

Iowa Department of Transportation

**SPECIAL PROVISIONS
FOR
ITS INFRASTRUCTURE RELOCATION**

ITS Infrastructure Relocation on I-35 from 280th Street to US-30 and on US-30 from Dayton Avenue to the Iowa DOT Ames Maintenance Garage

ITS-035-4(228)108--25-85
Effective Date:
January 15, 2016

	I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.	
	<i>Justin P. Petersen</i>	<i>1-15-2016</i>
	Justin P. Petersen, PE, PTOE	Date
	License number <i>20842</i>	
	My license renewal date is December 31, 2017.	
	Pages or sheets covered by this seal: <u>Entire Document</u>	

THE STANDARD SPECIFICATIONS, 2015 EDITION, 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 fiber optic cables and infrastructure as described in the project plans and these special provisions.

This project involves supplying and installing conduit, handholes, tracer wire, fiber optic cable, and fiber optic acceptance testing deemed necessary for future uses planned by the Iowa DOT.

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.

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 for this project shall coordinate work with the Iowa DOT. 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

A. General

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 including the documents listed below. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete project.

1. 2015 edition of the Standard Specifications of the Iowa Department of Transportation with GS-15001
2. Latest published Supplements to Standard Specifications
3. Specifications of the Underwriter's Laboratories, Inc.
4. National Electric Code
5. Telecommunications Industry Association/Electronic Industries Alliance
6. Manual on Uniform Traffic Control Devices
7. Manual on Uniform Traffic Control Devices (Iowa Supplement)
8. Iowa DOT Flagger's Handbook
9. Iowa DOT Standard Road Plans Manual

1.02 Local Requirements

A. General

Comply with any special requirements and limitations identified in the Plans.

B. Coordination of Work

Contractor for this project shall coordinate work with the Contractor(s) working on other Iowa DOT projects in the vicinity. The anticipated start/finish dates and duration of these projects are shown in the table below. 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.

Project	Description
IM-NHS-35-4(173)109--03-85	Grading
IM-NHS-35-4(174)109--03-85	Bridge Replacement-PPCB
IM-NHS-35-4(203)209--03-85	Structures-Miscellaneous
IMN-35-4(176)87--0E-77	PCC Patching

The Contractor shall provide the Engineer any requests to perform work during the dates of special events a minimum of five (5) calendar days prior to the event. The decision of the Engineer regarding a request will be final.

1.03 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. One Call Locating

Until final acceptance, 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 forty eight (48) hours of receiving notice that such locations are needed.

C. 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 preferred clear zone, as far from the traveled way as practical and as approved by the Engineer. No equipment shall be stored at the toe of any roadway slope.
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
4. No open holes or mounds of dirt shall be left unprotected during non-working hours.

D. 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.

1.04 Disruption to Existing Fiber Networks

A. Planned Disruption

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

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 10 calendar days before the existing fiber network or equipment is disrupted. 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 being affected.

The Contractor shall restore the disrupted system upon completion of the Work within the allowable working hours. The Contractor shall remain on site until Iowa DOT and/or ICN notifies that the disrupted systems are fully operational. Failure of the Contractor to restore disrupted systems and equipment within the allowable working hours will constitute an unplanned disruption.

B. Allowable Working Hours

The Contractor shall only disrupt existing fiber according to the allowable working hours as follows.

1. Iowa DOT and ICN

Disruptions to the existing systems shall only occur between Midnight and 6:00 AM on working days unless otherwise approved by the Engineer.

C. 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.

D. 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, 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 Contractor Submissions

A. Materials List

The Engineer shall furnish a list of materials required for the project to each bidder with the Request for Proposal (RFP). Complete and submit one (1) electronic pdf file of the materials list within seven (7) 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 (1) 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 shall include, but is not limited to the following:
 - a. Duration of material procurement
 - b. Installation of conduit and handholes
 - c. Installation of fiber optic cable
 - d. Duration of fiber testing required and submission of test report
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 (1) 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. The Engineer will provide approval or rejection of shop drawings within fourteen (14) calendar days of the Contractor's submission. The Contractor shall re-submit the shop drawings for approval within seven (7) days of the Engineer's rejection.
3. The Contractor shall 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.

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 seven (7) calendar 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. Final Acceptance

1. The Contractor shall perform all the obligations under the contract before the final acceptance of the project by Iowa DOT. The final acceptance is anticipated date of August 1, 2016. Completion of the work will be the date of approval and work acceptance on "Statement of Completion and Final Acceptance of Work" (Form 830435) by the Engineer. Warranty begins on this date on the final acceptance form.
2. Final acceptance shall not constitute acceptance of any unauthorized or non-compliant Work or material. Iowa DOT shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any Work or material that is defective, unauthorized or that otherwise fails to comply with the Contract Documents or from recovering damages for any such Work or material.
3. Final acceptance shall not relieve the Contractor of any obligations and/or responsibilities relating to warranty requirements designated in the Contract Documents.

