



**SPECIAL PROVISIONS  
FOR  
FIBER OPTIC NETWORK**

**DES MOINES COUNTY  
ICAAP-SWAP-0977(651)--SH-29**

**Effective Date  
February 16, 2021**

**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.**

**157155.01 Description**

Furnish all work, apparatus, and materials to construct, install, and place in operation, to the Engineer's satisfaction, a complete fiber optic network as shown in the contract documents. Materials and construction not referenced in this Special Provision shall refer to Section 2525 of the Standard Specifications. Provide submittals for materials as identified in Section 2525 of the Standard Specifications.

**157155.02 Materials**

**A. Combined Video/Radar Detection System.**

**1. Detection Unit.**

- a. A single detection unit shall utilize a combination of video detection components and radar detection components to detect individual vehicles, by lane, from the stop line to at least 600 feet from the unit, and all distances in between.
- b. The video detection component shall produce a useable video image under all roadway lighting conditions, regardless of time of day.
- c. The detection unit shall be housed in a weather-tight enclosure.
- d. The unit shall operate satisfactorily in a temperature range from -25°F to +160°F and a humidity range from 0% RH to 95% RH.
- e. Utilize manufacturer's recommendation for connection cable(s) to signal cabinet. Cable(s) shall be continuous from unit to termination in cabinet.
- f. Provide all necessary mounting hardware to attach the unit to the signal pole.

**2. System Software.**

- a. The software shall facilitate placement of detection zones and setting of zone parameters or to configure system parameters.

- b. The system shall default to a safe condition, such as constant call on each active detection channel, in the event of unacceptable interference, low visibility or loss of video signal.
- c. The system shall automatically revert to normal detection mode when the problem condition no longer exists.

**3. Video Processor.**

- a. The system shall operate satisfactorily in a temperature range from -25°F to +160°F and a humidity range from 0% RH to 95% RH, non-condensing as set forth in NEMA specifications.
- b. The Processor shall utilize non-volatile memory technology to store on-board firmware and operational data.
- c. An Ethernet communications interface shall allow the user to remotely configure the system and to extract stored vehicle/roadway information.
- d. The Processor shall provide an SDLC connection to the controller with an option of TS2 Type 2 outputs to the controller.

**4. Warranty.**

- a. The supplier shall provide a 3 year warranty from the date of signal activation on the combined video/radar detection system components included in the specification.
- b. During the warranty period, technical support shall be available from the supplier via telephone within 4 hours of the time a call is made by a user and this support shall be available from factory-certified personnel or factory-certified installers.
- c. During the warranty period, updates to software and firmware shall be available from the supplier without charge.
- d. Supplier shall be responsible for all repairs, including parts, labor and shipping during this warranty period.
- e. One copy of the warranty shall be furnished with the catalog cut submission.

**5. Training.**

Provide necessary training to City staff to monitor and modify detection system at the implementation of the system. This is anticipated to include up to 8 hours.

**C. Fiber Optic Cable and Accessories.**

**1. General.**

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.

**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. 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.
- f. The fiber shall be designed to provide optimum performance from 1260 nm to 1625 nm intended for 16-channel Course Wavelength Division Multiplexing applications.

- g. 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.
- h. The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.
- i. The jacket or sheath shall be free of holes, splits, and blisters.
- j. The cable jacket shall contain no metal elements and shall be of a consistent thickness.
- k. 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.
- l. The shipping, storage, and operating temperature range of the cable shall be -40°F to +158°F. The installation temperature range of the cable shall be -22°F to +158°F.

### 157155.03 CONSTRUCTION.

#### A. Fiber Optic Cable and Accessories.

##### 1. Installation.

See Article 2525.03, A, 3, i of the Standard Specifications.

##### 2. Fusion Splices.

- a. Fusion splices shall be used to splice all continuous fiber runs in splice closures.
- b. Splices shall be allowed only in the splice closures as shown on the plans.
- c. Maximum attenuation per splice as estimated by the fusion splicer shall not exceed 0.08 dB. Any splice exceeding 0.08 dB at the time of splicing shall be re-spliced.
- d. Splice shall provide three axis core alignment using light injection and loss measurement techniques.
- e. No mechanical splices of fiber cable will be allowed.
- f. All fusion splice equipment shall be factory certified within the last year. The Contractor shall provide copies of the certification 10 calendar days prior to splicing.

##### 3. Fiber Optic Cable Acceptance Testing.

- a. The Contractor shall perform all testing in the presence of the Engineer.
- b. Post installation, 100% of the new cables' fiber count shall be tested bi-directionally with an Optical Time Domain Reflectometer (OTDR) at 1310 nm and 1550 nm; in addition, an Optical Loss Test Set (OLTS) shall be used to test all fibers at both wavelengths. Existing fibers that are spliced to or re-spliced as part of this contract shall also be tested in both directions and at both wavelengths. The Contractor shall provide the Engineer with up to five copies of any software required for viewing electronic files of the OLTS and OTDR traces. Use test equipment equal to EXFO FTB-500 OTDR meter, and Fluke DTX-CLT OLTS meter.
- c. All test equipment shall be factory certified within the last year. The Contractor shall provide copies of the certification 10 days prior to testing.
- d. 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 Engineer)

