

**OKLAHOMA TURNPIKE AUTHORITY
SPECIAL PROVISIONS
FOR
SECTION 883
PORTABLE AUTOMATED REAL-TIME WORK ZONE
INFORMATION SYSTEM**

T-MC-107-TR

These Special Provisions revise, amend, and where in conflict, supersede applicable Sections of the *Standard Specifications for Turnpike Construction*, Edition of 2010.

(Add the following:)

883.01. DESCRIPTION.

The Portable Automated Real-Time Work Zone Information System (Smart Work Zone System) shall provide advance traffic information to motorists when traffic speeds are reduced as a result of congestion caused by lane closures or other field conditions. These situations have the potential to produce abnormally large traffic backups that create opportunities for crashes, in particular rear-end crashes, inside and outside of the work zone.

The Smart Work Zone System shall consist of furnishing, installing, relocating, operating, and maintaining a portable, automated, solar powered, real-time work zone system capable of calculating vehicular speeds at downstream sections of a freeway and displaying the speed information on changeable message signs at upstream locations or decision points. The Smart Work Zone System shall acquire traffic flow data and use an accurate speed calculation technique that includes the capability of detecting stopped traffic, counting traffic volume, and lane occupancy. The Contractor shall furnish the system and shall assume all responsibility for any damaged equipment which occurs during the system's deployment due to, but not limited to, crashes, vandalism, or adverse weather.

883.02. MATERIALS.

All materials shall conform to the manufacturer's specifications and recommendations.

The Contractor shall provide brochures on all units of the Smart Work Zone System, with details of how the communication system shall be used, and implementation within the website.

883.03. EQUIPMENT.

(A) **General.** The Contractor is responsible for providing Smart Work Zone System equipment compliant with the National Transportation Communications for ITS Protocol (NTCIP) and approved for use on the ODOT Traffic Engineering Division Qualified Products List (QPL). The QPL webpage can be located at <http://www.okladot.state.ok.us/traffic/qpl/index.php>.

The Contractor shall submit brochures detailing each component of the proposed system. The Contractor shall also submit details on the proposed implementation of the website, laptops, and CCTV systems.

The Smart Work Zone System shall be capable of displaying current traffic condition information, calculating real-time speed, and providing the operational status of all system components. The information shall be displayed on Portable Changeable Message Signs (PCMS) at upstream locations. The real-time delay information displayed on the PCMSs shall automatically update a minimum of every 60 seconds. The website delay information shall be updated simultaneously with the PCMSs.

The Smart Work Zone System shall be capable of acquiring traffic flow data and selecting motorist information messages automatically without operator intervention.

Each device shall be capable of directly communicating through radios/modems with other device(s) at upstream or downstream locations and the base computer.

The Smart Work Zone System shall autonomously restart in case of power failure in any part of the system.

(B) Portable Changeable Message Signs (PCMS). Each PCMS shall be capable of displaying eight characters on each of three rows. The PCMS shall be equipped with a solar-powered trailer and be properly sized to allow continuous operation for up to ten (10) days during periods of darkness and inclement weather. Each PCMS shall be integrated with a sensor, radio/modem, and other equipment (e.g. controller) mounted on it and shall act as a single "device" for the purpose of communicating with similarly integrated "devices" and displaying real-time traffic condition information. Each PCMS shall be linked back to the central computer server.

(C) Portable Traffic Sensors (PTS). Each PTS shall be side-fired microwave radar type whose accuracy is not degraded by inclement weather and/or visibility conditions including precipitation, fog, darkness, excessive dust, and road debris. Each sensor shall be equipped with a solar-powered trailer and be capable of acquiring traffic data from up to eight (8) lanes of traffic on a lane-by-lane basis. Each PTS shall be integrated with a sensor, radio/modem, and other equipment (e.g. controller) mounted on it and shall act as a single "device" for the purpose of communicating with similarly integrated "devices". Each PTS shall be linked back to the central computer server.

(D) Communication System. The wireless communication system used must be capable of functioning at all times regardless of weather, locations, and cell phone usage. The Contractor shall be responsible for all communication cost, utilities, and satellite or cellular phone services needed to provide the Smart Work Zone System.

The Smart Work Zone System's communications system shall automatically configure during the system initialization; communication between the server and any individual PCMS and PTS are independent through the full range of deployed locations and do not rely upon communications with any other PCMS or PTS; and incorporate an error detection/correction mechanism to ensure the integrity of all traffic condition data and motorist information messages.

