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## Missouri Department of Transportation

### Smart Work Zone System Specification

**1.0 General.** The Smart Work Zone System (SWZS) shall be a portable, real-time, automated, solar powered system that calculates and displays travel time through work zones. The goal of this system is to provide advance traffic condition information to motorists at key decision points due to construction activity. The information reported to the public will include an accurate drive time through the work zone. This system shall be in operation 24 hours per day, seven days per week, during the construction period.

(\*\*Insert the following paragraph as needed)

**1.1 Pre-Bid Conference.** The SWZS shall be a proven system verifiable by at least ten months of continuous deployment in one or more states. In order to bid on this contract, all Contractors/Subcontractors will be required to attend a mandatory Pre-Bid Conference at the Missouri Department of Transportation office, (address), on (date). This meeting, which is held to clarify the scope of the work for this project, will begin promptly at (time). All contractors will be required to bring proof of prior deployments as well as contact information from prior deployments (names and phone numbers) to this Pre-Bid Conference. The references will be contacted by the Department and a determination will be made as to whether the Contractor's system meets the requirements and conditions of this specification. The Department reserves the right to reject any bids received from Contractors who do not meet the qualifications and certifications as described here. The decision to reject a bid may be based on information about past performance. Under no circumstances will a bidder be allowed to bid without attending the Pre-Bid Conference.

**2.0 Description.** This item shall consist of submittal and approval of a Smart Work Zone plan, furnishing, installing, relocating, and operating a portable, automated, solar powered real-time work zone system ("Smart Work Zone System") meeting the requirements noted herein, and providing a system manager to maintain the system during the duration of the project. The contractor shall assume responsibility for any damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the system's deployment.

**2.1** The Contractor shall furnish and maintain this system for measuring and delivering real-time messages for the work zone.

**2.2** The contractor is responsible for coordinating any work in adjacent roadway construction projects.

**2.3** The contractor will be responsible to relocate the devices as directed by the engineer. When the equipment is no longer required for this project, the contractor shall remove it and retain ownership.

### **3.0 System Requirements**

**3.1** The Smart Work Zone System shall be installed on (location). It shall consist of the following as a minimum:

- (#) portable changeable message signs
- (#) portable non-intrusive traffic sensors

- 1 central computer

#### **4.0 Smart Work Zone Plan**

**4.1 General.** The contractor shall submit to the Engineer for approval a written and illustrated SWZ Plan **three (3)** weeks prior to mobilization of any component of the SWZ System. The SWZ Plan shall include the items required in this specification. The Contractor will not be allowed to start any construction activities that will affect traffic on the project until the SWZ Plan is approved by the Engineer.

**4.2 Content of the SWZ Plan.** The SWZ Plan shall include, as a minimum, the following items:

- (a) A detailed plan showing the proposed locations of all SWZ devices and equipment description including make and model.
- (b) A description of all proposed thresholds and proposed CMS messages to be implemented.
- (c) The name and contact information of the SWZ System Manager.
- (d) A detailed description of the proposed methods of communication between SWZ devices and SWZ Central Computer and between SWZ Central Computer and the MoDOT Transportation Management Center (TMC) located at **14301 South Outer Forty Drive in Chesterfield, MO 63017**.
- (e) Proposed corrective method procedures including response times and notification process.

**4.3 Approval of Plan.** Approval of the SWZ Plan by the Engineer is required prior to the placement of any SWZ devices. Approval 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 SWZ Plan and operations, at no additional cost to the Commission, including removal of personnel, as necessary, to obtain the quality specified. The Contractor shall notify the Engineer in writing a minimum of seven (7) calendar days prior to any proposed changes in the SWZ Plan. Proposed changes are subject to approval by the Engineer.

#### **5.0 Materials.**

**5.1 Changeable Message Signs.** The Smart Work Zone System shall utilize MoDOT approved portable changeable message signs (CMS) in accordance with JSP DSP-94-04J, Changeable Message Sign (Contractor Furnished/Retained). Each CMS shall be capable of displaying eight characters on each of three rows. Each CMS power supply shall be properly sized to allow continuous operation for up to ten days during periods of darkness and inclement weather.

**5.2** Each CMS shall be integrated with a radio/modem, and/or a traffic sensor or 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 device shall be capable of communicating through radios/modems with other device(s) at upstream or downstream locations. MoDOT District TMC staff must have the ability to override messages displayed on any CMS in the system. This feature must be password protected and on a website separate from MoDOT’s public website.

**5.3 Portable Non-Intrusive Traffic Sensors.** The Smart Work Zone System 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 six (6) lanes of traffic on a lane-by-lane basis.