- Operator name
  - Date and Time
  - Setup and test parameters including wavelength, pulse width, range, scale and ambient temperature.
  - Test results for OTDR test in both directions for total fiber trace, splice loss/gain (dB), connector loss (dB), all events greater than 0.05 dB, measured length from cable markings and total length from OTDR.
  - Test results for attenuation test including measured cable length (cable marking), total length (from OTDR test), number of splices (from as-built) and total link end-to-end attenuation in each direction and the bidirectional average.
- e. OTDR testing shall use launch and receiving cables minimum 3300 feet or greater than the dead zone for the OTDR used for this test.
- f. All fiber connectors shall be cleaned and checked for dirt, scratches or chips before installed in adapters and testing. All dust covers shall be installed after testing is complete.
- The fiber optic cable shall have a maximum attenuation of 0.4 dB/km at 1310 nm and 0.3 dB/km at 1550 nm when measured with an OLTS.
  - Each connector shall have an averaged loss value of 0.25 dB or less when measured bi-directionally with an OTDR at 1310 nm and 1550 nm.
  - Each splice shall have an averaged loss value of 0.08 dB or less when measured bi-directionally with an OTDR at 1310 nm and 1550 nm.

**157155.04 METHOD OF MEASUREMENT.**

Method of Measurement for the quantities of the various items involved in the construction of the fiber optic network will be as follows:

- A. 12 Inch <R, <Y, <FY, <G (All LED) w/ Backplate, Mast Arm Mounted.**  
By count.
- B. Ethernet Switch.**  
By count.
- C. Full Intersection Video/Radar Detection System.**  
By quantity shown in contract documents.
- D. Mainline Only Video/Radar Detection System.**  
By quantity shown in contract documents.
- E. Signal Cabinet Modification (Flashing Yellow Arrows).**  
By quantity shown in contract documents.
- F. Signal Cabinet Replacement.**  
By quantity shown in contract documents.
- G. Splice.**  
By quantity shown in contract documents.
- H. Splice Case.**  
By quantity shown in contract documents.
- I. Terminations.**  
By quantity shown in contract documents.
- J. 2 Inch Conduit Trenched/Bored.**  
By linear feet shown in contract documents.

- K. Fiber Optic Cable 12 ct SM.**  
By linear feet shown in contract documents.
- L. Fiber Optic Cable 72 ct SM.**  
By linear feet shown in contract documents.
- M. Pull Tape.**  
By linear feet shown in contract documents.
- N. Signal Cable – 5c No. 14 AWG.**  
By linear feet shown in contract documents.
- O. Tracer Wire – 1c No. 10 AWG.**  
By linear feet shown in contract documents.
- P. Advance Warning Flasher System.**  
None.
- Q. Public Works Building Connection.**  
None.

**157155.05 BASIS OF PAYMENT.**

- A. 12 Inch <R, <Y, <FY, <G (All LED) w/ Backplate, Mast Arm Mounted.**
  - 1. Each.
  - 2. Payment is for all material, equipment, and installation of the signal head.
- B. Ethernet Switch.**
  - 1. Each.
  - 2. Payment is for all material, equipment, and installation of Ethernet switch into cabinet to provide connection between signal controller and fiber optic network.
- C. Full Intersection Video/Radar Detection System.**
  - 1. Each.
  - 2. Payment is for all material, equipment, and installation of fully operational combined video/radar detection on all intersection approaches.
- D. Mainline Only Video/Radar Detection System.**
  - 1. Each.
  - 2. Payment is for all material, equipment, and installation of fully operational combined video/radar detection on mainline intersection approaches.
- E. Signal Cabinet Modification (Flashing Yellow Arrows).**
  - 1. Each.
  - 2. Payment is for all material, equipment, and work to modify signal cabinet to provide functioning flashing yellow arrow signal heads as shown in plans.

**F. Signal Cabinet Replacement.**

1. Each.
2. Payment is for all material, equipment, and work to replace signal cabinet and relocate reused equipment to new signal cabinet.

**G. Splice.**

1. Each.
2. Payment is for all material, equipment, and work to splice fiber optic cables.

**H. Splice Case.**

1. Each.
2. Payment is for all material, equipment, and installation of a splice case.

**I. Terminations.**

1. Each.
2. Payment is for all material, equipment, and work to provide terminations for fiber optic cables.

**J. 2 Inch Conduit Trenched/Bored.**

1. Linear feet.
2. Payment is for all material, equipment, and work to splice fiber optic cables.

**K. Fiber Optic Cable 12 ct SM.**

1. Linear feet.
2. Payment is for all material, equipment, and installation of 12 ct SM fiber optic cables.

**L. Fiber Optic Cable 72 ct SM.**

1. Linear feet.
2. Payment is for all material, equipment, and installation of 72 ct SM fiber optic cables.

**M. Pull Tape.**

1. Linear feet.
2. Payment is for all material, equipment, and installation of pull tape.

**N. Signal Cable – 5c No. 14 AWG.**

1. Linear feet.
2. Payment is for all material, equipment, and installation of 5c #14 AWG cable for signal heads.

**O. Tracer Wire – 1c No. 10 AWG.**

1. Linear feet.
2. Payment is for all material, equipment, and installation of tracer wire.

**P. Advance Warning Flasher System.**

1. Lump sum.
2. Payment is for all material, equipment, and installation of an advance warning flasher system as shown in the plans.

**Q. Public Works Building Connection.**

1. Lump sum.
2. Payment is for all material, equipment, and work to provide a connection to the fiber optic network within the Public Works building as shown in the plans.