(E) Laptops. Laptop computers shall be equipped with the appropriate Smart Work Zone System software, a wireless Aircard PC Modem (for field use by the On-Site Representative) and/or a dedicated high speed communications connection (DSL/Cable/Satellite or approved alternative for stationary, office use) with at least 0.5 Mbps internet connection speed.

Laptops shall include all associated hardware including printer and fax machine.

Training will be provided to OTA Staff on the use and operation of both the physical field hardware and the electronic version (website) of the Smart Work Zone System.

- (F) **Website.** The Smart Work Zone System website shall have the capability of providing a password protected “link” for OTA approved personnel to gain remote access to monitor the corridor and the operational status (i.e. current traffic data and messages, communications systems, signs, and sensors) of the system. Personnel shall be able to manually override errant messages on the Portable Changeable Message Signs (PCMS) due to communication interruptions or other system failures; retrieve the motorist information messages, volumes and speed data the system is collecting; and include the historical information from each PCMS and Portable Traffic Sensor (PTS) that can be viewed or exported into both spreadsheet and access database (*.xls and *.mdb) format.

The Smart Work Zone System website shall be configured to assess any type of malfunction that has occurred, including communication disruptions between any device in the system configuration, changeable message board malfunctions, speed sensor malfunctions, loss of power, low battery, etc.

The Smart Work Zone System website shall provide full color maps via the internet and the dedicated website using Google™ maps, or an approved equal, depicting the project area with locations of all PTS and PCMS. The map shall reflect the current average speed at each PTS, and display the entire information message being shown by each PCMS either on the map or on the side bar of the website using a defined three color coding scheme (green/yellow/red). A legend and short description of each icon shall be displayed on the website. The map shall automatically refresh every 30 seconds to display any changes.

- (G) **Warranty.** The Contractor shall warranty all items in the Smart Work Zone System until the completion of the contract.

- (H) **Minimum Equipment.** The Smart Work Zone System shall consist of the following equipment:

1. 8 Portable Changeable Message Signs (PCMS)
2. 20 Remote PCMS
3. 21 Portable Traffic Sensors (PTS)
4. 2 Laptops
5. 1 Website system integrated with the Smart Work Zone System

883.04. CONSTRUCTION METHODS.

- (A) **General.** The Smart Work Zone System will be deployed, relocated, or removed upon approval by the Engineer. Once the decision has been made to deploy the system, the Contractor will coordinate with OTA for the remaining duration of the contract, including any traffic switches for construction sequencing.

At least twenty (20) days prior to installation, evidence detailing the Contractor’s successful completion of at least two (2) Smart Work Zone System projects similar in concept and scope to the proposed system shall be submitted to the Engineer for review and approval. Include reference names, addresses, and telephone numbers of the owner’s representatives for verification.

The Contractor shall demonstrate the Smart Work Zone System at the time, or within two weeks, of the Pre-Work Conference. Upon approval by the Engineer, the Contractor shall demonstrate the Smart Work Zone System prior to turning the message signs to the viewing public. Training will be provided to OTA Staff on the use and operation of both the field hardware and the website for the Smart Work Zone System.

The Smart Work Zone System software shall be configured so that approved OTA personnel are notified each time a malfunction occurs in the system and a record is made in the database. The notification message and website shall also display the revised status of the malfunctioned device.

The addition/deletion of signs shall not require any development of new software. The Contractor shall supply training and documentation to enable the system operators to add/delete signs without the assistance of the Contractor, if needed.

The Smart Work Zone System shall be maintained and operated for the duration of the project. The system shall operate continuously (24 hours, 7 days a week) in the automated mode when deployed on the project. The system shall be in the "data collection" mode continuously. All Smart Work Zone System data will be connected to OTA's designated server every 30 seconds. OTA will provide the XML format and IP address at the Pre-Work Conference.

The Contractor shall provide an "On-Site" Specialist who is skilled in the operation of the Smart Work Zone System equipment and software who is locally available 24 hours a day, 7 days a week, to maintain the system components, and to move portable devices as necessary. The Specialist shall be able to respond to emergency situations within two (2) hours of being notified, and be equipped with sufficient resources to correct deficiencies in the system. Non-emergency condition response time will be within the next business day.

OTA reserves the right to terminate this portion of the work at any time if it determines the Smart Work Zone System is not performing according to this Specification.

(B) Location. The Smart Work Zone System shall be installed on all approaches to the work zone on the turnpike corridor. The exact locations of all devices shall be coordinated with and approved by the Engineer.

