OKLAHOMA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISIONS
FOR
SMART WORK ZONE SYSTEM
OKCY-XTWN(015)TI , JP NO. 17428(34), OKLAHOMA COUNTY

(PORTABLE AUTOMATED REAL-TIME WORK ZONE INFORMATION SYSTEM)

These Special Provisions amend and where in conflict, supersede applicable sections of the 1999 Standard Specifications for Highway Construction, English and Metric. Units of measurement are provided in the subsections in both English and Metric equivalents. The units for this project will be those specified in the project plans.

Due to the number of Smart Work Zones being deployed in the State of Oklahoma, ODOT is working on developing a Master Smart Work Zone Server where all Smart Work Zone information will be housed and accessible by ODOT personnel, regardless of vendor. Although this server is not fully online at the time of this Special Provision is being used, ODOT is informing all, bidders of any Smart Work Zones that will become operational during the time limits of this construction project. By bidding on this project, Smart Work Zone Contractors and vendors accept and acknowledge their willingness to be integrated into this Master Smart Work Zone Server in the future at no additional cost to ODOT. Smart Work Zone Contractors and vendors shall work with ODOT in transmitting all Smart Work Zone data and information as required by this provision to the Master Smart Work Zone Server once operational. Not complying with transmitting of all Smart Work Zone data and information as per ODOT shall be considered non-compliance to meeting the website portion of this specification and punitive damages shall be enforced.

(add the following:)

882.01 DESCRIPTION

The goal of this system is to provide advance traffic information to motorists when there is a slowing of traffic due to congestion resulting from lane closures or other conditions. These situations have the potential to produce abnormally large traffic backups that create opportunities for crashes and, in particular, rear-end crashes inside and outside 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 displays the speed information on changeable message signs at upstream locations. 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.

882.02 MATERIALS

All materials implemented into the Smart Work Zone System 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 and which communication system shall be used, and implementation of the website.

882.03 EQUIPMENT

General. The Contractor is responsible for finding a company capable of providing Smart Work Zone equipment approved by ODOT. Reference the ODOT Traffic Engineering Qualified Products List (QPL) webpage at http://www.okladot.state.ok.us/traffic/qpl/index.php for contact information for Smart Work Zone Systems.

Equipment. The Smart Work Zone System shall consist of the minimum items listed in **Attachment "B"**.

Laptops. Laptop computers shall be for Department use. They shall be equipped with appropriate software, a wireless Aircard PC Modem, and a dedicated high speed communications connection (DSL/Cable/Satellite or approved alternative) with at least 0.5 Mbps internet connection speed at the construction trailer or residency. Laptops shall include all associated hardware including printer and fax machine. Training will be provided to ODOT staff on the use and operation of both the physical field hardware and the electronic version (website) of the Smart Work Zone. **See Attachment "B".**

Pagers. If necessary, 2 pagers shall be provided for Department use, and shall have text messaging capability. ODOT reserves the right to use their own pagers or cell phones for receiving text messages.

Website. The website shall have the capability of providing a password protected "link" for approved personnel to have access to the operational characteristics of the system. Personnel shall be able to manually override errant messages on the PCMS's due to communication interruptions or other system failures. **See Attachment "B".**

The website shall have the capability of providing a password protected "link" for approved personnel to have access to retrieve the motorist information messages, volume and speed data the system is collecting. This interface shall include the historical information from each PCMS and PTS that can be viewed on the website or exported into both spreadsheet and access database (xls and mdb) form.

The website shall be configured to assess any type of malfunction that has occurred. This assessment includes communication disruption between any device in the system configuration, changeable message board malfunctioning, speed sensor malfunction, loss of power, low battery, etc.

The Smart Work Zone website shall provide full color maps via the internet and the dedicated website using Google™ maps, or ODOT approved equal, depicting the project area with locations of traffic sensors and PCMSs. The map shall reflect the current average speed at each traffic sensor, and display the entire information message being shown by each PCMS either on the map or on the side bar of the website using an administer 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 .5 minute (30 sec) to display any changes to sensor or PCMS's.

A. **Portable Changeable Message Signs.** Each portable changeable message sign (PCMS) shall be capable of displaying eight characters on each of three rows. The changeable message signs and the solar powered trailers shall be properly sized to allow continuous operation for up to 10 days during periods of darkness and inclement weather. Each changeable message sign or solar-powered trailer 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.

B. **System Requirements.** The Smart Work Zone System shall be capable of displaying current traffic condition information on changeable message signs and calculating real-time speed and displaying information on portable changeable message signs at upstream locations to the nearest .5 minute (30 sec). The real-time delay information displayed on the PCMS's shall be updated every .5 minute (30 sec) minimum and the website delay information is updated simultaneously with the delay information displayed on the PCMS's. The system shall be capable of acquiring traffic flow data and selecting motorist information messages automatically without operator intervention.

