SP-127016

(New)

Iowa Department of Transportation

SPECIAL PROVISIONS

For

VARIABLE MESSAGE SIGNS

Polk County
STP-A-1945(805)--86-77

Effective Date
June 17, 2014

THE STANDARD SPECIFICATIONS, SERIES OF 2012, ARE AMENDED BY THE FOLLOWING ADDITIONS AND MODIFICATIONS. THESE ARE SPECIAL PROVISIONS AND SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

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PART 1 - GENERAL REQUIREMENTS

This part consists of the general provisions necessary to provide, install, and the Variable Message Signs (VMS)'s, as part of a Downtown Wayfinding Signage System.

1.1 RELATED SPECIFICATIONS AND STANDARDS

Unless otherwise specified in the project plans and special provisions the signs installed under this specification shall comply with:

A. Specifications of the Underwriters Laboratories Inc.
B. National Electrical Code.

1.2 LOCAL REQUIREMENTS

Adherence to the City Electrical Code will be required for service to the Signs.

All work on the project shall be supervised on-site or performed by an International Municipal Signal Association (IMSA), Level II Certified Traffic Signal Technician.

1.3 COORDINATION WITH UTILITIES

A. Location: The Contractor shall be responsible for determining the exact location and elevation of all public utilities in proximity to any construction work and shall conduct all activities to ensure that public utilities are not disturbed or damaged.

B. Liability: The Contractor shall be fully Liable for any and all expenses incurred as a result of failing to obtain required clearances, location of utilities, and any damage to the public utilities caused by construction.

1.4 CONTRACTOR SUBMISSIONS

A. Schedule of Unit Prices: Forward to the Engineer three copies of a list of unit costs for each item listed on the Schedule of Unit Prices attached to the Specifications by the preconstruction meeting. The sum of the costs for each item shall equal the total Contract Lump Sum price for the traffic signal installation(s). Partial payment estimates of the work performed on the project will be made by the Contracting Authority and the unit costs will be used to prepare progress payments to the Contractor.

B. IMSA Certification: The Contractor shall submit the name and contact information of the IMSA Level II Certified Traffic Signal Technician(s) working on the project and a copy of their IMSA certificate.

C. Shop Drawings, Catalog Cuts, Certifications: Six copies of shop drawings shall be furnished for steel mast arm poles to be furnished on the Project. Six copies of catalog cuts and manufacturer's specifications shall be furnished for all standard "off-the-shelf" items. Manufacturers shall certify electrical equipment, signal equipment, and materials to ensure compliance with these project documents. Upon request, the Contractor shall provide material certifications to the Engineer.

Review of shop drawings by the Engineer is for the purpose of checking for general conformance with the project design concept and contract documents. On each submittal, the Contractor shall specify in writing any deviations from the requirements of the plans or contract documents.

1.5 SUBSTITUTIONS

A. Use only materials conforming to these specifications unless permitted otherwise by Engineer.

B. Obtain approval of Engineer for substitutions prior to use.

1.6 SCHEDULING AND CONFLICTS

A. Schedule work to minimize disruption of public streets and facilities. Develop traffic control in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways, as adopted by the Department per 761 of the Iowa Administrative Code (IAC), Chapter 130. Submit a schedule of planned work activities.

B. Immediately notify the Engineer of any conflicts discovered or any changes needed to accommodate unknown or changed conditions as soon as found.

1.7 GUARANTEE

A. All equipment and materials shall be provided with a standard industry warranty. If defects develop under normal operating conditions within the warranty period, after acceptance of the completed installation by the Engineer, the defects shall be corrected by, and at the expense of the Contractor.

B. Provide guarantee in writing on Company or Corporation letterhead stationery to the Contracting Authority prior to final acceptance. Transfer required equipment warranties prior to the date of final acceptance to the Contracting Authority.

PART 2 - INSTALLATION REQUIREMENTS

This part consists of the installation details necessary during the construction of the signage complete, in place, and operational as described in the project plans and these special provisions.

An anti-seize compound shall be used in the installation of all mechanical connections and fasteners, including all nuts and bolts.

