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# Special Specification 6303

## Temporary Over-Height Vehicle Warning System

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### 1. DESCRIPTION

Furnish, install, relocate, operate, maintain, and remove various components of an automated, temporary, real time Temporary Over-Height Vehicle Warning System as shown on the plans or as directed. Each System deployed is for one travel direction only.

Furnish a System capable of directing the motorists to take appropriate action to avoid collision with any conflicting structures when any component of the vehicle or any load hauled by the vehicle is detected to be over-height. All over-height components of the vehicle or hauled load must be detected despite material type, density, size, or shape. Provide condition-responsive notification to the OHV driver using warning devices activated through real-time traffic data collected upstream of the warning devices location.

The System needs to operate continuously when deployed. This equipment must be a packaged System that operates as a stand-alone System meeting the specifications. Conditions might exist that require multiple deployments of the System at a given time. This will be shown on the plans. The Department reserves the right to terminate this Item at any time if it determines this System is not performing in accordance with this specification or the Contractor has not met the responsibilities identified in this specification.

Temporary Over-Height Vehicle Warning Systems used on this project will remain the property of the Contractor.

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### 2. MATERIALS

Provide materials and software that complies with the requirements of this Special Specification and the details shown on the plans. The System must comply with manufacturer's specifications and recommendations and National Transportation Communications for ITS Protocol (NTCIP) standards, specifically NTCIP 1203. Maintain an adequate inventory of parts to support maintenance and repairs of the Temporary Over-Height Vehicle Warning System within allowable down time limits.

Furnish, assemble, fabricate or install materials referenced under this Specification that are corrosion resistant, in good working condition and in strict accordance with the details shown on the plans or as directed.

Provide all equipment, supplies, materials, and labor to make the System operational. Assume all communication costs including cellular telephone service, FCC licensing, wireless data networks, satellite or internet subscription charges, solar power system support, and battery charging and maintenance. Additional to these requirements, the Contractor must assume all responsibilities for and all damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the contract period.

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### 3. EQUIPMENT

Ensure the System is comprised of all items required to provide an operational system. Any equipment furnished under this specification must be in good working condition. The equipment furnished and installed under this section must include the following:

- Power,
- Non-invasive sensors capable of detecting over-height vehicles,
- Controller Unit,
- Mounting Hardware,

- Cabling,
- Warning devices, and
- Communication System.

### 3.1. **Power.**

- 3.1.1. **Batteries.** If specified on the plans, provide unit equipped with heavy duty, deep cycle batteries which will power the unit 24 hr. a day for a minimum of 7 days during periods of darkness and inclement weather.
- 3.1.2. **Battery Regulator and Recharging System.** If specified on the plans to use batteries, provide unit equipped with an internal controller that regulates the amount of current delivered to the batteries and prevents overcharging.
- 3.1.3. **Solar Panels.** If specified on the plans, provide unit equipped with solar panels which generates enough power to enable the System to continually recharge the batteries.
- 3.1.4. **Utility Power.** If specified on the plans, provide connection from Service Point to Temporary Over-Height Detection System. The Contractor will be responsible for the cost of installation and for the monthly service unless specified on the plans.

