

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TRAVEL TIME SYSTEM

UNIV:SRP

1 of 6

ITS:APPR:CLC:DBP:02-02-12

a. Description. This work consists of furnishing, installing, integrating, and testing a Travel Time System (TTS) at locations as shown on the plans. The TTS will provide numeric travel times and must be mounted on a static guide sign panel as shown on the plans. All work and materials required for mounting the dynamic message panels (DMPs) to the static guide sign, conduit installed on the sign support, and cabling between the Intelligent Transportation System (ITS) cabinet and DMPs are included.

1. Furnish, install, integrate and test all equipment and components necessary to provide full and complete ITS functionality in all respects, without additional expense to the Department.

2. The TTS must be comprised of the following components:

A. Dynamic Message Panels (DMPs).

B. Controller hardware to operate the panels and communicate across the ITS network.

C. Power supply(s) (to be contained in the ITS cabinet).

D. All power and communications cabling connecting the power supplies and controller to the DMPs, installed in the conduit as shown on the plans.

E. Mounting hardware for the DMPs to be attached to the MDOT standard sign materials, as detailed on the plans.

3. Position and install the static guide sign with the front face of the DMP(s) facing oncoming traffic and in accordance with section 810 of the Standard Specifications for Construction. The final location and orientation of the TTS components are to be approved by the Engineer prior to installation.

4. The DMP must be mounted on a Type IA sign that comply with ASTM Type IX legend on a Type IV background in accordance with section 919 of the Standard Specifications for Construction.

b. Materials.

1. Travel Time System (TTS) requirements.

A. Each DMP must display two digits at 18 inches in height. Characters must use an industry standard height to width ratio, 7 pixels in height by 5 pixels in width or 7

pixels in height by 4 pixels in width. The characters must be separated by two unlit pixel columns of space.

B. The display must be made up of pixels with discrete light emitting diodes (LEDs), amber in color, and meet subsection 922.07.C of the Standard Specifications for Construction for legibility, visibility, brightness, angles, and materials. Pixels must be spaced 2.6 inches, measured center to center. Alternate pixel spacing that meets the standard specifications must be allowed with written approval by the Engineer.

2. Dynamic Message Panel (DMP) controller requirements.

A. The DMP controller must be capable of receiving message commands and control from the Advanced Traffic Management System (ATMS) software platform using National Transportation Communications for ITS Protocol (NTCIP) compliant commands.

B. The DMP controller must provide sign and communication, maintenance and diagnostic information to the operators at the Statewide Transportation Operations Center (STOC) as depicted within the plans or other operation centers as determined by the Department.

C. The TTS must be connected to the Internet by way of a cellular modem (paid for under Special Provision for Wireless Link, Cellular). The cellular modem must connect to the DMP controller by a Category 5 enhanced (CAT-5e) Ethernet cable and the controller must be capable of communicating NTCIP via Internet Protocol (IP)/Ethernet.

D. The Contractor, in accordance with the Special Provision for ATMS, Software Integration, must work with the ATMS software vendor to integrate the TTS into the statewide network and ATMS software package.

E. The DMP controller must be capable of delivering back to the operator accurate displayed message verification by way of "what-you-see-is-what-you-get" (WYSIWYG).

F. MDOT will communicate with the DMP(s) using NTCIP-compliant software. All features and capabilities of the DMP(s) must be controllable through the NTCIP-compliant software.

G. The DMP controller is to be capable of detecting faults with any component within the TTS and reporting those faults through the ATMS software and network. The diagnostic report must clearly describe the nature of the problem; the components involved; and any other information necessary to facilitate timely and efficient maintenance.

H. The DMP controller must contain circuitry to adjust the brightness of the DMP LEDs based on ambient light conditions. A photo sensor must be used to automate this process with a manual over-ride.

I. Supply the most current version of NTCIP. The Department, at its discretion, can require, at no additional cost to the Department, one firmware upgrade during the warranty period.

- J. The DMP controller must have the following characteristics.
- (1) Stand-alone microprocessor-based unit with integrated watchdog circuitry.
 - (2) Includes front panel or cabinet access door user interface with liquid crystal display (LCD) and keypad for direct operation and diagnostics.
 - (3) Mounts in a standard Electronic Industries Alliance (EIA) 19-inch (480 mm) equipment rack using supplied mounting hardware.
 - (4) Maximum weight of 10 pounds, including its enclosure.
 - (5) Minimum one NTCIP-compliant Recommended Standard (RS)-232 communication port for serial communications. One of the serial ports must have a secondary RS-422 interface option.
 - (6) One Ethernet port with Registered Jacks (RJ)-45 connector supporting NTCIP communication.
 - (7) Communicate directly with all DMP sensors.
 - (8) Include DMP-specific control firmware (embedded software) that must handle all external and internal sensors and communication inputs and drive the display modules as directed by external control software.
- K. DMP intensity control.
- (1) The DMP intensity control must not cause any flickering of the LED display matrix.
 - (2) The DMP intensity control must allow manual and automatic intensity control modes to be user selectable using the DMP controller, although the typical control mode will be "automatic".
 - (3) The DMP intensity control must allow manual intensity control from both local, and remote locations through the ATMS software platform.
3. Power supplies and electrical components.
- A. All electrical components must operate on 120/240 volt (V) 60 hertz (Hz) electricity, or the Contractor must provide appropriate Direct Current (DC) conversion for any equipment requiring DC power.
 - B. The TTS vendor is to utilize new, identical and completely interchangeable components within each TTS.
 - C. The Contractor is to utilize equipment designed to protect personnel from exposure to high voltage during equipment operation, adjustment and maintenance.
 - D. The power supply(s) must be contained in a cabinet mounted separate from the DMP, sign and support. The power supplies and associated cabling must be capable of

operating up to 350 feet from the furthest DMP.