F. 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 and shall remain in effect until at least one year after the final acceptance for all cables and equipment furnished and installed for this project.
3. The Contractor shall provide a minimum of one year workmanship warranty after the final acceptance of the Work. The workmanship warranty shall consist of an assurance by the Contractor that the Work is free of defects, conforms to professional engineering principles in the State of Iowa, and meets the requirements of the Contract Documents in which the Contractor agrees to repair or replace Work or items that are defective or do not meet the requirements of the contract during the workmanship warranty period.
4. At any time during the workmanship warranty period, if Iowa DOT determines that any of the Work has not met the standards set forth in the contract, then the Contractor shall correct the Work without additional cost to Iowa DOT, even if the performance of such correction extends beyond the workmanship warranty period.
5. Within seven (7) calendar days of receipt of notice from Iowa DOT specifying a failure of any work required to satisfy the workmanship warranty, the Contractor shall respond to Iowa DOT and shall mutually agree when and how the Contractor shall remedy such failure. In the event of an emergency requiring immediate action, the Contractor shall implement such immediate action it deems necessary and shall notify Iowa DOT of the urgency of a mutually agreed-upon remedy. If the Contractor does not use its best efforts to proceed to effectuate a remedy within 7-day period, or immediately in the case of emergency conditions, Iowa DOT, upon notice to the Contractor, will have the right to order the Contractor to perform the work, or to perform or have performed by others the remedy approved by Iowa DOT, and the cost shall be paid by the Contractor.

1.06 As-Built Documentation

A. General

1. As-built record drawings will be the responsibility of, and completed by, an on-site representative of the Engineer. As such, it will be the responsibility of the Engineer's representative 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.

1.07 Charging of Working Days

A. Definition

1. A working day will be considered to be any calendar day, exclusive of Sundays, a recognized legal holiday, or any other dates specifically noted in the Contract Documents on which weather or other conditions (not under control of the Contractor) will permit construction operations to proceed for not less than 3/4 of a normal work day in the performance of any major item of work. Major items of work shall be determined by the Contractor's approved schedule.
2. Saturdays will be considered a working day under this contract.

B. Determination

The Engineer shall determine if a day is considered a working day. Work is permitted at any time the Contractor determines that the work completed will be in compliance with the Contract Documents, subject to any limitations stated in the Contract Documents.

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 relocation project, in place, as described in the Contract Documents.

2.01 General

1. 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.
2. 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.
3. 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 Traffic Control

All traffic control on this project shall comply with Article 2528 of the Standard Specifications and the Contract Documents.

A. Materials

1. Use materials meeting the requirements of Part 6 of the MUTCD and Division 41 of the Standard Specifications for the respective traffic control signs and devices.
2. All signs for traffic control zones shall be mounted and maintained on Iowa DOT approved moveable skids, or other approved method, regardless of expected duration.

B. Construction

1. The contractor shall notify the local Iowa DOT Maintenance Shop and the Iowa DOT Traffic Operations Center, preferably 10 days in advance, but at a minimum 48 hours in advance, of any width or height restrictions on the primary highways.
2. The Engineer shall provide any required detour routes and detour route signage at no cost to the Contractor. All lane, ramp, and roadway closures are subject to the limitations stated in the Contract Documents and the approval of the Engineer. Request any such closures a minimum of ten (10) days prior to the desired closure date in accordance with

Article 1108.02M of the Standard Specifications. The decision of the Engineer regarding a request shall be final. Closures of convenience will not be permitted.

3. The Contractor shall maintain daily, and submit when requested, an Iowa DOT traffic control monitor checklist and diary. Found at:
http://www.iowadot.gov/construction/traffic_safety/tc_monitor_wz_checklist.xls
4. The Engineer shall resolve all conflicts.

C. Method of Measurement & Basis of Payment

1. Measurement and payment for traffic control shall be paid for at the lump sum contract unit price bid for the pay item "Traffic Control".
2. Payment is full compensation for:
 - Erecting, maintaining, moving, and removing all traffic control devices required by the contract documents, including warning lights,
 - Furnishing all materials, labor, equipment, and other items associated with all work zone traffic control necessary to meet the requirements of the Contract Documents, and
 - Traffic quality control.
3. The Engineer reserves the right to issue partial payment of this lump sum item based upon the estimated percentage of work completed as determined by the Engineer.

2.03 Mobilization

All mobilization on this project shall comply with Article 2533 of the Standard Specifications and the Contract Documents. Mobilization may include bonding, permit, and demobilization costs.