2.1 FIBER OPTIC CABLE

The cable end shall be secured inside the controller cabinet so that no load is applied to the exposed fiber strands. The minimum bend radius for static storage shall not be less than ten times the diameter of the cable measuring the cable on the outside, or as recommended by the manufacturer.

The minimum bend radius during installation shall not be less fifteen times the diameter of the cable measuring the cable on the outside, or as recommended by the manufacturer. The Contractor shall not use tie wrap devices on fiber optic cable.

A. Cable Slack: Slack shall be left in each handhole, at the top of any conduit riser, in each junction box, in each controller cabinet, and at each equipment rack or other point of termination. This slack cable requirement may be deleted where existing hand holes or through points lack sufficient area to maintain the minimum bend requirements. Where slack has been deleted, extra slack equal to the amount that would have been distributed in the through points shall be equally divided between the two controller cabinets and shall be in addition to the slack mandated at the cabinets. Slack in each handhole type shall be provided as designated on the plans. Slack cable shall be coiled and the coils bound at three points around the coil perimeter and supported in their static storage position.

B. Cable Installation in Conduits: A suitable cable feeder guide shall be used between the cable reel and the face of the conduit. The cable feeder shall be designed to protect the cable and guide the cable directly into the conduit off the reel. During the installation, the cable jacket shall be carefully inspected for jacket defects. If defects are found, the Engineer shall be notified prior to any additional cable being installed. The Contractor shall take care in the pulling of the cable to insure that the cable does not become kinked, crushed, twisted, snapped, etc. A pulling eye shall be attached to the cable and be used to pull the cable through the conduit. A pulling swivel shall be used to preclude twisting of the cable. The cable shall be lubricated prior to entering the conduit with a lubricant recommended by the manufacturer. Dynamometers or break away pulling swing shall be used to insure that the pulling tension does not exceed the specified force of 600 pounds or the cable manufacturer's recommendations, which ever is less. The mechanical stress on the cable shall not allow the cable to twist, stretch, become crushed, or forced around sharp turns which exceed the bend radius or scar or damage the jacket. The pulling of the cable shall be hand assisted at each pull point.

Cable shall not be pulled through any intermediate junction box, manhole, pull box, pole base or any other opening in the conduit unless specifically required by the Engineer in specific facilities. The necessary length of cable to be installed shall be pulled from one junction box, manhole, pull box, pole base, or cabinet to the immediate next downstream manhole, box, pole base, or cabinet. The remaining length of cable to be installed in the next conduit shall be carefully stored in a manner that is not hazardous to pedestrian or vehicular traffic yet ensures that no damage to the cable shall occur. The cable shall be stored in a manner that shall allow that length of cable to be safely pulled into the next conduit. The Engineer shall approve the storing methods to be used.

At each hand hole or through point and at the cabinet, the cable shall be visibly and durably marked or tagged as "FIBER OPTIC CABLE, CITY OF DES MOINES". Additionally, each cable shall be visibly and durably marked or tagged with the type of cable (single mode or multi-mode), the fiber count, and “FIBER OPTIC CABLE, CITY OF DES MOINES”. Additionally, each cable shall be marked with the adjacent intersection of origin and destination. IN cases where cables are spliced in a splice enclosure only the intersection of origin is needed.

Example:

FIBER OPTIC CABLE, CITY OF DES MOINES 48 FIBER – SM EAST – 63rd & HICKMAN WEST – WESTOVER & HICKMAN

C. Communications Cable Testing: A minimum of two fibers, selected at random, from each tube in the fiber optic cable shall be tested, both on-the-reel prior to installation and after installation using a high-resolution optical time domain reflectometer (OTDR). All single mode measurements shall be conducted at the 1310 ± 30 nm wavelength. All mulit-mode measurements shall be conducted at 850 ±30 nm wavelength. The Contractor shall record the identification, location, length, and attenuation measurements of each tested fiber and shall furnish all test reports to the Engineer. All cable readings/measurements shall be compared to the maximum allowable deviations in the cable specification and the levels of acceptance recommended by the manufacturer in their printed documentation. Any cable having measurements outside the allowable range shall be replaced and shall not be acceptable for installation on this project.