Refer to Table 883:1 for the approximate device locations:

Table 883:1			
Proposed Smart Work Zone System Device Locations			
Location	PTS	Smart PCMS (Rt & Lt)	Remote PCMS (Rt & Lt)
WB Milepost 202	1	-	-
WB Milepost 204	1	-	-
WB Milepost 206	1	-	-
WB Milepost 208	1	-	-
WB Milepost 210	1	-	-
WB Milepost 212	1	-	-

SMART WORK ZONE SYSTEM

WB Milepost 214	1	-	-
WB Milepost 216	1	1	-
SH-33 at WB/EB Kellyville on ramp	-	-	2*
Before WB Kellyville off ramp	-	-	2*
Before WB Sapulpa off ramp	-	-	2*
Before EB Bristow off ramp	-	-	2*
SH-66 at EB Bristow on ramp	-	-	2*
Before EB Kellyville off ramp	-	-	2*
Before EB Sapulpa off ramp	-	-	2*
SH-97 at EB/WB Sapulpa on ramp	-	-	2
EB Milepost 200	1	1	-
EB Milepost 202	1	-	-
EB Milepost 204	1	-	-
EB Milepost 206	1	-	-
EB Milepost 208	1	-	-
EB Milepost 210	1	-	-
EB Milepost 212	1	-	-
EB Milepost 214	1	-	-
EB Milepost 216	1	-	-
John Kilpatrick TPK/I-35 Interchange	-	-	4**
Locations to be determined by the Engineer	4	6	-
TOTAL	21	8	20

* To be paid for as 882(B) (SP) REMOTE CONTROLLED CHANGEABLE MESSAGE SIGN by SIGN DAY (SD)

** To be paid for as 882(B) (SP) REMOTE CONTROLLED CHANGEABLE MESSAGE SIGN by EACH (EA)

(C) **Messages.** OTR approved personnel shall be allowed to create and save a library of messages with up to 160 different default or automatic advisory messages for each PCMS. The Smart Work Zone System shall be programmed to allow a manual override of motorist information messages for a user-specified duration, after which automatic operations will resume display of messages reflecting the prevailing traffic conditions. The overriding message shall log the message content and the username into the database.

The default and advisory message content shall be capable of being scheduled, as well as programmed, from the laptops. The website shall support the scheduling and programming of default and advisory messages.

The sequences below are the minimum requirement for a message set and can be adjusted by the Engineer. Message Sets are detailed in the Smart Work Zone Message Logic at the end of this specification.

If the current speed on the turnpike section is at or above the posted speed limit, the upstream PCMS will display the message:

“CAUTION WORKZONE AHEAD; REDUCE SPEED AHEAD”

If the current speed on any downstream section of the turnpike is below the posted speed limit (for example, 60 mph), the following two cycle messages will be displayed on the upstream PCMSs in increments of 5 mph as shown below.

“SPEED AHEAD 55 MPH; XX Min TO END OF WZ”

“SPEED AHEAD 50 MPH; XX Min TO END OF WZ”

“SPEED AHEAD 45 MPH; XX Min TO END OF WZ”

“SPEED AHEAD 40 MPH; XX Min TO END OF WZ”

“SPEED AHEAD 35 MPH; XX Min TO END OF WZ”

“SPEED AHEAD 30 MPH; XX Min TO END OF WZ”

“SPEED AHEAD 25 MPH; XX Min TO END OF WZ”

If the current speed on a section of the turnpike drops below 25 mph, the following two cycle messages will be displayed on the PCMSs.

“PREPARE TO STOP; XX Min TO END OF WZ”

If the current speed on a section of the turnpike drops below 5 mph, the following two cycle messages will be displayed on the PCMS's.

“PREPARE TO STOP; STOPPED TRAFFIC AHEAD”

- (1) **Programming.** Program the Smart Work Zone System to ensure that all traffic data is acquired, and all motorist's information messages displayed are archived in the database with time and date stamps; Default and advisory messages are automatically selected based on traffic conditions at a single traffic sensor point, or at multiple traffic sensor points in combination; and the system autonomously restarts in case of power failure in any part of the system.

883.05. METHOD OF MEASUREMENT.

System downtime will not be measured for payment. System down time includes, but is not limited to, the inability of the system to provide accurate real-time traffic condition information, the inability to withstand the traffic environment, and the inability to withstand weather conditions.