### 3.2. **Over-Height Detection.**

- 3.2.1. **Sensor Performance.** Provide non-invasive sensors that will detect objects that dynamically cross a user created horizontal elevated plane at a user-determined height above the roadway surface. Position the sensors so that it only detects objects moving in one travel direction. The detection system will use infra-red, red source technology, or approved equal and spectrally matching detectors mounted on poles positioned on opposite sides of the approach at locations shown on the plans. Alternate detection technology may be used with the approval of the Engineer. Furnish units with an effective detection coverage that meets the areas specified on the plans, with a reaction speed range of 1 mph to 75 mph for a 2.5 in. diameter object that extends 1 in. above the height of the detectors. Provide detection system that negates the effect of ambient light and an internal environmental control that reduces operational failure from fog condensation and insects. Sensor mounting options must be approved by the Engineer.
- 3.2.1.1. **Sun Effects.** Furnish equipment that operates properly when the sun is outside 10° axis of the receiver/master unit in its installed configuration. If the above requirements cannot be met, the equipment will be deemed satisfactory if explicit installation information is provided by the manufacturer such that the rays of the sun will not interfere with the proper operation of the equipment. This provision includes reflections from vehicles.
- 3.2.1.2. **Shadow Effect.** Furnish equipment that ensures that light intensity caused by the shadow of passing clouds will not interfere with the proper operation of the equipment.
- 3.2.2. **Access.** Provide transmitter, remote, receiver, and master units required to operate the equipment. The enclosure must maintain its structural integrity for the operational life of the equipment, and allow access for control adjustment and electrical interconnection without the use of any special tools. Provide lockable enclosures.
- 3.2.3. **Controller Unit.** Provide a local controller unit that controls the System. The local controller unit must continuously monitor detector inputs for a positive over-height detection reading. When the detectors sense an over-height vehicle, the local controller must activate the warning devices of the System. The Temporary Over-Height Vehicle Warning System must be capable of selecting messages automatically without operator intervention after System initialization. Refer to the plans for messages to be displayed. The lag time between detection of over-height object and the posting of the appropriate messages must be no longer than 1 sec.

If a PCMS is being used, when the sensor does not detect an over-height vehicle upstream the default message that the PCMS must display is the height of the hazard ahead or as specified on the plans. An example of the message to be displayed is LOW/BRIDGE/12 ft. - 0 in.

The controller must restart automatically in case of power failure. If PCMS are being use, they must display the height of the hazard ahead until the System can re-establish normal operation. An example of the message to be displayed is LOW/BRIDGE/12 ft. -0 in. The local controller must have automated error detection/correction mechanisms.

Provide password protected login and the ability to be remotely configured.

The local controller must operate 24 hr., 7 days a week with automated continuous data acquisition.

Archive all messages displayed with time and date stamps.

Provide user-configurable settings on the local controller for adjusting the duration of the activation of the warning devices to accommodate anticipated travel conditions.

### 3.3. **Mounting Hardware.**

3.3.1. **Mounting Provision.** Furnish mounting hardware that will securely attach the detection equipment to a vertical cylindrical pole that does not require any machining operation. The attachment must not stress or deform the unit and must prevent the movement of the unit in any direction by the force of wind speed up to 80 mph.

Furnish mounting hardware that has the capability of adjustment to the angular orientation of the optical axis in both the horizontal and vertical plane over an angular range of  $\pm 5^\circ$ .

3.3.1.1. **Unit Mounting.** Provide structural members that support the dead weight of the equipment, resists dynamic external forces and that allows for detectors to be adjustable in the vertical plane. Structural members may include an existing metal pole, a temporary structure or a bridge mount as shown on the plans. Support structure will be approved by the Engineer. Due to the temporary nature of these Systems, existing roadway structures may be identified on the construction plans to be used as mounting sites instead of dedicated poles.

3.4. **Warning Devices.** Warning devices must be used to present messages to drivers with a lag time of less than 1 second. The warning devices can be any of the following;

3.4.1. **Static Warning Signs.** Integrate signs as shown on the plans that directs detected over-height vehicles to take appropriate action. Flashing beacons must only be activated when an over-height vehicle is detected upstream. Provide flashing beacons with each sign as shown on the plans.

Each flashing beacon must be capable of being controlled by the System Coordinator in the event of a system malfunction.

Provide flashing beacons in accordance with Item 685 "Roadside Flashing Beacon Assemblies." Provide static sign assemblies in accordance with the *Texas Manual on Uniform Traffic Control Devices (TMUTCD)* latest version.

3.4.2. **Portable Changeable Message Sign (PCMS).** If the use of a PCMS is specified on the plans, provide a display panel that contains LED technology. Each PCMS must be capable of being controlled by the System Coordinator in the event of a System malfunction. Provide PCMS that are NTCIP compliant.

Provide PCMS in accordance with Statewide Special Specification "Portable Changeable Message Sign."