The Smart Work Zone System shall be capable of providing current operational status (i.e. current traffic data and messages, communications system, signs and sensors) via the internet to a dedicated website established for the purpose of monitoring the corridor and the Smart Work Zone System equipment.

The Smart Work Zone system equipment and software shall be NTCIP (National Transportation Communications for ITS Protocol) compliant, and shall utilize Oklahoma approved portable changeable message signs. Each device shall be capable of directly communicating through radios/modems with other device(s) at upstream or downstream locations and base computer.

The Smart Work Zone traffic sensors shall be side-fired microwave radar type whose accuracy is not degraded by inclement weather and visibility conditions including precipitation, fog, darkness, excessive

dust and road debris. These sensors shall be capable of acquiring traffic data from up to 8 lanes of traffic on a lane-by-lane basis.

The wireless communication system used for this project 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 system shall autonomously restart in case of power failure in any part of the system.

C. System Communications. Ensure that the Smart Work Zone communications meet the following requirements:

Any required configuration of the Smart Work Zone System's communications system is performed automatically during system initialization.

Communications between the server and any individual PCMS and sensor are independent through the full range of deployed locations, and do not rely upon communications with any other PCMS or sensor.

The Smart Work Zone System's communication system incorporates an error detection/correction mechanism to insure the integrity of all traffic condition data and motorists information messages.

D. Warranty. The Contractor shall warranty all items in the Smart Work Zone System until the completion of the project.

882.04 CONSTRUCTION METHODS

A. General. The decision to deploy, relocate or remove the Smart Work Zone System will be made with the approval of the Engineer. Once the decision is made to deploy the system the Department will coordinate with the Contractor on the remaining duration of the system. The Department anticipates deployment of the system in conjunction with traffic switches for each phase.

At least 20 days prior to beginning installation, submit to the Engineer for review and approval evidence that the Contractor has successfully completed at least two Smart Work Zone System projects similar in concept and scope to the proposed system. Include names, addresses, and telephone numbers of the owner's representatives for verification. 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. Upon approval from the Engineer, the Contractor shall demonstrate the Smart Work Zone System prior to turning the message signs to the viewing public.

The Contractor shall demonstrate the Smart Work Zone System at the time of, or within two weeks of the project's pre-work conference. Training will be provided to ODOT 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 designated Department personnel are notified by text message each time a malfunction occurs in the system and a record is made in the database. Configure the software so that any number of approved Department personnel will be notified in this manner. The text message shall also display what the revised status of the device or devices is. The website shall also display an error message for the device or devices affected.

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

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 "XML"ed to ODOT's designated server every .5 minute (30 sec). ODOT will provide the XML format and IP address at the pre-work for the project to be used.

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, in none emergency conditions response time will be within the next business day.

The Department 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 freeway. The exact locations of all devices shall be coordinated with and approved by Engineer. For proposed locations see **Attachment "B".**

C. Messages. Administrative users 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 ODOT project personnel to manually override motorist information messages for a user-specified duration, after which automatic operation will resume display of messages appropriate to the prevailing traffic conditions. The overriding message shall have the message content and the username logged into the database. The default and advisory message content shall be capable of being scheduled, as well as programmable, from the laptops. The website shall support the scheduling and programming of default and advisory messages.

(1) Message Sets. The sequences below are a minimum requirement and can be adjusted by the Engineer at their discretion. (Message sets are detailed in **Attachment "A"** of this special provision.)

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

"CAUTION WORKZONE AHEAD; REDUCE SPEED AHEAD"

or another ODOT approved message.

If the current speed on any downstream section of the freeway is below the posted speed limit (for example, 60 mph), the following two cycle messages will be displayed on the upstream PCMS 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"

or another ODOT approved message.

If the current speed on a freeway section of the freeway drops below 25 mph, the following two cycle messages will be displayed on the PCMS's:

"PREPARE TO STOP; XX Min TO END OF WZ"

or another ODOT approved message.

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

"STOPPED TRAFFIC AHEAD; PREPARE TO STOP"

or another ODOT approved message.

D. **Programming.** Program the Smart Work Zone System to ensure that the following general operations are performed:
   (1) All traffic data acquired, and displayed motorists information messages are archived in the database with time and date stamps.
   (2) 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.
   (3) The system shall autonomously restart in case of power failure in any part of the system.

882.05 METHOD OF MEASUREMENT

This work will be measured for payment on a Sign Day basis for the Smart Work Zone System components listed in **Attachment "B"**. One Sign Day shall constitute furnishing, placing at a location designated by the Engineer, maintaining, and operating one acceptable Smart Work Zone System component for one day. Mobilization, relocation, or removal of the system, or any of its components, from the project will be considered incidental to the contract unit price for daily rental of each component and will not be measured for payment.