Each component of the system which is down for more than 15 hours in a day shall be considered to be non-working, and the Contractor shall not be paid for said unit. If the non-working unit is not repaired or replaced within 24 hours of the initial notification, then payment to the Contractor shall be reduced by the unit cost of the respective unit plus 10% of the total daily price bid for the Smart Work Zone System for each day the unit remains inoperable.

If requested by the Engineer, Smart Work Zone System – System Setup will be measured as the relocation of two or more sensors or PCMS during the construction phase, requiring a modification in the algorithm configuration is required.

883.06. BASIS OF PAYMENT.

The accepted quantities, measured as provided above, shall be paid for at the contract unit price as

SMART WORK ZONE SYSTEM

follows:

Pay Item:	Pay Unit:
(A) SMART WORK ZONE SYSTEM	SD
(B) SMART WORK ZONE – PORTABLE CHANGEABLE MESSAGE SIGN.....	SD
(C) SMART WORK ZONE – PORTABLE TRAFFIC SENSOR.....	SD
(D) SMART WORK ZONE SYSTEM – PAN-TILT-ZOOM CAMERA	SD
(E) SMART WORK ZONE SYSTEM – WEBSITE SYSTEM	SD
(F) SMART WORK ZONE SYSTEM - SYSTEM SETUP.....	Each

The costs associated with mobilizing, relocating and removing the system shall be included in the cost of each unit.

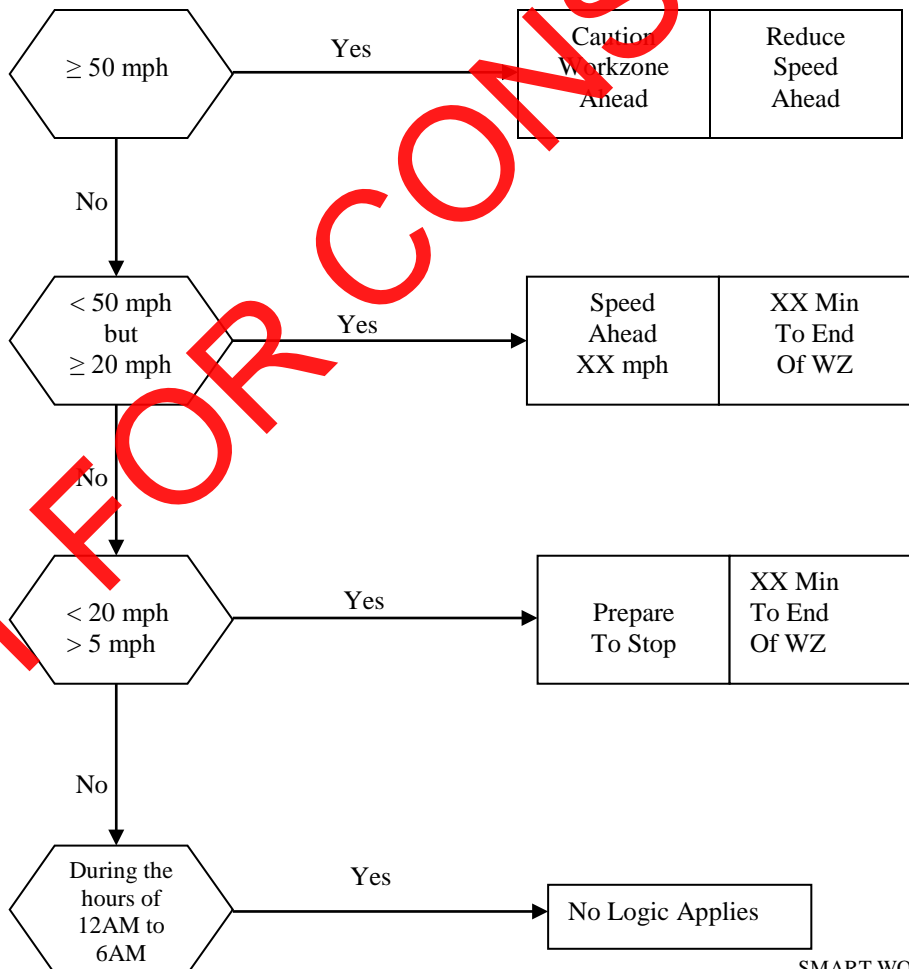
Such payment shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

The initial deployment and system setup, including calibration and algorithm configurations shall be considered in the cost of unit price of the item.

