

**PORTSMOUTH-KITTERY
16189B**

November 17, 2020

SPECIAL PROVISION**SECTION 677 – INTELLIGENT TRANSPORTATION SYSTEMS (ITS) EQUIPMENT**

This special provision provides for installation of permanent, ground-mounted dynamic message signs (DMS), supports, foundations, and all equipment necessary to provide a working DMS system. All provisions of Section 677(Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification), except as modified or changed below, shall apply.

Add to Description (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

1.4 This work shall consist of furnishing, installing, wiring, connecting, configuring, testing, and providing GPS as-built documentation of a new permanent post-mounted dynamic message sign (DMS) structure system, including foundations, controller, hardware, software, integration, training, technical assistance and warranty.

Add to 2.1 General Standards Requirements (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

2.1.6 General DMS Requirements. The DMS board and controllers shall be designed in accordance with NEMA Standards Publication TS 4, Hardware Standards for Dynamic Message Signs (DMS), with NTCIP Requirements, and the current edition of *ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures*.

2.1.7 Aluminum Welding. The DMS housing shall be fabricated, welded, and inspected in accordance with current ANSI/AWS D1.2 Structural Welding Code Aluminum including Part E Workmanship Class I Structures and NHDOT Standard Specifications for Road and Bridge Construction (NHDOT Standard Specifications), Section 716.

2.1.8 Environmental Resistance. The DMS housing shall be designed to protect components from rain, ice, dust and corrosion in accordance with NEMA enclosure Type 3R standards, as described in NEMA Standards Publication 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

2.1.9 Product Electrical Safety. All DMS and associated equipment and enclosures shall be listed by the Underwriters Laboratories (UL®) and shall bear the UL mark. DMS shall be listed as conformant to UL 48 Standard for Electric Signs and UL 50 Enclosures for Electrical Equipment. Control equipment and enclosures shall be listed as conformant to UL 1433 Standard for Control Centers for Changing Message Type Electric Signs.

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2.1.10 Radio Frequency Emissions. All equipment shall be designed in accordance with Federal Communications Commission (FCC) Part 15, Subpart B as a “Class A” digital device.

2.1.11 Communication Protocols. The DMS controller hardware/firmware and DMS control software shall conform to the applicable National Transportation Communication for ITS Protocol (NTCIP) standards. Refer to the NTCIP section of this specification for detailed NTCIP requirements for this contract.

Add to 2.3 Technical Submittal (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

2.3.9 The Contractor shall provide documentation of the DMS Manufacturer’s previous experience. Only experience with manufacturing of electronic LED sign products that meet these specifications will satisfy the requirements for Manufacturer’s qualifications. Experience with other sign types will not be considered. Requirements of the DMS Manufacturer’s previous experience are as follows:

2.3.9.1 The DMS Manufacturer shall have been in the business of manufacturing DMS used to manage vehicular roadway traffic for a minimum period of 5 years prior to the contract bid date.

2.3.9.2 The DMS Manufacturer shall have in operation, as of the contract bid date, a minimum of 10 different project specific LED DMS systems. Each of the 10 systems shall use the National Transportation Communications ITS Protocol (NTCIP 1203 v02) as their primary communication protocol.

2.3.10 The DMS Manufacturer shall provide a customer service department that is contactable via telephone, e-mail, and fax to provide technical support and help services 24 hours per day, 365 days per year for the applicable DMS systems. Contact information for the customer service department shall be provided in this technical submittal.

2.3.11 The DMS Manufacturer shall provide documentation indicating that the DMS product has been built and tested to the standards referenced in Section 2.1. Failure to conform to the testing requirements shall be grounds for rejection.

2.3.12 The Manufacturer shall provide results of third party testing, performed to demonstrate the DMS system (message board and controllers) meets the standards below. The report shall include a record of the test laboratory and the test lab’s representative that witnessed the tests, including the signature of the lab’s representative. Provide test reports for the following standards:

2.3.12.1 NEMA Standards Publication TS 4, Hardware Standards for Dynamic Message Signs (DMS), and a minimum NTCIP 1203 V03.

2.3.12.2 Underwriters Laboratories (UL), UL 48 Standard for Electric Signs, UL 50 Enclosures for Electrical Equipment, and UL 1433 Standard for Control Centers for Changing Message Type Electric Signs. The UL report numbers for all DMS and control equipment manufactured shall be submitted and the products shall bear the UL mark.