**5.4 Central Computer.** The central computer shall provide the functionality described below:

**General**

- Provide a Graphical User Interface that is compliant with Windows standards.
- Communication between the central computer and any device shall be independent and *non-reliant* upon communications with any other CMS or sensor.
- Alerts to MoDOT TMC staff and the Engineer shall be provided via pagers and/or e-mail. Alerts shall be sent in the event of device failure or traffic delays over 15 minutes.

**Data Processing Software**

- The capability to collect and store sensor data.
- The capability to compare traffic data collected from sensors to user-defined thresholds and automatically update one or more CMS's.
- The capability to estimate travel times and automatically update one or more portable CMS's consistent with user-defined thresholds.
- The capability to display alternate route messages consistent with user-defined thresholds.

**Data Management**

- Storage of speed, volume, occupancy, CMS message history, and travel times as well as appropriate sensor status for each day.

**Website**

- The Contractor will be responsible for hosting the website and obtaining domain names. Possible domain names and overall website design must be submitted to the Engineer for approval prior to it being made available.
- The website shall contain an accurate map of the area affected by the work zone, including state highways or routes that may be used as alternates.
- Icons or hyperlinked text should accurately depict the current location of the system components and give real-time information provided by each component. In the event components are moved to a new location, the website must reflect these changes to the system layout.
- Historical data should be password protected and stored on the website for each day the system is in use, with date and time stamps included. The above data shall be available to MoDOT staff at all times for the duration of work zone activity. An electronic copy of all data, including date and duration of system malfunction, shall be provided to MoDOT staff after all work zone activity is completed and the SWZS has been removed.
- The MoDOT TMC staff and the Engineer shall have the capability to override messages, via password protection, from the website.
- Device information shall be provided to MoDOT TMC staff through icons or hyperlinked text representing each device. Detectors should provide real-time speeds at the respective locations and CMS's should provide the current message of each sign.
- The website shall be designed and operated to allow 20 users to access the site at one time.

**6.0 System Manager.** The contractor shall employ a system manager for the SWZS. The system manager shall be locally available to maintain system components, maintain the website, move portable devices as necessary, and respond to emergency situations. The system manager shall be 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 shall 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 shall not perform any other duties on the jobsite.

**7.0 Operational Test.** Once the SWZS is installed, it shall undergo a five-day operational test. The operational test shall include a test of the system in operation during a lane closure to ensure that all SWZS equipment (including the [changeable message signs](#), [traffic sensors](#), [central computer](#), [communication devices](#), and [website](#)) is operating in a fully functional manner and in accordance with the Smart Work Zone Plan for a duration of at least five (5) calendar days. The contractor shall provide for complete operations support from the vendor during the operational test, and the contractor shall 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 four (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 five-day operational test will reset.

**7.1** The contractor shall maintain records of equipment stoppages and resumptions during the five-day operational test for submission to the engineer for his approval. In the event that ten percent or more of the time similar malfunctions occur that affect the proper operation of the SWZS, 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 five-day operational test shall begin again after all defective equipment is replaced and the system is fully operational.

**7.2 Report.** The contractor shall submit a report to the engineer detailing the daily activity of the system during the operational test. The report shall indicate the date and time of any activity necessary to maintain operation of the SWZS during the operational test period. Each entry shall include the following information:

- Identity of the equipment on which work was performed
- Cause of equipment malfunction (if known)
- A description of the type of work performed
- Time required to repair equipment malfunction

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

**8.0 Method of Measurement.** Smart Work Zone System (SWZS) shall be measured by one lump sum and shall be divided into the following payment schedule:

- 35 percent will be paid when all of the SWZS equipment is delivered to the jobsite.
- 25 percent will be paid when the engineer approves the Operational Test Report.
- 20 percent will be paid after [30](#) calendar days of full system operation.
- 20 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.

**8.1 Deduction for Failed System.** A percentage of the lump sum will be deducted should the system malfunction for [three \(3\)](#) or more consecutive calendar days or any total of [five \(5\)](#) calendar days in any one calendar month 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. This deduction will not reduce the total system payment to less than 60 percent of the lump sum.

**9.0 Basis of Payment.** Payment for submittal and approval of a Smart Work Zone plan, furnishing, installing, relocating, operating, maintaining, testing, monitoring, providing a website, providing historical data, and removal of the Smart Work Zone System (SWZS), including all items required for proper operation of this installation, will be completely covered by the contract unit price for Item Number 930-99.01, "Smart Work Zone System," per lump sum.