1. On-Reel Testing: Prior to the installation, the Contractor shall perform on-site, on-reel testing. This testing shall be for both attenuation and continuity. The tests shall be

conducted at 850 nm for multi-mode fibers and at 1310 nm single mode fibers. The testing shall be performed using an OTDR by means of a pigtail splice. All test results shall be within ± 3% of factory-supplied attenuation measurements. Testing shall be done in one direction only. Hard copy or electronic copies (with applicable software) of the OTDR traces for the testing shall be furnished to the Engineer prior to installation of the cables. Except for the access to and the test preparation of any one end of the newly furnished cable to be tested, the Contractor shall preserve the cable in its originally-shipped condition. If any fiber of the cable fails the on-reel attenuation test, the cable shall be rejected and shall not be used on this project. The rejected cable shall be replaced at the Contractor's expense.

2. Cable Segment Testing: As each cable segment is terminated, the Contractor shall perform an end-to-end attenuation (power loss) test of each terminated fiber of each FO cable. This testing shall be performed using hand-held optical test sets and shall be tabulated and be included in the documentation package to be provided to the Engineer at the conclusion of the project. Overall loss for each link shall not exceed the cumulative specified maximum losses of the components. For example, at 850 nm, a one mile link with two splices and a connector on each end shall not exceed 7.0 dB:

1.0 mile x 5.6 dB/mile:	5.6 dB
0.2 dB per splice x 2:	0.4 dB
0.5 dB per connector x 2:	1.0 dB
Maximum allowable loss:	7.0 dB

The cable segment shall be rejected for use on this project if any terminated fiber of the cable segment fails the attenuation test. Rejected cables shall be repaired or replaced by the Contractor at the Contractor's expense. The Contractor shall retest all fibers of any repaired or replaced cable segment. After the complete fiber optic system is installed and terminated, an OTDR reading shall be performed on all fibers to insure that each section is in compliance with the issued specification. All fibers shall be tested.

3. Final System Testing: After the complete fiber optic system is installed and terminated, an OTDR reading shall be performed on all cables to insure that each section is in compliance with the issued specification. All fibers shall be tested. A hard copy of OTDR signature traces for all fibers for all sections shall be provided to the Engineer. Fibers which have been terminated shall be indicated in the report. In addition to the OTDR test report, the Contractor shall provide the test results of an Attenuation Test for the installed fibers using the insertion loss test procedure and the Transmitter/Receiver Power Level Test and the Continuity Test.

D. Fiber Optic Termination Unit:

All fibers, unless stated otherwise in the plans, shall be terminated in the fiber optic termination unit.

The enclosure shall be mounted on an EIA 19 inch rack in an area that does not interfere with the normal maintenance of the cabinet electronics

The field cable shall be secured to the enclosure in a manner that does not degrade the fiber optic cable but insures a firm and secure mount. Sufficient lengths of every loose fiber shall be coiled within the enclosure to provide spare distance and reach the fiber interface panel. Sprial wrap each individual fiber in the fan out kit.

Each fiber shall be labeled on the bulkhead by direction and intersection of origin.

Example:

A – North –

B – South – 63rd & Univ.

C – East – MH & Hick.

D - West

E. Documentation:
The Contractor shall submit a table showing all entrance and exiting footages at each handholes, pole base, splice case and controller cabinet. This table shall include “tip-to-tip” footages at each location. This table shall be submitted in electronic, spreadsheet format.

The Contractor shall record the identification, location, length, and attenuation measurements of each tested fiber and shall furnish all test reports to the Engineer. Test reports include all cable segment attenuation tests; OTDR signature traces for all fibers; and an attenuation test for the installed fibers using the insertion loss test procedure and the transmitter/receiver power level test and the Continuity Test. Fibers which have been terminated shall be indicated in the reports. Such documentation shall be submitted in either hardcopy (written) form or in Engineer-approved electronic format.