2.3.13 Submit third-party test results verifying management information base (MIB) object support for the device. Documentation shall show all required MIB and object groups are fully supported by the device and meet NHDOT NTCIP requirements as specified in 2.6 below.

2.3.14 The Contractor shall provide a compact disk that contains all management information base and an Interface Control Document that enables the Department's Advanced Transportation Management System (ATMS) software integrator to integrate the new DMS into the NHDOT ATMS.

2.3.15 The Contractor shall provide two copies of the DMS control software on CD, as described in section 2.11.2 below, along with the controller operator's manual.

2.3.16 The Contractor shall indicate on the technical submittal that the DMS provided meets NTCIP 1203 Version 2, or latest supported specification, and that the signs to be delivered are equipped with the software and hardware required to meet all NTCIP Conformance Requirements below.

2.3.17 In addition to the documentation described above, the Contractor shall also provide NTCIP documentation as described in section 2.6.9. NTCIP documentation shall be included on the control software CD copies provided in section 2.3.15.

2.3.18 Documentation that proves the DMS manufacturer complies with these Specifications shall be provided with the DMS manufacturer's Technical Submittal. A cross-matrix shall be provided that lists each specification point and indicates how the manufacturer meets that requirement.

2.3.19 Failure to provide complete and accurate submittal information may be cause for rejecting the proposed DMS system.

Add to Materials (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

2.6 NTCIP Conformance Requirements.

2.6.1 This section describes the minimum specifications for the NTCIP communication capabilities of the DMS controller and DMS control software. All hardware, software, firmware, and services necessary to install and operate the DMS system shall fully comply with the NTCIP functional requirements specified herein.

2.6.2 These specifications reference standards and MIBS through their NTCIP designated names. Each NTCIP device covered by these project specifications shall implement the version of the standard that is specified in Table 2. Refer to the NTCIP library at www.ntcip.org for information on the current status of NTCIP.

Table 2: NTCIP Document References

Document Number and Version	Document Title	Document Status
NTCIP 1101:1996 and Amendment 1	Simple Transportation Management Framework (STMF)	Approved Standard with Amendment
NTCIP 1102:2004 v01.15	Octet Encoding Rules (OER) Base Protocol	Recommended Standard
NTCIP 1103 v02.16	Transportation Management Protocols	Jointly Approved
NTCIP 1201 v02	Global Object (GO) Definitions	Jointly Approved with Amendment
NTCIP 1203 v02	Object Definitions for Dynamic Message Signs	Recommended Standard
NTCIP 2101:2001 v01.19	Point to Multi Point Protocol (PMPP) Using RS-232 Subnetwork Profile	Jointly Approved
NTCIP 2103 v02	Point-to-Point Protocol Over RS-232 Subnetwork Profile	Jointly Approved
NTCIP 2104v01.11	Ethernet Subnetwork Profile	Jointly Approved
NTCIP 2201 v01.15	Transportation Transport Profile	Jointly Approved
NTCIP 2202 v01.05	Internet (TCP/IP and UDP/IP) Transport Profile	Jointly Approved
NTCIP 2301 v02.18	Simple Transportation Management Framework (STMF) Application Profile	Recommended Standard

2.6.3 Each serial or modem port on each NTCIP device shall be configurable to support both NTCIP 2101:2001 v01.19 and NTCIP 2103 v02. Only one of these profiles shall be active at any given time. Serial ports shall support external dial-up modems.

2.6.4 Each Ethernet port on the NTCIP device shall comply with NTCIP 2104 v01.11

2.6.4.1 The NTCIP device may support additional Subnet Profiles at the manufacturer's option. At any one time, only one subnet profile shall be active on any single port of the NTCIP device. All response datagram packets shall use the same transport profile used in the request.

The NTCIP device shall be configurable in a way that allows a field technician to activate the desired subnet profile and shall provide a visual indication of the current selected subnet profile.

2.6.5 Each Ethernet port on the NTCIP device shall comply with NTCIP 2202 v01.05

2.6.5.1 The NTCIP device(s) may support additional transport profiles at the manufacturer's option. Response datagrams shall use the same transport profile used in the request. Each NTCIP device shall support the receipt of datagrams conforming to any of the supported transport profiles at any time.

2.6.6 Each NTCIP device shall comply with NTCIP 2301 v02.18.

2.6.6.1 The NTCIP device may support additional application profiles at the manufacturer's option. Responses shall use the same application profile used by the request. Each NTCIP device shall support the receipt of application data packets at any time allowed by the subject standards.