A. Materials

None

B. Construction

None

C. Method of Measurement & Basis of Payment

1. Measurement and payment for project mobilization shall be paid for at the lump sum contract unit price bid for the pay item "Mobilization".
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:
 - The movement of personnel, equipment, supplies, and incidentals to the project site,
 - The establishment of all offices, buildings, and other facilities necessary for work on the projects, and
 - All other work operations which shall be performed or costs incurred prior to beginning work on the various items on the project site.

3. The Engineer reserves the right to issue partial payment of this lump sum item per the stipulations of Article 2533.05, A of the Standard Specifications.

2.04 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 two percent of the original weight of material under test conditions per "Standard Test Method for Water Absorption of Plastics" ASTM D-570.
- d. The handhole shall be functional without failure throughout a temperature range of - 50 to +170 deg. F.
- e. The handhole walls shall not deflect more than 0.24 inches per foot of length of box when installed and subject to an ASTM C-857 TIER 22 load.
- f. Handholes shall meet 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 lbs (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.

B. Construction

1. General

- a. Install the type and size of handholes at the locations indicated in the Contract Documents.
- b. Construct all Type Fiber Vault handholes as located by the Engineer
- c. Set handholes flush with the surface when constructing in a sidewalk or driveway. Set handholes approximately six (6) to twelve (12) inches below the finished surface of the surrounding ground when constructing in an earth embankment or non-paved surface.
- d. Install course aggregate bedding to a depth of one (1) foot below the handhole.
- e. Conduit shall enter the handhole from the bottom and extend conduit ends between four (4) and six (6) inches above the aggregate bedding.
- f. Side penetrations of the handholes are not permitted.
- g. Plug all open conduit ends within the handhole using ETCO duct plugs provided by the Iowa DOT.
- h. Rodent proof all handholes to the satisfaction of the Engineer.

C. Method of Measurement & Basis of Payment

1. Measurement and payment for all handholes shall be paid for at the contract unit price per each for the pay items "Handhole, Type FOR27" and "Handhole, Type Fiber Vault".

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 all materials, labor, equipment, and other incidental items necessary to meet the requirements of the Contract Documents.

2.05 Conduit

A. Materials

1. 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 SDR13.5, and NEMA TC-7 EPEC-B standards.
- c. Use SDR11 for Skunk River bore, as noted on plans.
- d. Sequential foot markings printed on HDPE.
- 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, structure attachment 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 twenty five (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 ETCO duct plugs provided by the Iowa DOT at all conduit openings at the junction boxes handholes, poles, cabinets, and building entrances.
- k. Transverse bore pits and receiving pits shall be within 15 feet of right-of-way.

2. Installation Clearances

- a. Maintain the minimum depth throughout the length of all conduit installations.
- b. Maintain a minimum of two (2) feet of separation when underground conduits parallel an existing facility.

3. Conduit Splicing

- a. All mechanically joined conduit splices shall use compression couplings designed for underground placement and blown-in fiber installation.
- b. Electrofusion joining of HDPE conduit will be allowed provided that method used does not create a ridge on the inside of the conduit that may impact future 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 forty eight (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 six (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 Iowa DOT.
- 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. Conduit In Trench

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

C. Method of Measurement & Basis of Payment

- 1. Measurement and payment for all conduit shall be paid for at the contract unit price per linear foot for the pay items "2" Conduit, Plowed", "2" Conduit, Bored", and "2" SDR11 Conduit, Bored".
- 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.

2.06 Wire and Cable

A. Materials

1. Tracer Wire

Single conductor, solid copper or copper clad steel, Type XHHN, No. 12 AWG with UL approval and orange colored jacket.

2. Grounding/Bonding

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

B. Construction

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. 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 wires are installed, the Contractor shall:
 - Splice tracer wires only in fiber vaults, handholes, cabinets, and pole bases to form a continuous network using splice kits UL tested for wet locations.
 - Terminate each tracer wire run at Type Fiber Vault handholes in test stations per detail in plans.
 - Test all tracer wire for continuity.
- c. Labeling Requirement
 - Place tags on all fiber optic cable identifying the owner and direction of the cable at each termination point and in every handhole, Fiber Vault, and cabinet.
 - Tags shall clearly identify where each individual cable run originated and where it ends (handhole to handhole, handhole to cabinet, handhole to building, etc.)

3. Grounding/Bonding

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

C. Method of Measurement & 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 pay items "Tracer Wire"
2. Payment is full compensation for:
 - The furnishing and installation of all wire and cable,
 - 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 cables, and
 - Furnishing all materials, labor, equipment, and other incidental items necessary to meet the requirements of the Contract Documents.

2.07 Fiber Optic Cable

A. Materials

1. General

- a. The cable shall meet the latest applicable standard specifications by American National Standards Institute (ANSI), Electronic Industries Association (EIA) and Telecommunications Industries Association (TIA) for the single-mode fiber cable of the size specified per the Plans.
- b. 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.