### 3.5. **Environmental Requirements.**

3.5.1. **Meteorological Conditions.** Provide equipment that operates and meets all of the requirements of this specification under the following atmospheric conditions:

- Ambient Temperature: -40°F to 135°F (-40°C to 57°C),
- Relative Humidity: 5% to 90% non-condensing,
- Rain: 3 in. per hour rate,
- Snow: 5 in. per hour rate,
- Fog: 200 ft. visibility, and
- Wind Velocity: AASHTO 2013 LTS Design Spec, "Wind Velocity and Ice Zones."

The System operation and accuracy must not be appreciably degraded by inclement weather.

3.6. **Communication System Requirements.**

3.6.1.1. **Communication Requirements.** The System must be capable of providing constant communication to and from the warning devices, the local controller, and the sensors to the Traffic Management Center (TMC).

The Communication System must have a lag time of no more than 1 second from the sensor to the local controller and the warning device. If the System is not able to operate with a 1 second lag time, the System must be considered inoperative. All other communications between the controller, the Traffic Management Center (TMC), the cloud, etc. may be accomplished by cellular modem, radio frequency or other means that provide reasonable performance as approved by the Engineer.

The Communication System must have an automatic error detection/correction mechanism that addresses anomalies in the detection data to insure the integrity of all traffic condition data and motorist information messages. Any required configuration of the Communication System must be performed automatically during System initialization.

If communication is lost for more than 10 consecutive minutes, the System must revert to a fail-safe condition. If a PCMS is being used the height of the hazard must be displayed until communication is restored. An example of the message to be displayed is LOW/BRIDGE/12 ft. – 0 in.

Data must be integrated as shown on the plans.

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## 4. CONSTRUCTION

4.1. **Alignment.** Allow for directional adjustment and aiming after initial installation. Perform basic alignment of the detectors either manually or electronically. Perform this step on both the transmitter/remote and receiver/master unit locations as per the manufacturer's guidelines and recommendations.

4.2. **Mounting Height.** Mount the transmitter/remote and receiver/master unit to detect the presence of vehicles that exceed the specified vertical height.

4.3. **Installation.** Install the Temporary Over-Height Vehicle Warning Systems in accordance with the manufacturer's specifications to achieve specified accuracy and reliability. Install the System so that proper operation of the equipment will commence within 15 seconds after restoration of power. Install all System components at the locations shown on the plans or as directed.

Follow the Temporary Over-Height Vehicle Warning System time frame and duration for System implementation as shown on the plans or as directed.

Use established industry and utility safety practices to erect assemblies near overhead or underground utilities. If utility power is used, Contractor must coordinate with local utility companies. Consult with the appropriate utility company before beginning such work.

- 4.4. **Performance.** If the system displays the default message or unrealistic values for more than 24 hr., or 5 times while the system is deployed, the Engineer may declare a System defective and require replacement of the appropriate equipment at no additional cost. Failure may be determined by any method, including but not limited to remote or direct observation, Monitoring Systems, and data received and collected by the Traffic Management Center (TMC).
- 4.4.1. **Report.** Provide a System capable of generating a daily report that documents equipment stoppages and resumptions, over-height detections, and warning sign activations during the entire time the System is operational. Submit a report to the Department at a minimum every month or as scheduled on the plans detailing the following:
- 4.4.1.1. Daily report of the System during any time the System is not operational. The report must indicate the date, time, and location of any activity necessary to maintain operation of the Temporary Over-Height Vehicle Warning System and record the time/date stamps for any events when the System failed. Each entry must include the following information:
- Identify the equipment on which work was performed,
  - Cause of equipment malfunction (if known),
  - Description of the type of work performed, and
  - Time required to repair equipment malfunction.
- 4.4.1.2. Total number of over-height alerts triggered per month for the entire duration the System is operational. Total number of times warning message was posted or, if static signing is used, the total number of times the flashing beacons were activated. The report must indicate the date, time, and location of each alert and each message or flashing beacon activation. Date and times of alerts and warning activations must be system generated.
- 4.4.1.3. Total number of times the structure was struck by over-height vehicles or cargo per week for the entire duration the System is operational. The report must indicate the date, time and location of each incident.
- 4.4.2. **Consequences of Failed Performance.** Failure to satisfy the performance requirements is considered a defect. Upon any notification of failure of any duration, the Contractor is required to complete a repair within the maximum allowable 4 hr. The equipment is also subject to rejection by the Engineer. The rejected equipment may be offered again for retest provided all noncompliance has been corrected.
- If a failure pattern develops in similar units within the System, implement corrective measures, including modification or replacement of units, to all similar units within the System as directed. Perform the corrective measures without additional cost or time extension of the contract period within 4 hr. after the failure pattern is identified.
- 4.5. **Experience Requirements.**
- 4.5.1. **Contractor Experience Requirements.** Contractor or designated subcontractor must meet the following experience requirements:
- 4.5.1.1. **Completed Project.** Demonstrate experience from one successfully completed project where the personnel installed, tested and integrated various similar equipment combined as a System to create an operational function. This may include such systems as high-water detection and warning systems, variable speed limit systems, wrong-way detection and warning systems, roadway weather detection and warning systems, travel time delay estimate system, queue detection system or similar applications of technology requiring specialized equipment, electrical, and networking.
- Submit the names, addresses and telephone numbers of the references that can be contacted to verify the experience requirements given above.
- 4.5.2. **Documentation Requirements.** Provide a compliance matrix documenting conformance to this specification.