2.6.7 Each NTCIP device shall support all mandatory objects of all mandatory conformance groups as defined in NTCIP 1201 v02 and NTCIP 1203 v02.

2.6.7.1 All mandatory and optional objects listed in these MIBS shall be supported. Table 3 outlines the specific groups within the MIBS that must be supported:

Table 3: Object Support MIBS
NTCIP 1201 V02
Time Management Group Time Based Event Schedule Group Report group PMPP Group Security Group Auxiliary Group
NTCIP 1203 V02
Sign Configuration and Capability Conformance Group Font Definition Conformance Group VMS Configuration Conformance Group MULTI Configuration Conformance Group Message Table Conformance Group Sign Control Conformance Group

2.6.8 Each NTCIP device shall support the following message formatting MULTI tags as shown in Table 4. The manufacturer may choose to support additional standard or manufacturer-specific MULTI tags.

Table 4: Required Multi Tags

Multi Tag	Description
f1	Field 1-time (12 hr)
f2	Field 1-time (24 hr)
f8	Field 8- day of month
f9	Field 9-month
f10	Field 10-2 digit year
f11	Field 11-4 digit year
fl (and /fl)	Flashing text on a line-by-line basis with flash rates controllable in 0.1-second increments.
Fo	Font
jl2	Justification- line-left
jl3	Justification- line-center
jl4	Justification- line- right
jp2	Justification- page- top
jp3	Justification- page- middle
jp4	Justification- page- bottom
mv	Moving text
nl	New line
np	New page up to 5 instances in a message (i.e. up to 6 pages/frame in a message counting first page)
pt	Page times controllable in 0.1-second increments

2.6.9 NTCIP documentation shall be provided on a CD-ROM and will contain ASCII versions of the following Management Information Base (MIB) files in Abstract Syntax Notation 1 (ASN.1) format:

2.6.9.1 The relevant version of each official standard MIB modules referenced by the device functionality.

2.6.9.2 If the device does not support the full range of any given object within a standard MIB Module, a manufacturer specific version of the official standard MIB Module with the supported range indicated in ASN.1 format in the SYNTAX and/or DESCRIPTION fields of the associated OBJECT TYPE macro. The filename of this file shall be identical to the standard MIB Module except that it will have the extension “man”.

2.6.9.3 A MIB module in ASN.1 format containing any and all manufacturer specific objects supported by the device with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.

2.6.9.4 A MIB containing any other objects supported by the device.

2.7 Post-Mounted Dynamic Message Sign. The DMS shall be a Ver-Mac model B-1500C or approved equivalent.

2.7.1 The Contractor shall furnish and install all hardware required to attach the DMS panel to the applicable supports. DMS shall be mounted using two (2) Zee bars attached along the top and bottom of the DMS panel. For ground mounted installations, the Zee bars shall be bolted to the steel H beams on each side of the web as shown in the Plans.

2.7.2 Operating temperature range: - 30°C - +74°C.

2.7.3 Humidity operating range: 10 to 95 percent relative humidity, non-condensing.

2.8 DMS Controller. The DMS Controller shall be a Ver-Mac V-Touch Controller or approved equivalent.

2.8.1 The DMS controller shall have the same environmental standards as the DMS sign.

2.9 DMS Ground Mounted Control Cabinet. The DMS Ground Mounted Control Cabinet shall be ground mounted and installed at the locations shown in the Plans, and in conformance with all requirements shown in the Plans. The DMS cabinet shall consist of an aluminum weatherproof housing, and all ancillary equipment necessary to provide a complete, operational control cabinet for the DMS equipment. This work shall include all wiring, cabling, and connectorizing from DMS cabinet to the DMS panel.

2.9.1 The DMS cabinet shall be NEMA 3R rated.

2.9.2 The DMS cabinet shall be a NEMA “P-44” cabinet with 15-inch extension base meeting the requirements of MaineDOT Standard Specifications Section 643.042, with the exception that the DMS cabinet shall not require a switch compartment as described in the sixth paragraph of MaineDOT Standard Specifications Section 643.042.

2.9.3 A 36-inch x 56-inch x 4-inch concrete work pad shall be installed in front of each cabinet door. The pad shall be placed on a minimum of four inches of compacted granular material. The pad shall be set with at least one percent grade such that any water on the pad shall flow away from the cabinet. The DMS cabinet shall be secured to the concrete foundation provided by the Contractor as shown in the Contract Documents. Where the work pad is installed on a slope, the depth of the pad shall be increased such that there is at least two inches of the concrete pad below grade.