2. Single-mode Fiber Optic OSP Cable – Dielectric Loose Tube

- a.** Fiber optic, single-mode, graded loose tube dielectric cable constructed with industry standard 3mm buffer tubes stranded around a central strength member.
- b.** 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 and be colored with ultraviolet (UV) curable ink.
- c.** The cable core shall be water blocked with dry water blocking materials to improve access and handling of individual tubes.
- d.** 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.
- e.** Single-mode, dispersion-unshifted fiber meeting ITUT G.652D requirements.
- f.** The fiber shall be fully capable of handling existing and legacy single-mode applications which traditionally operate in the 1310 nm and 1550 nm regions and shall also be designed to operate the full-spectrum from 1260 nm to 1625 nm for optical transmission.
- g.** The fiber shall be designed to provide optimum performance from 1260 nm to 1625 nm intended for 16-channel Course Wavelength Division Multiplexing applications.
- h.** 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.
- i.** The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.
- j.** The jacket or sheath shall be free of holes, splits, and blisters.
- k.** The cable jacket shall contain no metal elements and shall be of a consistent thickness.
- l.** Cable jackets shall be marked with the manufacturer's name, month and year of manufacturer, sequential meter or foot markings, a telecommunication handset symbol 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.
- m.** The maximum pulling tension shall be 2700 N (600 lbf) during installation (short term) and 890 N (200 lbf) long term installed.
- n.** 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.

B. Construction

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 conduit or 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 the Contractor shall 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.

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 (2668 N).
- 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 twenty (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 of 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 Iowa DOT provided ETCO duct plug at all conduit openings at the junction boxes, handholes, poles, and cabinets after cable installation.

3. Facilities Protection

- a. In the event it is suspected that cable damage has occurred prior to final acceptance, Contractor shall test the cable with an OTDR within seventy two (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, type FOR27 – 60 feet
 - Handhole, type Fiber Vaults – 150 feet
- b. Storage of slack cable in cabinets and handholes shall be neatly coiled. The slack coils shall be bound at a minimum of three (3) points around the coil perimeter. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames and terminals.
- c. For storage purposes, the minimum bending radius shall not be less than ten (10) 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 clearly identify where each individual cable run originated and where it ends (handhole to handhole, handhole to cabinet, handhole to building, etc.).
- c. For fiber installations with joint Department of Transportation/other agency (or entity) use where the fiber will be owned by the other agency (or entity), install typical identifiers and/or markings for that fiber.

C. Method of Measurement & Basis of Payment

- 1. Measurement and payment for all fiber optic cable shall be paid for at the contract unit price per linear foot for the pay items “96 SM Fiber” and “288 SM Fiber”.
- 1. Payment is full compensation for:
 - a. The furnishing and installation of all cables and wires per the Contract Documents,
 - b. Furnishing all materials, labor, tools, consumable items and other incidental items necessary to meet the requirements of the Contract Documents.

PART III
ACCEPTANCE CRITERIA

3.01 Fiber-Optic Cable Acceptance Testing

A. Materials

None

B. Construction

1. Fiber Optic Cable Acceptance Testing Methods

- a. Visually inspect fiber optic cable prior to installation. Report any defects to Engineer.
- b. Post installation, one hundred percent (100%) of the cable's fiber count shall be tested with an Optical Time Domain Reflectometer (OTDR) at 1310 nm and 1550 nm to verify attenuation and continuity of strands for the entire length of cable. 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.
- c. 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.
- d. 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.
- e. All test equipment shall be factory certified within the last year. The Contractor shall provide copies of the certification 10 days prior to testing.
- f. 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.
- g. OTDR testing shall use a launch and receiving cables minimum 1000 meters or greater than the dead zone for the OTDR used for this test.

C. Method of Measurement & Basis of Payment

1. Measurement and payment for fiber optic acceptance testing shall be paid for at the lump sum contract unit price bid for the pay item "Post-Installation 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.

**PART IV
ADDITIONAL BIDDING ATTACHMENTS**

4.01. Equipment and Materials List

IOWA DOT PROJECT NO. ITS-035-4(228)108--25-85 IN STORY COUNTY, IOWA

DESCRIPTION	MANUFACTURER	CATALOG NUMBER
HANDHOLE, TYPE FOR27		
HANDHOLE, TYPE FIBER VAULT		
HDPE CONDUIT		
SDR11 CONDUIT		
DUCT SEAL		
1C #12 TRACER WIRE		
96 SINGLE MODE FIBER OPTIC CABLE (INCLUDE # OF REELS AND REEL LENGTH)		
288 SINGLE MODE FIBER OPTIC CABLE (INCLUDE # OF REELS AND REEL LENGTH)		
OTDR METER		