



**SPECIAL PROVISIONS
FOR
ITS INFRASTRUCTURE INSTALLATION**

**Pottawattamie County
ITS-006-1(131)--25-78**

**Effective Date
July 17, 2018**

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.

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PART I GENERAL REQUIREMENTS

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.

This project involves supplying and installing handholes, tracer wire, conduit, and attachments; as well as confirming handhole locations and conduit routes deemed necessary for a complete ITS Infrastructure installation designed for use with existing and future ITS fiber and device deployments and other uses planned by the Iowa DOT.

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

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.

The Contractor will need to coordinate with any other projects along work sites. 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.

1.01 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

1.02 Contractor's Responsibility

A. Coordination with Utilities

1. 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.
2. 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.
3. 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.

B. Material and Equipment Storage and Construction Site Access

1. 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.

2. 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.
3. 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.

C. 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.

1.03 Contractor Submissions

A. 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.

B. Construction Schedule

1. 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.
2. Major items of work to be included on the schedule are installation of conduit, handholes, device poles and footings, device cabinets, and electrical installations.
3. 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.
4. 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.

1.04 Disruption to Existing Fiber Networks

A. Unplanned Disruption

Any unplanned disruptions determined by the Engineer to be caused by the actions of the Contractor shall be corrected by the Contractor at no additional cost to Iowa DOT.

In the case of an unplanned disruption and subsequent notification by the Engineer, the Contractor shall immediately stop all other work in progress and shall expend all of its efforts to restore the disrupted system(s) or correct the problem causing the disruption. The Contractor will not be granted an extension of time for delays caused by repairing disrupted systems. Unplanned disruptions shall result in the assessment of liquidated damages.

B. Liquidated Damages

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.

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.

1.05 As-Built Documentation

A. General

1. 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.

2. 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.

B. GPS Data Recording Staking Assistance

1. The Engineer's on-site representative 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's on-site representative to coordinate with the Contractor and collect construction progress daily.
2. 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.

PART II TECHNICAL PROVISIONS

This part consists of the material requirements, construction details, and methods of measurement and basis of payment necessary to complete construction of the ITS Infrastructure project, in place, as described in the contract documents.

2.01 General

- A. 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. The Contractor shall stake, per the Iowa State Plane South coordinates provided in the plans, all handholes, fiber vault, cabinet, proposed conduit alignment 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.
- C. 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.

2.02 Field Investigation

A. Materials

1. Excavator

Skid loader with excavating capabilities or equivalent.

2. Cable Locator and Line Transmitter for Line Locator

DitchWitch 150R/T or equivalent cable locator and line transmitter (project engineer must confirm cable locator and line transmitter is acceptable for field use).

B. Construction

1. Potholing to confirm Conduit Cable, and Handhole Locations

- a. Field investigation will be required to locate some conduit routes and handholes. Some existing conduits and handholes are buried which requires potholing and possibly excavating at and around sites if and when handholes and conduits cannot be located to confirm their existence and location.
- b. Field investigation will be required to locate some direct buried fiber optic cable routes. Some existing direct buried fiber optic cables require potholing and possibly excavating at and around sites if the fiber optic cable cannot be located to confirm their existence and location.

2. Verify Tracer Wire Exists

The Contractor must confirm tracer wire exists in handholes and conduits by field investigation.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for Field Investigation shall be paid for at the lump sum contract unit price bid for the pay item Field Investigation.
2. Payment is full compensation for all preparatory work and operations for all items under the contract, including, but not limited to those necessary for:
 - Confirming the existence of tracer wires in existing conduits.
 - Field investigation to locate various conduit routes and handholes. Some existing conduits and handholes are buried which requires potholing and possible excavation at and around various sites if handholes and conduits cannot be located to confirm their existence and location.
 - Field investigation will be required to locate some direct buried fiber optic cable routes. Some existing direct buried fiber optic cables require potholing and possibly excavating at and around sites if the fiber optic cable cannot be located to confirm their existence and location.

2.03 Handholes

A. Materials

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 -50°F to +170°F.
- 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 22,500 pounds (Tier 15).
- 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 TVTI780B-EMC6300 or approved alternate test stations at all Type Fiber Vault handholes.
- b. Test Stations shall be 60 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.