2.2 BONDING AND GROUNDING

All electrical equipment shall be made mechanically and electrically secure to form a continuous system, and shall be effectively grounded. The grounding conductor shall be a No. 6 AWG copper, non-insulated wire.

Grounding shall be accomplished by bonding the grounding circuits to copper clad metal, driven electrodes. All electrodes shall be as a minimum, 5/8 inch in diameter by 10 feet long. The electrodes shall be driven vertically until the top of the rod is a minimum of 4 inches below grade. Bonding to the ground rod shall be made by means of suitable screw type positive ground rod clamps.

Grounding of the conduit and neutral at the service point shall be accomplished as required by the National Electric Safety Code, except bonding jumpers shall be No. 6 AWG or equal.

Grounding to existing water lines will not be permitted.

PART 3 - MATERIAL REQUIREMENTS

This part consists of material requirements necessary for the construction of a traffic signal installation complete, in place, and operational as described in the project plans and these special provisions.

3.1 VMS SIGNS

A. The VMS sign shall be Model VL-3550-32x128-20-RGB as manufactured by Daktronics, Inc., Brookings, S.D.

B. All mounting brackets shall be in accordance with the manufacturer’s recommended mounting method, in order to provide a rigid-mount for the sign. All necessary hardware for a complete installation shall be included.

3.2 FIBER OPTIC CABLE AND ACCESSORIES

A. Fiber Optic Cable: Furnish and install the loose tube fiber optic cable(s) of the type, size, and number of fibers specified and all associated accessories.

The cable shall meet the latest applicable standard specifications by American National Standards Institute (ANSI), Electronics Industries Association (EIA), and Telecommunications Industries Association (TIA) for the type mode cable of the size specified and the specifications herein.

Single-Mode Fiber	
Typical Core Diameter:	8.3 µm ± 1.0 µm

Cladding Diameter:	125.0 µm ±1.0 µm
Core Concentricity:	± 1%
Attenuation Uniformity:	No point discontinuity greater than 0.1 µm at either 1300 nm or 1550 nm
Max. Attenuation:	0.40 dB/mile

The coating shall be a dual layer UV cured acrylate applied by the fiber manufacturer. The coating shall be mechanically or chemically strippable without damage to the fiber.

The central member of the cable shall be a glass reinforced plastic rod designed to prevent the buckling of the cable. The cable core interstices shall be filled with water blocking tape to prevent water infiltration.

Dielectric fillers may be included in the cable core where needed to lend symmetry to the cable cross-section.

Buffer tubes shall be of dual layer construction with the inner layer made of polycarbonate and the outer layer made of polyester. Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conducting homogeneous gel or a waterblocked with a water-swellable yarn or tape. If gel is used it shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents. Buffer tubes shall be stranded around the central member using reverse oscillation, or "SZ", stranding process.

The buffer tubes shall meet TIA/EIA-598A, "Color coding of fiber optic cables". The single mode cable shall include a total of 3 loose tubes with 12 fibers in each for a total of 36 fibers. The multi mode cable shall include one loose tube with 12 fibers. The tube and fiber colors shall follow the industry color code (BL, OR, GR, BR, SL, WH, RD, BK, YL, VI, RS, AQ).

The cable tensile strength shall be provided by a high tensile strength aramid yarn and/or fiber glass.

All dielectric cables, without armoring, shall be sheathed with medium density polyethylene. The minimum nominal jacket thickness shall be 0.055 inch. Jacketing material shall be applied directly over the tensile strength members and flooding compound. The jacket or sheath shall be marked with the manufacturer's name and the words "Optical Cable", the year of manufacture, and sequential feet marks. The markings shall be repeated every foot. The actual length of the cable shall be within the range plus one percent of the length marked. The marking shall be in a contrasting color to the cable jacket. Additionally, the jacket marking shall have a durable weather proof label which shows the actual attenuation of each fiber expressed in dB/mile.

The cable shall be fabricated to withstand a maximize pulling tension of 600 pounds during installation (Short term) and 135 pounds upon installation (Long term).

