

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
STOPPED TRAFFIC ADVISORY SYSTEM

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APPR:JJG:LWB:10-30-13

a. Description. This work consists of providing, installing, operating, maintaining, and removing a portable, automated, and self-powered Real-Time Work Zone Traffic Monitoring System (RTWZTMS) that calculates and displays information on portable changeable message signs (PCMS) regarding stopped and slowed traffic in work zones. The system must be in accordance with the standard specifications and this special provision. The system will operate for the duration of the project specified in the Special Provision for Maintaining Traffic. All maintenance of the system is to be performed by the Contractor at no additional cost to the Department. The RTWZTMS must be a field proven system verifiable by the manufacturer and a reference from a contracting owner agency must be provided.

The Department may provide information to the Contractor on anticipated delays or stoppages related to the construction project, as determined during plan development. The Contractor is responsible for coordinating with any work in adjacent work zone projects.

This work consists of two primary components:

1. Preparation and submittal of a RTWZTMS plan.

A. Submit to the Engineer for review and approval a written and illustrated RTWZTMS plan at least 4 weeks prior to deployment of any component of the RTWZTMS. The Contractor must not start any system deployment or construction activities that will impact traffic until the RTWZTMS plan is approved by the Engineer.

B. The minimum requirements for the RTWZTMS plan include:

(1) A detailed plan showing the proposed locations of all RTWZTMS devices and equipment descriptions, including make and model.

(2) A description of all proposed thresholds and proposed PCMS messages to be implemented. Use the following messages unless otherwise approved by the Engineer. For traffic below 45 MPH – CAUTION SLOWED TRAFFIC / X MILES AHEAD and for traffic below 15 MPH CAUTION STOPPED TRAFFIC / X MILES AHEAD.

(3) The name and contact information of the RTWZTMS System Manager who must be accessible 24 hours a day.

(4) A detailed description of the proposed methods of communication between RTWZTMS devices and RTWZTMS central computer, and between RTWZTMS central computer and designated MDOT office(s), as provided by the Engineer.

(5) Proposed corrective method procedures, including response times and notification process.

(6) Note any changes that could be necessary due to stage changes or other factors relating to the project.

C. Approval of RTWZTMS Plan. Engineer approval of the RTWZTMS plan is conditional and will be predicated on satisfactory performance during construction. The Engineer reserves the right to require the Contractor to make changes in the RTWZTMS plan and operations, at no additional cost to the Department, to obtain the quality specified.

Notify the Engineer in writing prior to any proposed changes in the RTWZTMS plan. Proposed changes are subject to approval by the Engineer. Do not implement any changes in the RTWZTMS plan until the modified plan has been approved by the Engineer.

2. The furnishing, installation, and operation of a portable, automated, self-powered RTWZTMS must meet the following requirements:

A. National Transportation Communications for ITS Protocol (NTCIP) compatible PCMS;

B. Portable non-intrusive traffic sensors;

C. Portable trailer mounted Closed Circuit Television (CCTV) cameras to operate the system;

D. A central computer at vendor's location; and

E. A system web page for the project.

b. Equipment Requirements.

1. PCMS. All PCMS must be able to connect to RTWZTMS and populate a preprogramed message. All PCMS must meet the requirements and be paid for as detailed in the Special Provision for NTCIP Compliant Portable Changeable Message Sign (PCMS) 12IT812(A455).

2. Portable Non-Intrusive Traffic Sensors. The non-intrusive traffic sensors must meet the following:

A. Be a non-intrusive type, unless otherwise approved;

B. Provide an auto-configuration application;

C. Be capable of counting individual vehicles and reporting speeds ranging from 5 miles per hour up to 99 miles per hour;

D. Provide traffic volumes, over a user-defined interval ranging from 30 seconds up to 10 minutes;

E. Provide average vehicle speed data over a user-defined interval ranging from 30 seconds up to 10 minutes;

F. Detect traffic in up to five lanes in one direction of traffic simultaneously;

G. Maintain accurate performance in all weather conditions, including rain, freezing rain, snow, wind, dust, fog, and changes in temperature and light; and

H. Not rely on temperature compensation circuitry and be capable of continuous operation over an ambient temperature range from -40 degrees Fahrenheit (F) to +167 degrees F, and a relative humidity range from 5 percent to 95 percent (non-condensing).