4. Cabling.

A. All cabling between the DMP(s) and controller/power supply must be provided by the Contractor. Copper cabling for power must be appropriate for the voltage drop between the equipment cabinet and DMP(s) as shown on the plans.

B. All exposed conduit above ground must be Schedule 80 Polyvinyl chloride (PVC). Flexible conduit will be allowed between a junction box mounted on the back of the static guide sign and the DMP(s) but not for the vertical run between the ground and the sign.

C. All cables entering a conduit raceway must be 600V rated. Additional cables not rated 600V (Ethernet and communication cables) must be sleeved within the same conduit raceway or installed into a separate conduit raceway.

5. Mounting hardware. Supply all mounting hardware, including but not limited to; brackets, bolts, etc., as recommended by the DMP vendor for mounting to the static guide sign.

6. Environmental Requirements.

A. The TTS components must be manufactured for outdoor use and in conformance with NEMA TS-2 for operating temperature of -29 degrees Fahrenheit (F) to +165 degrees F and relative humidity (RH) of 0 percent to 95 percent, non-condensing.

B. The TTS enclosures, components, heating, ventilation and workmanship must be of new components; corrosion resistant; and adequate to ensure full sign functionality and durability in all Michigan environmental conditions.

C. All outdoor enclosures must resist water infiltration during hose-directed water per NEMA 250 - Class 4X requirements.

D. Install all the field equipment to be capable of operating in all weather conditions and withstand a wind load of at least 90 miles per hour (mph) without permanent damage or deformation to sign, sign structure, or mechanical and electrical equipment.

E. All connections, internal or external to the TTS, must be watertight.

F. If the DMP is subjected to temporary storage, the DMP must be protected from impacts and intrusion from the environment including but not limited to; weather and animals.

7. Light Emitting Diodes (LED) Display Requirements.

A. The LED's must have a 30 degree viewing angle for DMPs. All 30 degree LEDs must have a nominal viewing cone angle of 30 degrees with a half-power angle of 15 degrees measures from the longitudinal axis of the LED.

B. Discrete LEDs must be manufactured by either the Toshiba Corporation or

Avago Technologies formally Agilent Technologies. Substitutes will not be accepted. Discrete LEDs must conform to the following specifications:

(1) LEDs must be non-tinted, non-diffused, high-intensity, solid-state lamps that utilize AlInGaP semiconductor technology.

(2) LED lenses must be fabricated from ultraviolet (UV) light resistant epoxy.

(3) The LED lens diameter must be 0.2 inches.

(4) LEDs must emit amber light that has a peak wavelength of 590 ± 5 nanometers (nm). LEDs must be obtained from no more than two consecutive color "bins".

C. The LED manufacturer must perform color sorting of the bins.

(1) LEDs must be obtained from no more than two luminous intensity "bins". The LED manufacturer must perform intensity sorting of the bins.

(2) The various LED color and intensity bins must be distributed evenly throughout the sign and must be consistent from pixel to pixel. Random distribution of the LED bins is not acceptable.

(3) All LEDs used in all DMPs provided for this contract must be from the same manufacturer and of the same part number.

(4) The LEDs must be driven with a nominal current of 20 mA.

c. Construction.

1. Provide permanent power to the TTS within 72 hours of installation and mounting.

2. The DMP must be mounted to the front face of the static guide sign, without requiring any cut outs. Cut outs are not permitted. Access holes for cabling or drilled holes for bolted connections through the static guide sign panel must be approved by the Engineer before the work is conducted.

3. Install the cabling in underground conduit between the equipment cabinet and the TTS support posts. Between the underground sweep and the DMP(s) schedule 80 PVC conduit must be used and is paid for as part of this special provision. The schedule 80 PVC conduit must be attached to a single sign support post with stainless steel straps or another method only as approved in writing by the Engineer, as shown on Signing Detail, SIG-027-A.

4. All conduit and cabling must be attached to the back side of the static guide sign as to not obscure the visibility of the sign in any way.

5. Testing.

A. Acceptance Test Plan (ATP). Develop and submit to the Engineer for approval an ATP at least 14 days before testing is scheduled. The test plan must demonstrate

the complete functionality and integrity of the TTS after installation and integration. The plan must describe test procedures, detail features being tested and the expected values that demonstrate TTS compliance. At a minimum the plan must include inspection of the DMP housings, power supplies and electrical distribution, DMP controller, LED display modules, light control, and TTS failure conditions.

B. All TTS must be tested in accordance with the approved ATP. The final acceptance test must be conducted and witnessed by the Engineer or designated representative once the sign is fully installed and integrated.

6. Warranty. Once the sign is accepted in accordance to this special provision and the testing requirements above, the Contractor is required to supply a 5 year manufacturer warranty on parts and labor for the DMP system. The Contractor warrants that:

A. All Work furnished pursuant to the contract documents conforms to all professional engineering and electrician principles generally accepted as standards of the industry in the State of Michigan.

B. The TTS will be free of defects.

C. Materials and equipment furnished under the contract documents will be new when installed.

D. The Work will meet all of the requirements of the contract documents.

E. The specifications and/or drawings selected or prepared for use during construction are appropriate for their intended use.

F. The TTS will be fit for use for the intended function.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Travel Time System, 2 Panel	Each

Travel Time System, 2 Panel includes all work necessary to furnish, install, integrate and test a travel time system at locations shown on the plans, including DMPs, power supplies, controller(s), power cables, communications cables, mounting brackets, conduit and any other items as needed for complete functionality.