B. Construction

1. General

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

- b. Construct all Type FOR27 and Fiber Vault handholes as located by the Engineer
- c. Set Type Fiber Vault and Type FOR27 handholes flush with the surface when constructing in a sidewalk, driveway, earth embankment or non-paved surface.
- d. 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.
- e. Conduit shall enter the handhole from the bottom and extend conduit ends between 4 and 6 inches above the aggregate bedding.
- f. Side penetrations of the handholes are not permitted.
- g. Terminate each tracer wire run in test stations at Handhole, Type Fiber Vault locations.
- h. Install ground rods at all Type Fiber Vault handholes as indicated in the contract documents.
- i. Plug all open conduit ends within the handhole in a manner acceptable to the Engineer.
- j. Rodent proof all handholes to the satisfaction of the Engineer.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all handholes shall be paid for at the contract unit price per each for the bid items Handhole, Type Fiber Vault and Handhole, Type FOR27.
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 Fiber Vault locations and all handhole markers at Handhole, Type FOR27 locations, and
 - d. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.04 Test Station, Ground Rod, WGU

A. Materials

1. Test Stations

- a. Supply Rhino part TVTI780B-EMC6300 or approved alternate test stations at all Type Fiber Vault handholes.
- b. Test Stations shall be 60 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.

2. Ground Rods

Supply copper ground rod in accordance with the NEC at all Type FOR27 and Fiber Vault handholes.

3. Wire Grounding Units

Supply and install a wire grounding unit (WGU) at all Type FOR27 and Fiber Vault handholes called for in the plans.

B. Construction

1. Install Test Stations at the locations indicated in the contract documents.

2. Construct all Test Stations as located by the Engineer.
3. Terminate each tracer wire run in test stations at Handhole, Type Fiber Vault locations.
4. Install ground rods and WGUs at all Type Fiber Vault handholes as indicated in the contract documents.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all test stations shall be paid for at the contract unit price per each for the bid item Test Station, Ground Rod, WGU.
2. Payment is full compensation for:
 - The furnishing and installation of all test stations, ground rods, and wire grounding units
 - 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
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.05 Locate Marker, Ground Rod, WGU

A. Materials

1. Locate Markers

- a. Supply a locate marker at each Type FOR27 handhole required in the contract documents.
- b. Locate markers shall be 36 inches or more above grade rectangular flexible orange plastic marker.
- c. Place custom warning decal on side facing ROW, the Engineer shall provide prior approval of decals.

2. Ground Rods

Supply copper ground rod in accordance with the NEC at all Type FOR27 and Fiber Vault handholes.

3. Wire Grounding Units

Supply and install a WGU at all Type FOR27 and Fiber Vault handholes called for in the plans.

B. Construction

1. Install a locate marker at the locations indicated in the contract documents.
2. Construct all locate markers as located by the Engineer.
3. Install ground rods and WGUs at all Type FOR27 handholes as indicated in the contract documents.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all locate markers, ground rods, and wire grounding units shall be paid for at the contract unit price per each for the bid item Locate Marker, Ground Rod, WGU.

2. Payment is full compensation for:
 - The furnishing and installation of all locate markers, ground rods, and WGUs,
 - 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 locate markers at Handhole, Type FOR27 locations and,
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.06 Terminate Tracer Wires in Test Station

A. Materials

1. See Test Stations.
2. **Terminate Tracer Wires**
 - a. Expose bare tracer wire and coil end of exposed wire on Test Station terminal board bolt end.
 - b. Add nut to the Test Station terminal board bolt so exposed tracer wire is securely attached to the terminal board.

B. Construction

1. Terminate tracer wires at the locations indicated in the contract documents.
2. Terminate each tracer wire run in test stations at Handhole, Type Fiber Vault locations.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all tracer wires terminated in test stations shall be paid for at the contract unit price per each for the bid item Terminate Tracer Wires in Test Station.
2. Payment is full compensation for:
 - The termination of tracer wires in test stations,
 - Including all surface excavations, repair or restoration of any nearby areas, concrete, proper water/moisture drainage materials, all necessary electric grounding materials and installation, and
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.07 Splice Tracer Wires

A. Materials

1. See Handholes.
2. See Tracer Wire.

B. Construction

1. Splicing tracer wires will be allowed only when approved by the Engineer or noted in the contract documents.

2. Splice tracer wires only in handholes to form a continuous network using UL tested for wet location splice kits.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all spliced tracer wire shall be paid for at the contract unit price per linear foot for the bid item Splice Tracer Wires.
2. Payment is full compensation for:
 - The furnishing and installation of all tracer wire splices,
 - Including the proper installation of the spliced wire into existing handholes, supply and installation of splices, and slack, coiled, or stored wires or cable, and
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.08 Removal Items: Remove Existing Handhole and Remove ITS Equipment

A. Materials

None.

B. Construction

The Contractor shall remove items as indicated on the plans. Unless otherwise specified in the contract documents, 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.

C. Method of Measurement and Basis of Payment

Measurement and payment for all removal items shall be paid for at the contract unit price per units indicated in the tabulation of quantities in the plans for the bid items Remove Existing Handhole and Remove ITS Equipment.