3. CCTV Camera Surveillance System. The surveillance system must, at a minimum, meet the following:

A. Provide streaming video that can be used by trained personnel and other system devices to monitor work zone traffic flow;

B. Be equipped with a dome-style Pan/Tilt/Zoom (PTZ) CCTV camera that is mounted at an operational height of at least 32 feet above ground level;

C. Provide a 360 degree view in all directions, except as prevented by geography, vegetation, and structures other than the surveillance system;

D. Provide an optical camera zoom level of at least 12x;

E. Provide software to allow trained personnel to use the PTZ functions to adjust the camera in real-time, either on-site or from a remote location;

F. Provide real-time video images to the Graphical User Interface (GUI) described below in subsection b.4 of this special provision;

G. Maintain an adequate connection to facilitate desired video frame rates of 5 frames per second;

H. Include a solar array that provides sufficient power to the system and can be adjusted 360 degrees;

I. Include a battery system, including but not limited to batteries and a charger, which is capable of providing power for at least 15 days without recharging;

J. Be mounted to a portable trailer that is equipped with:

(1) Extendable outriggers to provide stability when deployed;

(2) A trailer hitch;

(3) Stop/turn/marker lighting as necessary for system transport; and

(4) Reflective markings meeting the standard specifications and the *Michigan Manual of Uniform Traffic Control Devices (MMUTCD)*.

K. Properly secure and ventilate all system components, and provide appropriate protection against weather, corrosion, vandalism, and/or theft;

L. Be of sufficient strength and design to adequately support all components of the unit, both during system operation as well as during transport;

M. Be capable of continuous operation over an ambient temperature range from -4 degrees F to +140 degrees F, and a relative humidity range from 5 percent to 95 percent (non-condensing);

N. Be capable and tested with supporting documentation to withstand 90 mph wind gusts for 3 seconds; and

O. Vender must ensure through video servers that an unlimited amount of users can view the video without reduction to the video quality and/or video frame rate.

4. RTWZTMS. The RTWZTMS must meet, at a minimum, the following:

A. Use vehicle speed and volume over a user-specified period to detect queuing of traffic;

B. Be capable of communicating with all devices in the system, including PCMS, detectors, and CCTV cameras;

C. Be capable of automatically setting the PCMS message sequences to reflect the current traffic flow status to the nearest minute, updated every 60 seconds or updated to a customized frequency as determined by the Engineer;

D. Account for short-term variations in traffic flows and prevent frequent, abrupt, and unnecessary changes in PCMS messages and web site updates;

E. Be capable of detecting conflicts that may exist between PCMS messages, as defined by the user;

F. Display and/or send an alert via e-mail or text when traffic is slowed or stopped;

G. Display and/or send an alert via e-mail or text whenever conflicting messages are being provided to motorists;

H. Be capable of allowing trained personnel to change any PCMS message, either on-site or remotely, using an application that is password protected and accessible from an Internet browser;

I. Be capable of controlling and activating messages on a combination of PCMS from different NTCIP-compliant manufacturers;

J. Have default queue level thresholds based on vehicle speeds that are:

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- (1) Normal: 45 miles per hour or greater
- (2) Slowing: 16 to 44 miles per hour
- (3) Stopped: less than 15 miles per hour

K. Allow thresholds to be based on any combination of vehicle speed, volume, and/or density, based on conditions in the slowest or most congested lane.

L. Allow thresholds to be changed by an authorized user.

M. Be able to alert Contactor, Department personal, including the Traffic Management Center/Transportation Operations Center (TMC/TOC) staff via e-mail or text alert whenever a queue level changes from Normal to Slowing or Stopped.

N. Provide a GUI that is accessible via an Internet web browser and meets the following requirements:

- (1) All system functions and capabilities are accessible from the GUI;
- (2) Secure logins are provided for all users;
- (3) System administrators can add, delete, and change user login accounts and user functions;
- (4) Automatic updates once per minute without page reloads; and
- (5) Online help is provided for all functions.

O. Provide current system health information for corrective and preventative maintenance, including:

- (1) The Global Positioning System (GPS) location of all system devices;
- (2) Solar and battery voltage monitoring;
- (3) User selectable alarms for battery voltage thresholds and/or communication problems;
- (4) Watch Dog Timer to prevent system lockups; and
- (5) Automatic power cycling of local system components to correct system problems.

5. Central Computer. The central computer must provide a GUI that is compliant with Windows standards. Communication between the central computer and any device must be independent and not reliant upon communications with any other PCMS or sensor. Alerts to the Contractor or Department personal including the TMC/TOC staff and must be provided via cell phone and/or email. Alerts must be sent in the event of device failure or traffic delays over 15 minutes or another time frame as specified by the Engineer. The Contractor

is required to allow the Engineer or their designee access to the equipment at any time as necessary throughout the project.

c. System Performance. Traffic volume data must be accurate within 5 percent of actual for any direction of travel in nominal conditions. Individual lane accuracy must be within 10 percent of actual during nominal conditions. Nominal conditions exist when traffic is flowing at speeds greater than 10 miles per hour, with less than 10 percent truck traffic per lane and at least 30 percent of each vehicle visible above roadway barriers for true sensor detection.

Average traffic speed must be a measured quantity using phase information or another true measurement, and cannot be derived from a presence measurement as this has been shown to produce biases during congestion. Average traffic speed data must be accurate within 5 mph for any direction of traffic and for all conditions involving more than 16 cars per lane in an interval. Speed accuracy for individual lanes must be accurate within 10 mph for all traffic conditions and similar intervals. Speed accuracy must be verified with radar gun, or by video speed trap using the frame rate as a time reference.