System down time 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. If the system, excluding the website, is not restored within 24 hours of initial notification, no payment will be made from the time of initial notification until the system is fully restored.

Each component of the system identified in subsection 882.03 which is down for more than 15 hours in a day, shall be considered 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 component(s), plus 10% of the total daily price bid for the Smart Work Zone System for each day the unit is inoperable. If the website is down for more than 24 hours the payment to the Contractor shall be reduced by 10% of the of the total daily price bid for the Smart Work Zone System for each day the website is down.

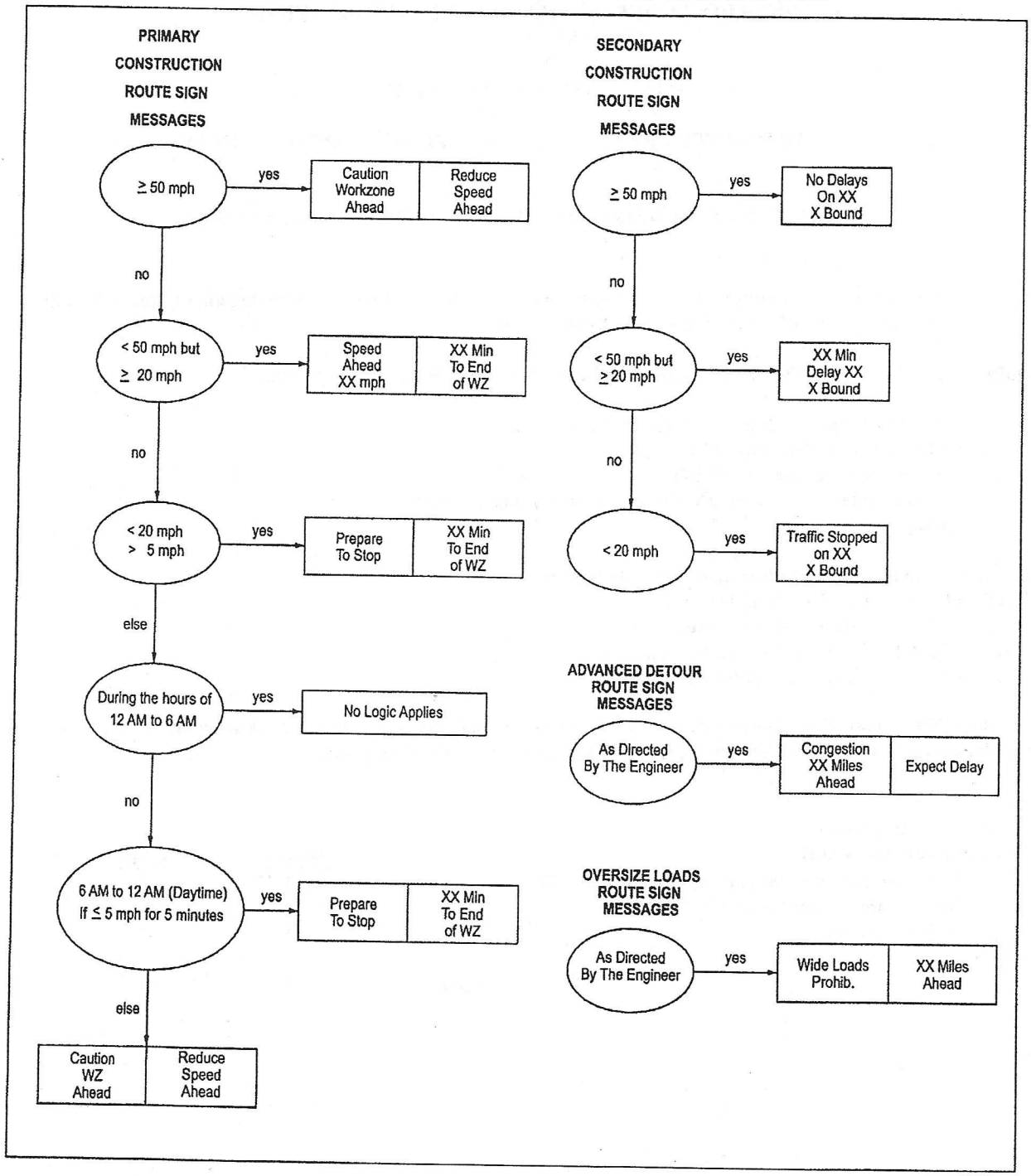
882.06 BASIS OF PAYMENT

The Smart Work Zone System will be paid for at the contract unit price in Sign Days (S.D.) for each component of the system installed as required. The cost of mobilizing, relocating, and removing the system shall be included in the cost of each unit. The price and payment stipulated herein shall be full compensation for all work, materials, labor, and incidentals related to furnishing, installing, relocating, operating, maintaining, and removing the system at the discretion of the Department.