2.9.4 Each cabinet shall contain a power panel. The power panel shall contain a primary circuit breaker, which will accept the incoming power from the AC utility power. This primary circuit breaker shall serve as the electrical disconnect for the cabinet and shall shut off all cabinet power when in the “off” position.

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2.9.5 Each cabinet shall contain an uninterruptible power supply with remote power manager, as detailed in Special Provision 677 for Cabinet Components.

2.9.6 Each cabinet shall contain an Ethernet switch as detailed in Special Provision 677 for Cabinet Components.

2.9.7 The DMS cabinet shall protect the electronics and interfaces against: sustained winds of 90 miles per hour (MPH), with 120 MPH wind gusts, blowing sand and dust, roadside pollutants from vehicle exhausts, blowing rain and snow and heavy ice accumulations experienced in the project area.

2.9.8 The cabinet door shall be supplied and installed with Corbin 1548-1 locks for access by #2 keys.

2.9.9 The DMS cabinet shall be supplied with a captive door restraint bar. The bar shall allow the door to be kept open at a minimum of two different angles with one at 90 degrees and the other in the fully open position. The door restraint bar shall be supplied and installed such that the door is held in place during a 40 MPH wind without the restraint bar being bent. The door restraint bar shall be provided to prevent door movement when open in windy conditions.

2.9.10 Door hinges shall be continuous and bolted to the cabinet and door utilizing steel carriage bolts and nylock nuts. The hinges shall be made of a minimum 0.083-inch thick aluminum and shall have a minimum 0.250-inch diameter stainless steel hinge pin. The hinge pin shall be capped at the top and bottom by a weld to prevent removal.

2.9.11 The top and bottom of the latching pushrods shall contain nylon rollers to promote secure door closure.

2.9.12 The door handle shall be stainless steel. The latching handle shall have provisions for padlocking in the closed position; however, no padlocks are required.

2.9.13 The DMS cabinet shall be covered by a two-year dated warranty covering material defects for two years from date of acceptance. The Contractor shall provide a letter, prior to project close out, from the DMS manufacturer stating the manufacturer will uphold the two-year warranty.

2.9.14 The DMS cabinet shall contain a power switch mounted within the cabinet to control power to all duplex outlets. The cabinet shall include a minimum of two duplex outlets (total of four outlets), each rated for 15 amps. The cabinet shall also include a Tripp Lite power outlet strip, model IBAR 12-20T or approved equal.

2.9.15 The Contractor shall supply and install a thermostatically controlled electric fan in the cabinet to maintain the temperature within the field cabinet to that required by the equipment for outside temperatures as specified in these Special Provisions. Thermostats shall have the capability of being field adjusted from 50° F to 120° F.

2.9.16 All exposed, high voltage electrical terminals shall be insulated with non-conducting material such as rubber boots or silicon/rubber caulking.

2.9.17 The DMS cabinet shall be electrically bonded to all of its associated metallic DMS support structure grounding systems, as described elsewhere in this document or in the Contract Documents.

2.9.18 All air venting arrangements shall contain air filters. The air filters shall have an average rated efficiency of 30% and an arrestance of 90% when tested in accordance with ASHRAE 52.1-1992 Test Standard. The filter shall be listed and rated Class 2 by the Underwriters Laboratories. Each cabinet shall be supplied with all required air filters. All fans shall be located above the air filters at the top of the cabinet.

2.9.19 All intake and exhaust vents shall meet NEMA 3R requirements with and without powering the air venting arrangements. All exhaust vents shall be furnished with a screen to prevent insects from entering the DMS cabinet.

2.9.20 The DMS cabinet shall be supplied and installed with an internal light located in the top of the cabinet inside each door. These lights shall automatically turn on when the cabinet door is open and shut off when the door is closed. The lights shall be hardwire connected to the cabinet's electrical power distribution buss. The lights shall be LED.

2.9.21 The Contractor shall furnish in a watertight container a control cabinet-wiring diagram. Three sets of identical wiring diagrams shall be furnished for each cabinet.