2.09 Raise Handhole to Grade

A. Materials

1. See Handholes.
2. Install Portland Cement Concrete fine aggregate gradation No. 1 in the Standard Specifications Aggregate Gradation Table bedding to raise handhole elevation. The bedding shall extend 3 inches beyond the base of the handhole.
3. 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.

B. Construction

1. Excavate existing handhole and maintain in place conduits, fiber optic cables, and tracer wires.
2. Install Portland Cement Concrete fine aggregate gradation No. 1 in the Standard Specifications Aggregate Gradation Table bedding to raise handhole elevation. The bedding shall extend 3 inches beyond the base of the handhole.
3. Arch conduits to maintain entrance through the bottom of the handhole and extend above the aggregate bedding if possible.
4. The existing handhole should be reinstalled at existing grade.
5. 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.
6. Plug all open conduit ends within the handhole in a manner acceptable to the Engineer.
7. Rodent proof all handholes to the satisfaction of the Engineer.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all handholes shall be paid for at the contract unit price per each for the bid item Raise Handhole to Grade.
2. Payment is full compensation for:
 - The raising of required 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 of aggregate,
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.10 Tracer Wire

A. Materials

1. Tracer Wire

Single conductor, solid copper, Type THHN, No. 12 AWG with UL approval and orange colored jacket.

2. 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.

B. Construction

1. Tracer Wire

- a. Install tracer wire in all conduit installations as indicated on the contract documents.
- b. Splicing tracer wires will not be allowed unless approved by the Engineer or noted in the contract documents. Maintain solid, uncut wire continuity of the tracer wire through Type FOR27 pulling handholes unless otherwise noted in the contract documents. If Engineer

approved, splice tracer wires only in handholes to form a continuous network using UL tested for wet location splice kits.

- c. Terminate each tracer wire run at Type Fiber Vault handholes in test stations.

2. 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 Iowa DOT.

C. Method of Measurement and Basis of Payment

1. Measurement and payment for all wire and cable shall be paid for at the contract unit price per linear foot for the bid item Cable, No. 12 Tracer Wire.
2. Payment is full compensation for:
 - The furnishing and installation of all tracer wire,
 - Including the proper installation of the wire into existing conduit and new conduit systems, supply and installation of splices and connectors, and slack, coiled, or stored wires or cable, and
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.

2.11 Conduit

A. Materials

1. Polyvinyl Chloride Conduit

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

2. High Density Polyethylene 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.

B. Construction

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 twenty 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. 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 an approved sealing compound (duct seal) at all conduit openings at the junction boxes handholes, poles, cabinets, and building entrances.
 - k. 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. Conduit splicing shall only be permitted at locations where conduit of differing materials must be joined.
 - c. All mechanically joined conduit splices shall use compression couplings designed for underground placement and blown-in fiber installation.
 - d. Butt fusion welding and solvent welding of conduits will not be allowed.
 - e. All conduit splices shall be watertight to 200 psi.
 - f. 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.
- i. 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.

6. 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 three tons and a drum width between 4 and 6 feet or by other suitable means approved by the Engineer.

C. Method of Measurement and Basis of Payment

- 1. Measurement and payment for all conduits shall be paid for at the contract unit price per linear foot for the bid item Conduit, 2 Inch HDPE.

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.

2.12 Tracer Wire Testing.

A. Materials.

DitchWitch 150R/T or equivalent cable locator and line transmitter (project engineer must confirm cable locator and line transmitter is acceptable for field use).

B. Construction.

1. Place tags on all tracer wire identifying the owner and direction of the wire at each termination point and in every handhole, fiber vault and test station.
2. Tags shall clearly identify where each individual tracer run originated and where it ends (handhole to handhole, handhole to cabinet, handhole to building, etc.).
3. Test for tracer wire continuity in all conduit installations and test stations as indicated on the contract documents. The Engineer shall witness continuity testing. Submit continuity test verification documentation to the Engineer for final acceptance.
4. For instances where existing tracer wire in direct buried/not within a conduit system, Contractor must trace and document.
5. Prior to final acceptance, the Contractor shall meet with ICN and Iowa DOT to demonstrate the locate system is working properly throughout the entire locate system.

C. Method of Measurement and Basis of Payment.

1. Measurement and payment for all tracer wire testing shall be paid for at the contract unit price lump sum for the bid item Tracer Wire Testing.
2. Payment is full compensation for:
 - a. Testing of all tracer wire,
 - b. Properly labeling/tagging all tracer wire,
 - c. Confirming the proper installation of the wire into existing conduit and new conduit systems, confirming installation of splices and connectors, and slack, coiled, or stored wire, and
 - d. Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the contract documents.