furnish and Install, HPDE, 2 Inch; Conduit, Furnish and Install, HDPE, 2 Inch, Bored; And Conduit, Furnish and Install, RSC, 2 Inch.

2. Payment is full compensation for:
- The furnishing and installation of all conduits per the contract documents,
- Including all surface excavations or surface preparation work, repair or restoration of any disturbed areas to pre-construction conditions, proper water/moisture drainage materials,
- Conduit mounting on new or existing infrastructure, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

C. Wire and Cable.

1. Payment for all wire and cable shall be at the contract unit price per linear foot for the bid items Cable, Furnish and Install, No. 6 AWG; Cable, Furnish and Install, No. 4 AWG; Cable, Furnish and Install, No. 2 AWG; and Cable, Furnish and Install, No. 10 Tracer Wire.

2. Payment is full compensation for:

- 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 wires or cable,
- All required electrical and grounding testing per Article 2523.03.U of the Standard Specifications, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

D. Fiber Optic Cable.

1. Payment for all fiber optic cable shall be at the contract unit price per linear foot for the pay items Cable, Furnish and Install, 12 Count SM Fiber Optic; Cable, Furnish and Install, 24 Count SM Fiber Optic; and Cable, 24 Count SM Fiber Optic, Install Only.

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

E. Device Cabinets.

1. Payment for device cabinets shall be at the contract unit price per each for the bid items Cabinet, Ground Mount, Install Only and Cabinet, Pole Mount, Install Only.

2. Payment is full compensation for:
- The installation of all cabinets,
- Including all internal components and accessories required to provide a complete cabinet installation per the contract documents,
- Providing and installing all mounting materials, cable pulling, routing and management, cable termination, and all necessary electric grounding materials, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

F. Power Connections.

1. Payment for all power connections shall be at the contract unit price per each for the bid item Power Connection.

2. Payment is full compensation for:
- The furnishing and installation of all power connection accessories as shown in the contract documents,
- Including the proper installation of the conduit, breaker enclosures, circuit breakers, wiring and accessories, neutral bars and accessories, ground bars and accessories, terminations, and grounding in the power source, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

G. Poles.

1. Payment for all steel poles shall be at the contract unit price per each for the bid item Steel Pole 45 Foot, Install Only.

2. Payment is full compensation for:
- The installation of all poles and accessories,
- Including fitting the appropriate bolt pattern to the transformer base foundation base plate,

all conduit entrances and attachments, all necessary electric grounding materials, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

H. Power Installed Foundation.

1. Payment for power installed foundations shall be at the contract unit price per each for the bid item Power Installed Foundation, Install Only.

2. Payment is full compensation for:
- The installation of all power installed foundations,
- Including all surface excavations, repair or restoration of any nearby areas, bolts, and bolt mounting assemblies for connection to poles or other structures, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

I. Step-down Transformers.

1. Payment for all step-down transformers shall be at the contract unit price per each for the bid items Step-Down Transformer 3kVA and Step-Down Transformer 10kVA.

2. Payment is full compensation for:
- The furnishing and installation of all step-down transformer accessories as shown in the Contract Documents,
- Including the proper installation of the conduit, breaker enclosures, circuit breakers, wiring and accessories, neutral bars and accessories, ground bars and accessories, terminations, and grounding in the transformer, and
- Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

J. Removal.

Payment for removals shall be at the contract unit price per lump sum for the item Removal of ITS Devices and Infrastructure.

K. Fiber-Optic Cable Acceptance Testing.

1. Payment for fiber optic acceptance testing shall be at the lump sum contract unit price bid for the item Fiber Optic Acceptance Testing.

2. Payment is full compensation for:
a. The furnishing of all test equipment
b. Furnishing labor, tools, testing equipment, consumable items, and incidentals necessary to complete all acceptance testing satisfying the requirements of the contract documents.

ATTACHMENT
EQUIPMENT AND MATERIALS LIST FOR SUBMITTAL REQUIREMENTS

Project No. IM-NHS-029-3(183)53--03-78 in the City of Council Bluffs in Pottawattamie County.

DESCRIPTION	MANUFACTURER	CATALOG NUMBER
HANDHOLE, TYPE FIBER VAULT		
HANDHOLE, TYPE 24”x36”x36”		
HANDHOLE, TYPE I ITS		
LOCATE TEST STATIONS		
HANDHOLE MARKERS		
GROUND ROD		
EXOTHERMIC WELDING KIT		
DUCT SEAL		
DUCT PLUGS		
1C #10 TRACER WIRE		
#6 AWG COPPER WIRE		
#4 AWG COPPER WIRE		
#2 AWG COPPER WIRE		
POWER CONNECTIONS		
2 INCH HDPE		
2 INCH RSC		
12 SM FIBER OPTIC CABLE		
24 SM FIBER OPTIC CABLE		
STEP-DOWN TRANSFORMER 3kVA		
STEP-DOWN TRANSFORMER 10kVA		
FIBER OPTIC TESTING EQUIPMENT		