2.10 DMS Post & Mounts.

2.10.1 Support posts shall be ASTM A992 steel, galvanized in accordance with Section 550.2.9.

2.10.2 DMS board mounting brackets shall be 6061-T6 aluminum Z-extrusions.

2.10.3 All mounting hardware and bolts shall be stainless steel.

2.11 Foundation.

2.11.1 Concrete for foundations shall be Class B and shall conform to Section 520. Reinforcing steel shall conform to Section 544.

2.12 Communications & Control.

2.12.1 The sign controller shall be capable of being controlled on site from either a hand held terminal, a personal computer equipped with the sign software, or both, and from a remote computer through the proposed communication methods for the installation. The Contractor shall provide the hand held terminal to be used as an interface to the controller. The terminal must be environmentally sealed.

2.12.2 The signs shall be supplied with computer software that allows NHDOT personnel to remotely control the on-board computer from a personal computer equipped with the latest Windows released version. Control software shall be provided on CD and allow the NHDOT to install software on as many computers as NHDOT deems necessary to remotely control the DMS. The software will be password protected and allow administrator defined privileges for at least three levels of users.

2.12.3 The DMS controller shall contain a minimum of one 10/100Base-T Ethernet communication port. This port shall be available for use for communicating to and from the sign's central controller for the purpose of modifying sign messages, changing configuration settings, obtaining sign diagnostic information, and performing all sign management functions. The Ethernet port shall have a standard RJ45 connector, which conforms to EIA/TIA standard 568A or 568B. The sign shall have configurable IP address, subnet mask, and gateway addresses, and shall be capable of being assigned a fixed IP address or be assigned an address via DHCP.

2.12.4 The DMS shall be native Ethernet-ready for installation of a wireless modem or other Ethernet communications device.

2.12.5 Communications on the Ethernet port shall be NTCIP-compatible using the NTCIP 2202 Internet transport profile, and the NTCIP 2104 Ethernet sub network profile. This shall permit the controller to be operated on any typical Ethernet network using the TCP/IP and UDP/IP protocols.

2.13 Training. The contractor shall provide up to 6 hours of training as required by the Owners on all components of the DMS system. The Training shall meet the following requirements:

2.13.1 The Contractor shall provide training on the configuration, operation, and maintenance of the items provided under this contract as described herein. The training shall be on the new items provided under this contract, including the DMS and DMS controller.

2.12.2 The Contractor shall develop and supply all necessary manuals, displays, class notes, and visual aids, and other instructional materials furnished by equipment manufacturers. Instructional materials shall include all data sheets and manuals from manufacturers for all contract items supplied.

2.12.3 All training shall include hands-on use of all equipment, both field equipment and central equipment.

2.13 Testing. The Contractor shall provide testing on all components of the system. The testing shall meet the following requirements:

2.13.1 The Contractor shall propose a test plan for the DMS system and submit the test plan(s) and procedures as detailed herein. Each of the test plans shall contain the following elements:

- 2.13.1.1** Proposed date, time, and location of the testing
- 2.13.1.2** Names and credentials of the Contractor personnel who will be conducting the testing
- 2.13.1.3** Descriptive overview of the proposed test procedure
- 2.13.1.4** List of test equipment required to perform the testing
- 2.13.1.5** Test cases and test logging forms which detail every step of the test procedure.

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2.13.2 Test logging forms shall be presented in tabular format, with separate columns for each of the following:

- 2.13.2.1** Test case description detailing the test step to be performed.
- 2.13.2.2** Expected result
- 2.13.2.3** Actual result
- 2.13.2.4** Pass/fail
- 2.13.2.5** Comments

2.13.3 The Contractor shall supply separate test logging forms at the time of testing for each test plan, and for each device location. The test logging forms shall show the device location date, and the start and end times of the test.

2.13.4 At the end of each test logging form, there shall be signature and date locations for each of the following:

- 2.13.4.1** Contractor personnel conducting the test
- 2.13.4.2** Engineer of Record representative witness
- 2.13.4.3** Construction Quality Control Manager
- 2.13.4.4** Owners' representative

2.13.5 Signatures on the test logging form will signify only that the test was performed and witnessed, not that it passed or failed.

2.13.6 The detailed Test Plans shall be submitted to the Engineer no later than thirty (30) days prior to the beginning of each test phase.

2.13.7 The Contractor shall have approved test plans prior to submitting a request to schedule the start of any test activities. The Contractor shall notify the Resident no less than seven (7) days prior to the beginning of any equipment or systems testing.