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**5. SYSTEM COORDINATOR**

The Contractor's Responsible Person (CRP) identified under Item 7, "Legal Relations and Responsibilities" must designate a System Coordinator who is responsible to oversee the placement of the devices and for testing and calibrating the equipment. The System Coordinator must be locally available to maintain system components, move portable devices as necessary, and respond to emergency situations. It is the responsibility of the System Coordinator to move system components that interfere with construction operations and relocate the components to another area. The Contractor's Responsible Person (CPR) must provide a local phone number or a toll free number to the Engineer to contact the System Coordinator for the maintenance of the system at any time. The System Coordinator must be accessible 7 days a week and 24 hr. a day while the System is deployed, and must respond within 2 hr.

Submit a schedule of implementation for approval at the pre-construction meeting. The Temporary Over-Height Vehicle Warning System must be continually monitored throughout all periods of deployment. The decision to deploy, relocate, or remove field equipment is made by the Department and accomplished by the System Coordinator.

Technical Support for the System must be available for all periods of operation.

In the event, communication is lost between any field equipment; provide a means and staff to manually program a message within 2 hr. of notification.

System Operator local control functions and remote management operations must be password protected per TxDOT Policy.

The System must be capable of storing ad-hoc messages created by the System Coordinator and logging this action when overriding or default of automatic advisory messages.

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**6. MEASUREMENT**

This Item will be measured by each directional Temporary Over-Height Vehicle Warning System furnished, installed or relocated, or by the number of days furnished and installed. All Temporary Over-Height Vehicle Warning System components must be set up on the work area and operational before the time can be considered measurable. When measured by the day used is specified, a day will be measured for each Temporary Over-Height Vehicle Warning System set up and fully operational on the worksite.

When this Item is measured by the day and more than one Temporary Over-Height Vehicle Warning Systems will be needed on a project and operational at the same time, a multi-system bid item code must be used. The bid item code description will reflect the number of systems operating concurrently. The total number of days measured for that bid item includes all systems combined. For example, a particular project may require two systems to be deployed at different locations operating concurrently over a period of time. In this example, the total number of days measured for the individual bid item description code includes the sum of both systems combined.

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**7. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for "Temporary Over-Height Vehicle Warning System" of the number of systems specified when measured by the day. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for "Temporary Over-Height Vehicle

Warning System” when measured by each system. This price is full compensation for the use of all equipment, including labor to set-up, furnish, operate, relocate, adjust and remove equipment, replacement parts, maintenance, all related consumables, software, programming, on-site System Coordinator, and for incidentals necessary to complete the work. This price must also include any costs associated with communications (ex. cellular fees), power and damage from vandalism, weather or traffic incidents.

- 7.1. **Deduction for Failed System.** Should the System malfunction for a period of 4 consecutive hours without the Contractor correcting the deficiency, the payment for that day will be deducted.