The shipping, storing, installing and operating temperature range of the cable shall be -40°F to +158°F.

The manufacturer shall test at the 100% level all fiber optic cable for the following tests:

a. Each fiber proof tested at a minimum load of 350 MPa.
b. Each fiber tested for attenuation and the reading shall be part of cable labeling.

The cable shall meet the appropriate standard Fiber Optic Test Procedure for the following measurements:

a. Fluid Penetration
b. Compound Drip
c. Compressive Loading Resistance

d. Cyclic Flexing
e. Cyclic Impact
f. Tensile Loading and Bending

The cable ends shall be available for testing. The cable ends must be sealed to prevent moisture impregnation.

B. Fiber Optic Jumpers/Patch Cords: The number of fibers and termination points shall be as specified in the plans. They shall be terminated in the distribution unit.

Length of patch cord will vary according to distribution unit to the network switch, and shall provide for a minimum of 2 feet total slack.

Patch cords shall consist of factory-assembled patch cords, each of which shall contain two single-mode fibers. Each such fiber shall have a connector with ceramic ferrule on each end (i.e., a total of four connectors per cord). The type of connector shall be as specified in the plans. Each patch cord shall have a dielectric strength member and a durable outer jacket designed to withstand handling.

C. Connectors: Only connectors of ceramic ferrule and Physical Contact end finish shall be used to terminate fibers to equipment. Mechanical connectors shall not be used to splice cables. Maximum attenuation per connector shall be 0.75 dB.

E. Splices: Fusion splices shall be used to splice all continuous fiber runs in splice enclosures.

The fiber cable shall be installed in continuous runs as designated on the plans. Splices shall be allowed only in the splice enclosures as located on the plans. Maximum attenuation per splice shall be 0.3 dB.

F. Fan Out Kits: Fan out kits shall be provided for separation and protection of individual fibers with buffer tubing and jacketing materials suitable for termination of the fiber and fiber optic connector as specified.

G. Splice Enclosure: Ends of continuous fiber cable runs and/or traffic signal controller branch circuit points will be spliced in an outside plant splice enclosure located in handholes as shown on plans.

Enclosure shall accept a minimum of six cables and provide enough trays to splice all fibers. All fiber cables shall enter the enclosure at one end.

Enclosure shall be watertight and re-enterable using gel-compressed cable connections and a re-enterable gasket.

PART 4 - METHOD OF MEASUREMENT

Plan quantities are for estimating purposes only, and these quantities will not be paid for separately.

PART 5 - BASIS OF PAYMENT

A. Payment for “VARIABLE MESSAGE SIGN (VMS) SYSTEM” will be made at the lump sum contract price. This price shall be full compensation for furnishing all equipment, materials, and labor necessary or incidental for all sign installations, complete.

B. Monthly estimates of the work performed will be made based on the schedule of unit prices and will be used to prepare progress payments to the Contractor. The schedule of unit prices will also be used to establish the total cost for any extra work orders related to variable message sign installation work items unless otherwise negotiated.

VI SCHEDULE OF UNIT PRICES

SCHEDULE OF UNIT PRICES

VMS INSTALLATIONS (4 LOCATIONS)
STP-A-1945(805)--86-77
Activity ID 04-2014-004

('LUMP SUM' ITEM) VARIABLE MESSAGE SIGN (VMS) SYSTEM

ITEM	UNIT	TOTAL QUANTITY	UNIT COST	TOTAL EXTENSION
12-FIBER SM CABLE	L.F.	2650		
VMS SIGN	EACH	4		
NETWORK SWITCH WITH MOUNTING HARDWARE (4 PORT)	EACH	1		
NETWORK SWITCH WITH MOUNTING HARDWARE (8 PORT)	EACH	1		
SPLICE ENCLOSURE	EACH	2		
FIBER SPLICES REQUIRED	EACH	8		
TWO-FIBER SFP (SM)	EACH	4		
FIBER TERMI-NATIONS	EACH	10		
		Subtotal (VMS)		

Approved _____ Date _____