2.13.8 Testing shall provide verification and documentation that all requirements as detailed in this Section and the Plans are met. The Test Plans shall be developed by the Contractor to provide a mechanism that ensures that all contract requirements have been met and tested successfully and verified.

2.13.9 If any deviations or changes to the approved Test Plans arise, it shall be resubmitted for review and approval by the Engineer at least fourteen (14) calendar days prior to any planned test activity stage. No tests shall be conducted until the Engineer has approved the test plan.

2.13.10 A summary of all tests shall be produced at the completion of each testing phase of the project to ensure that all requirements defined by the system are satisfied.

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Amend 3.7 (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification) as follows:

3.7 Operational Acceptance Test Period.

3.7.1 A 60 day Operational Acceptance Test Period will be required for all ITS components installed. This test period shall commence upon successful completion of field tests, communication tests, and central control tests, and will last for 60 consecutive days. This test period will demonstrate that all the ITS devices, systems and components are properly installed, are free from problems, exhibit stable and reliable performance, communicate reliably with NHDOT's TMC and comply with the Contract Documents.

3.7.2 If necessary, the Contractor shall coordinate with the TMC to schedule any exercises and have a representative at the device to provide on-site verification of device functionality.

3.7.3 In the event of a failure, the problem shall be reported to the Contractor. The failure shall be corrected and the test shall then be restarted for another 60 days.

Amend 3.11.3 (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification) as follows:

3.11.3 Guarantee Period. The length of guarantee will be 2 years from the date of Final ITS System Acceptance by the Engineer, as specified in section 3.8 above, for each site. Additionally, the Contractor shall guarantee availability of compatible replacement equipment (to the field replaceable unit level) for a ten year time period from the same date.

Add to Construction Requirements (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

3.12 DMS Construction.

3.12.1 The sign face shall be installed to optimize the sign display for oncoming traffic. The sign itself should be visible both day and night from a distance of up to 0.5 miles from the sign.

3.12.2 The sign message shall be legible from a minimum distance of 800 feet for daytime conditions and 600 feet for nighttime conditions, per the MUTCD.

3.12.3 All electrical components for the sign shall be placed in either the Control Cabinet or the Sign Board, and all enclosures shall be water tight and water proof.

3.12.4 Photocells shall be installed on the sides of the DMS housing, facing south.

3.12.5 The Contractor shall coordinate with local utilities for power access and schedule all required electrical inspections.

3.13 Foundations, Posts & Mounting.

3.13.1 The DMS shall be mounted to two wide-flange, steel beams set in concrete placed within a drilled shaft, in accordance with the project details.

3.13.2 The posts for DMS mounts shall be set in the foundation holes and securely held in place by a brace or template before the concrete for the base is placed. All posts shall be plumb and properly oriented with the roadway. Flanges supporting the DMS will lie in the same plane.

3.13.3 The forms and templates supporting the posts shall not be removed until the concrete has cured at least 24 hours. No sign shall be attached to the posts until the concrete has cured as provided in Section 520, Table 10 – Concrete Loading, for substructure concrete including footings.

3.13.4 After erection, all bare steel shall be thoroughly wire brushed or power-tool cleaned and covered with 2 coats of approved zinc-rich primer. The first coat shall be thoroughly dry before the second coat is applied.

3.13.5 When rock is encountered in erecting posts, the depth to be drilled into the rock shall be as stated on the details.

3.13.6 The DMS shall be mounted to the support posts using two Z bars attached along the top and bottom of the DMS panel. The back of the DMS shall be flush with the Z bars after mounting is complete.

3.13.7 The DMS shall be mounted horizontally on the posts by the Z bars. The Z bars shall be bolted to the steel beams on each side of the web. The back of the Z bars shall be flush with the posts after the mounting is completed.

3.14 Grounding, Bonding and Surge Suppression.

3.14.1 The Contractor shall furnish and install Transient Voltage Surge Suppression (TVSS) devices for all power and communications conductors. TVSS devices shall be installed for all conductors leaving the ITS equipment cabinet, DMS controller cabinet, and any solar power cabinets.

3.14.2 The Contractor shall supply and install a ground array system to be installed at the base of the DMS. The ground rod array system shall be connected to the DMS through an appropriate ground clamp. A #4 AWG copper wire shall be installed between the DMS posts and the ITS equipment cabinet, providing a common ground system for each terminus.

3.14.2.1 Additional ground rods shall be installed to meet the manufacturer's recommended resistance to ground, or a maximum of 25 ohms, whichever is less.