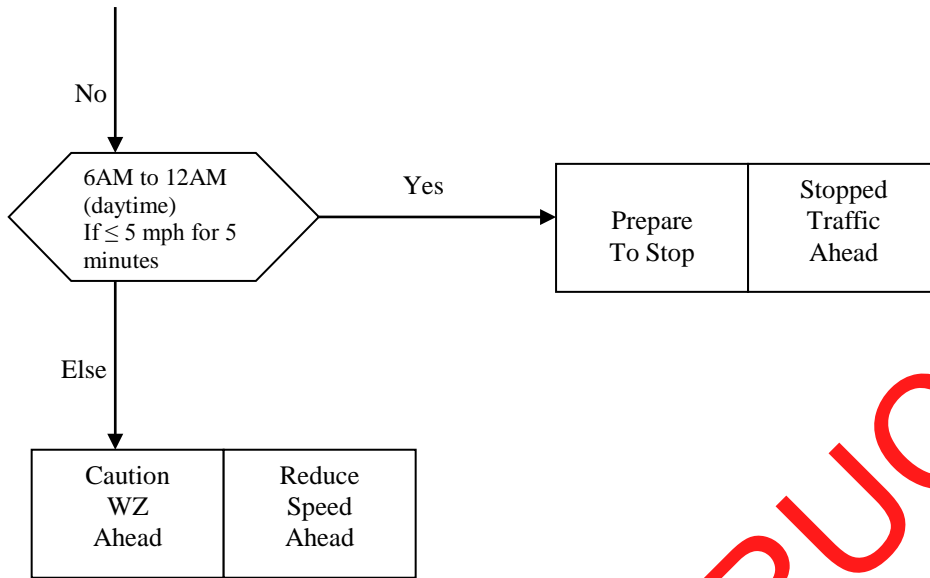
Payment for Smart Work Zone System – System Setup” includes the calibration and relocation of any devices, and algorithm configurations modifications.

Smart Work Zone System Message Logic

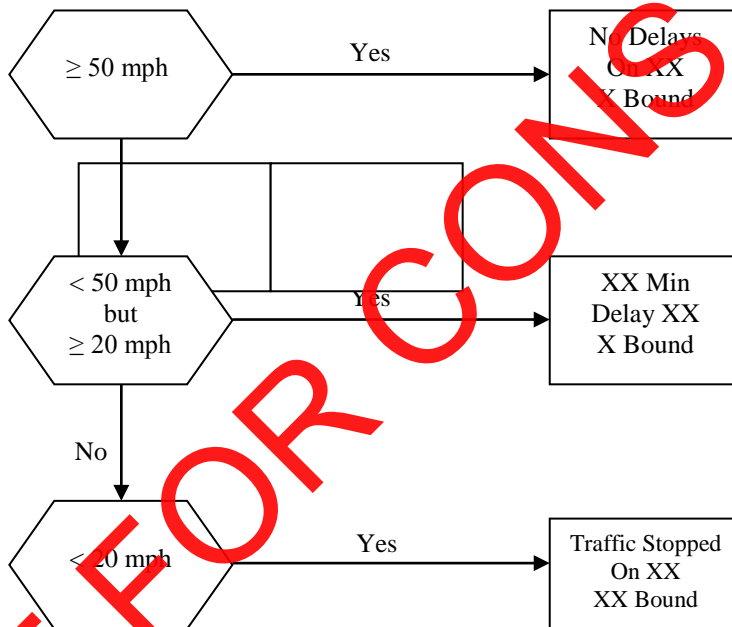
Primary Construction Route Sign Messages:



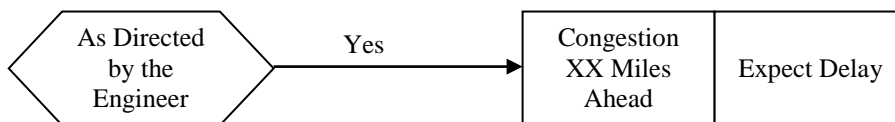
SMART WORK ZONE SYSTEM



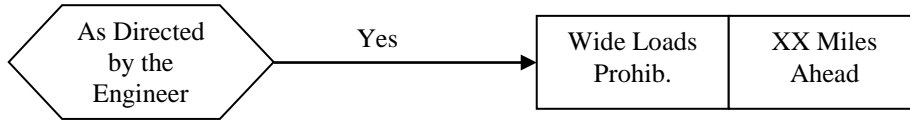
Secondary Construction Route Sign Messages:



Advanced Detour Route Sign Messages:



Oversize Loads Route Sign Messages:



NOT FOR CONSTRUCTION