1. Data Processing Software. The software must, at a minimum, have the following capabilities:

A. Provide proof to the Engineer that communication with all sensors and message boards can take place simultaneously to ensure real time data and messages to the motoring public;

B. Compare traffic data collected from sensors to user-defined thresholds and automatically update one or more PCMS;

C. Estimate travel times and automatically update one or more PCMS consistent with user-defined thresholds; and

D. Provide the capability to display alternate route messages consistent with user-defined thresholds.

2. Data Management. All collected traffic, system health, and maintenance data are to be recorded and provided to the Engineer at the completion of the project. This includes, but is not limited to:

A. Vehicle volumes;

B. Vehicle speeds;

C. Occupancies;

D. PCMS message history;

E. System health history;

F. Solar and battery voltage history;

G. Preventive and responsive maintenance activities; and

H. Complete system operations history, including GPS device locations.

Data must be archived and maintained in a Tier One Data Center and must be transferable to an Oracle database. Traffic data must be provided in 15 minute bins unless otherwise specified by the Engineer.

3. Deduction for Failed System. A percentage of all the associated pay items will be deducted should the system malfunction after the approval of the operational test. This deduction will be based on a ratio of calendar days of unsuccessful operation to total calendar days of operation following the approval of the operational test. If the system malfunctions for durations longer than a one hour period, or an accumulation of malfunctions of which the sum is greater than 1 hour in a calendar day; a deduction for a full calendar day will be assessed.

d. **System Manager.** Employ a system manager for the RTWZTMS. The system manager must be locally available to maintain system components, move portable devices as necessary, and respond to emergency situations. The system manager is responsible for coordinating the placement of devices in the project areas. It is the responsibility of the system manager to move system components that interfere with construction operations and relocate the components to another area. The system manager must supply a local phone number and/or a toll free number to the Engineer to contact the system manager or other system representative at any time. The system manager must not perform any other duties on the jobsite without prior approval from the Engineer.

e. **Operational Test.** Once the RTWZTMS is installed, it must undergo a 5 day operational test. The operational test is to include a test of the system in operation during a lane closure to ensure that all RTWZTMS equipment (including the PCMS, traffic sensors, central computer, and communication devices) is operating in a fully functional manner and in accordance with the RTWZTMS plan for duration of at least 5 calendar days. Provide complete operations support from the vendor during the operational test, and the Contractor must provide verification that the reported drive time through the work zone accurately reflects actual field conditions. If any equipment malfunctions occur for a combined period of 4 hours or more during this operational test on any day, no credit will be given for that day for the operational test period, and the 5 day operational test will reset.

Maintain records of equipment stoppages and resumptions during the 5 day operational test for submission to the Engineer. In the event that 10 percent or more of the time similar malfunctions occur that affect the proper operation of the RTWZTMS, the Engineer may declare a system component defective and require replacement of the equipment at no additional cost. When a system component defect is declared, the 5 day operational test will begin again after all defective equipment is replaced and the system is fully operational.

1. Report. Submit a report to the Engineer detailing the daily activity of the system during the operational test. The report must indicate the date and time of any activity necessary to maintain operation of the RTWZTMS during the operational test period. Each entry is to include the following information:

- A. Identity of the equipment on which work was performed;
- B. Cause of equipment malfunction (if known);

- C. A description of the type of work performed; and
- D. Time required repairing equipment malfunctions.

Once the operational test report is received and approved by the Engineer, the RTWZTMS will be considered operational and the system will be accepted for use.

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

Pay Item	Pay Unit
Stopped Traf Advisory System.....	Lump Sum
Central Computer	Lump Sum
Closed Circuit Television Camera	Each
Portable Non-Intrusive Traffic Sensors	Each

1. **Stopped Traf Advisory System** includes payment for submittal and approval of a RTWZTMS plan, testing, monitoring, providing a website, providing historical data, and removal of the RTWZTMS. As part of the RTWZTMS plan, the Contractor is responsible for all system communication costs, including, but not limited to, cellular telephone and satellite subscription charges.

Stopped Traf Advisory System is measured by one lump sum and paid using the following payment schedule:

A. 60 percent will be paid when the Engineer approves the Operational Test Report.

B. 40 percent will be paid after traffic is in its final position, the Contractor's equipment has been removed from the project, and historical data has been provided to the Engineer, minus deductions for system failures.

2. **Central Computer** includes payment for housing all equipment and materials at a non-MDOT facility and the cost of alert messaging by either text message or e-mail notifications as specified by the Engineer.

3. **Closed Circuit Television Camera** includes payment for all material, communication devices, equipment and labor required to install, adjust and remove each CCTV camera surveillance system as depicted on the plans or as directed by the Engineer.

4. **Portable Non-Intrusive Traffic Sensors** includes payment for all material, communication devices, equipment and labor required to install, adjust, and remove each traffic sensor as depicted on the plans or as directed by the Engineer.