3.14.2.2 The Contractor shall provide and install a transient voltage surge suppressor between the AC power mains and all DMS equipment.

3.14.3 Anti-oxidation grease shall be used on all attachment points of the ground system where dissimilar metals intended for grounding and bonding come in contact with each other

3.15 Communications & Control.

3.15.1 Each DMS shall be controlled and monitored by its own DMS controller. Each DMS installation shall include a DMS controller, auxiliary control panel, and all other associated

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equipment independent from any other installation unless otherwise shown on the plans or directed by the Engineer.

3.15.2 The management information base (MIBS) and an Interface Control Document provided in the Contractor's technical submittal specified in section 2.3.14 shall be used by the Department's Advanced Transportation Management System (ATMS) software integrator to integrate the new DMS into the NHDOT ATMS. Integrating the DMS into the NHDOT ATMS shall be the responsibility of the Contractor.

3.15.2.1 The Contractor shall coordinate integration of the installed DMS system with the ITS Project Manager at the NHDOT TMC (271-6862).

3.15.2.2 NHDOT operators shall be able to monitor and remotely control the sign messages as if they were being controlled locally.

3.15.2.3 NHDOT operators shall be able to access a library of pre-programmed standard or customized messages and graphics. Text messages shall be easily created, labeled, stored, and programmed with Windows-based message sign software provided as part of this installation.

3.16 ITS Cables.

3.16.1 All equipment shall be installed using the Manufacturer's recommended cables.

3.16.2 The Contractor shall furnish, install, connectorize, and test all Category 6 (Cat. 6) cables, of the types required for the application, at locations shown in the plans or as required to construct a complete, functional system.

3.16.2.1 The Cat. 6 cables shall not exceed 325 feet in length unless the Contractor is granted written permission from the Engineer.

3.16.3 All cables shall be installed in a continuous run. Splicing will not be allowed.

3.16.4 All above ground cables shall be installed in flexible liquid tight conduit in accordance with Section 3.3.

3.17 Spare Parts.

3.17.1 The Contractor shall provide the following spare parts when up to 4 DMS are installed:

- (a) 3-each LED Modules
- (b) 1-each spare controller
- (c) 1-each spare handheld terminal unit, if such a handheld unit is offered by the sign manufacturer
- (d) 1-each of every other circuit board in the sign
- (e) 1-each spare surge protector

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3.17.2 If more than 4 DMS are installed, the Contractor shall supply another full set of spare parts as outlined in section 3.16.1 for the fifth sign installed, or for every 2 additional signs installed thereafter.

Add to Method of Measurement (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

4.8 Post-mounted dynamic message signs will each be measured by the unit installed and integrated. Where more than one unit is specified in the contract, separate item numbers will appear for each unit.

4.8.1 Support posts and foundations will not be measured for payment but shall be subsidiary to the DMS item.

Add to Basis of Payment (Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – Base Specification):

5.7 The accepted quantity of DMS will be paid for at the contract lump sum price complete in place. Payment shall be full compensation for the preparation and submittal of the Technical Submittal, fabrication and installation of the DMS board and mounting system, mounting hardware, steel posts, foundation, controller, DMS controller cabinet if required, spare parts, hand-held terminal, flexible conduit, grounding and bonding, connection and electrical wiring within cabinets and DMS, connection to electrical and communication services between cabinets and the DMS, training, testing and providing as-built record documentation.

5.7.1 Partial payments for this item will be made approximately as follows:

- (a) Up to 50 percent of the contract unit price will be paid after receipt and installation of all equipment
- (b) Remaining 50 percent of the payment will be made after the completion of Acceptance Testing and receipt of the as-built GPS coordinates in accordance with 3.10

5.8 If more than one ground rod is required to achieve the required earth grounding resistance, all additional ground rod installation and ground wire connections will be subsidiary to the DMS.

5.9 Excavation and backfill for sign support foundations will be subsidiary.

5.10 All costs associated with 2.3 and device integration will be subsidiary.

5.11 ITS equipment cabinets shall be paid for under Special Provision to Section 677 - Intelligent Transportation Systems (ITS) Equipment – ITS Cabinet Specification.

5.12 All conduit and pull boxes, except flexible liquid tight conduit, will be paid for under Section 614.

Pay Items and Units:

3/14/2019

677.12__ Permanent Fixed Location Dynamic Message Sign (DMS)

Unit