SMART WORK ZONE SYSTEM - ..... SIGN DAY
SMART WORK ZONE SYSTEM - PORTABLE CHANGEABLE MESSAGE ..... SIGN DAY
SMART WORK ZONE SYSTEM - PORTABLE TRAFFIC SENSOR ..... SIGN DAY
SMART WORK ZONE SYSTEM - PAN-TILT-ZOOM CAMERA ..... SIGN DAY
SMART WORK ZONE SYSTEM - WEBSITE SYSTEM ..... SIGN DAY

ATTACHMENT "A"

SMART WORKZONE "MESSAGE LOGIC"



882-2(g)99
6-22-10

Attachment "B"

OKLAHOMA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISIONS
FOR
SMART WORK ZONE SYSTEM

(PORTABLE AUTOMATED REAL-TIME WORK ZONE INFORMATION SYSTEM)

Project # OKCY-XTWN(015)HP, JP NO. 17428(34), Oklahoma County

The Smart work zone for this project shall be comprised of the following items working together to provide motorist information on the slowing of traffic due to the construction work zone.

Equipment. The Smart Work Zone System shall consist of the following as a minimum:

35 Portable Changeable Message Signs (PCMS)
22 Portable Traffic Sensors (PTS)
2 Pan-Tilt-Zoom Cameras (PTZC)
1 Website system integrated with the Smart Work Zone System
2 Laptops

Equipment should be independent mounted on trailer units.
Each PCMS, PTS and PTZC shall be:

- equipped with portable solar-powered trailers,
- equipped with portable radios/modems, and
- linked back to a central computer server.

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

Proposed Locations:

I-40 at Dallas Junction **West Leg (I-40 EB & WB)**	**Sensor**	**CMS**
• 500' before Pennsylvania Ave. off ramp on I-40	1	0
• 500' before Western Ave. off ramp on I-40	1	0
• at BOP on I-40	1	0
Total	**3**	**0**

South Leg (I-35 NB)	Sensor	CMS
• 500' before I-240 interchange on I-35	0	1 Rt.
• 500' before S.E. 59th St. off ramp on I--35	0	2 Lt. & Rt.
• 500' before S.E. 44th St. off ramp on I-35	1	2 Lt. & Rt.
• 500' before S.E. 29th St. off ramp on I-35	1	2 Lt. & Rt.
• 500' before S.E. 15th St. off ramp on I-35	1	2 Lt. & Rt.
• 500' before Oklahoma River bridge on I-35	1	1 Lt.
• at on ramp to I-40 WB on I-35	1	0
Total	**5**	**10**

East Leg (I-40 WB)	Sensor	CMS
• 500' before Air Depot Blvd. off ramp on I-40 (optional if needed)	0	1 Rt.
• 500' before Sooner Rd. off ramp on I-40 (may use DMS in lieu)	0	1 Rt.
• 500' before Sunnylane Rd. off ramp on I-40	1	1 Rt.
• 500' before I-40 WB ramp at Ft. Smith Junction	1	1 Rt.
• 500' before I-235 NB on ramp on I-40 (may use DMS in lieu)	1	2 Lt. & Rt.
• at BOP	1	0
Total	**4**	**6**

North Leg (I-35 SB)	Sensor	CMS
• 500' before I-44 interchange on I-35	0	2 Lt. & Rt.
• 500' before N.E. 50th St. off ramp on I-35	0	2 Lt. & Rt.
• 500' before N.E. 23rd St. off ramp on I-35	1	2 Lt. & Rt.
• 500' before N.E. 10th St. off ramp on I-35	1	1 Rt.
• 500' before I-40 WB on ramp at Ft. Smith Junction on I-35	1	2 Lt. & Rt.
Total	**3**	**9**

North Leg (I-235 SB)	Sensor	CMS
• 500' before I-44 interchange on I-235	0	1 Rt.
• 500' before N.E. 36th St.off ramp on I-235	0	2 Lt. & Rt.
• 500' before N.E. 23rd St.off ramp on I-235	1	2 Lt. & Rt.
• 500' before N.E. 10th St.off ramp on I-235	1	1 Rt.
• 500' before I-40 WB on ramp at Dallas Junction on I-235	1	1 Rt.
Total	**4**	**7**

	Sensor	CMS
(Additional Sensors and CMSs to be used as determined by the Engineer)	3	3
Grand Total	**22**	**35**