
Special Specification 6302

Temporary Queue Detection System



1. DESCRIPTION

Furnish, install, relocate, operate, maintain, and remove various components of an automated, portable, real time Temporary Queue Detection System as shown on the plans or as directed. Each System deployed is for one travel direction only.

Furnish a System capable of providing advanced traffic information to motorists when there is slowed or stopped traffic approaching or inside a work zone. The condition-responsive notification to the motorist occurs with the use of Portable Changeable Message Signs (PCMS) activated through real-time traffic data collected downstream of the PCMS location.

This equipment must be a packaged System that operates as a stand-alone System meeting the specifications. The System must calculate and notify motorists via PCMSs of the traffic conditions ahead. The System needs to operate continuously when deployed. 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 Queue Detection Systems used on this project will remain the property of the Contractor.

2. MATERIALS

Ensure 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, including NTCIP 1203. The Contractor must maintain an adequate inventory of parts to support maintenance and repair of the Temporary Queue Detection System within allowed 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 damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the Contract period.

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 Queue Detection Sensors,
- PCMSs,
- Controller Unit,
- Portable trailers, and

- Communication System.

3.1. Power.

3.1.1. **Batteries.** Provide heavy duty deep cycle batteries to power the system components 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.** 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.** Provide unit equipped with solar panels which generates enough power to enable the System to continually recharge the batteries.

3.2. Queue Detection Sensors

3.2.1. **Sensors Performance.** Provide non-invasive sensors that will detect vehicle's speed and traffic occupancy. Position the detection system so that it detects up to 8 approaching lanes and differentiates by direction. The System must utilize non-invasive sensors approved by the Engineer. Furnish units with an effective detection range that meets the areas specified on the plans with a reaction speed range of 5 mph to 99 mph. Sensors mounting options must be approved by the Engineer.

3.3. **PCMS.** Provide display panels that contain LED technology. Each System must be capable of being remotely controlled by both the Traffic Management Center (TMC) and by the System Coordinator in the event of a System malfunction. Provide PCMS that are NTCIP compliant.

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

3.4. **Controller Unit.** Provide a local/remote controller unit that operates the System. The System's algorithm must determine that vehicles are stopping and creating a queue. The controller unit will continuously monitor detector inputs for a positive queue detection reading. When the detectors sense a queue, the controller must activate the appropriate messages on the PCMS using predetermined triggering thresholds without operator intervention after System initialization. Refer to the standard drawings included on the plans for the messages and thresholds to be used. The lag time between changes in threshold ranges and the posting of the appropriate messages must be no longer than 60 sec.

The controller must be capable of storing at least 100 programmed messages and have the ability to manually override messages both remotely and on-site.

When the sensors do not detect a queue ahead the default message that the PCMS must display is ROAD/WORK/AHEAD or as specified on the plans.

The controller must restart automatically in case of power failure and must display ROAD/WORK/AHEAD message until the System can reestablish normal operation.

Provide password protected login and the ability to be remotely configured. The controller must have automated error detection/correction mechanisms.

The System must be configured so that during low volume time periods such as early morning, the lack of traffic does not produce the stopped traffic message on the PCMS. The System must also recognize a trend toward stopped traffic when sensors stop detecting after the speed drops below 5 mph. In that situation, the System must self-check the detection to ensure it is working, and will then go into "Sleep Mode" with STOPPED/TRAFFIC/AHEAD message posted on the upstream message signs. When the stopped traffic resumes, the System must "wake up" and resume normal operation.

Archive all messages displayed with time and date stamps.

3.5. **Portable Trailers.** Provide heavy duty portable trailers with trailer lights and delineated with retroreflective material for mounting vehicle detection devices. Other mounting options that produce cost savings or meet special conditions may be possible, but only with the approval of the Engineer.

3.6. **Environmental Requirements.**

3.6.1. **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.

3.7. **System Communication Requirements.**

3.7.1. **Communication System.** The System must be capable of providing constant communication to and from the PCMSs, the controller, and the sensors. It must also support communications between the controller and to the Traffic Management Center (TMC).

The Communication System must have a lag time of no more than 60 sec. from the sensor to the controller and the PCMSs. If the System is not able to operate within the 60 sec. 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 incorporate an 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 and a ROAD/WORK/AHEAD message displayed until communication is restored or message approved by the Engineer.

Data must be integrated as shown on the plans.

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 the sensors per the manufacturer's guidelines and recommendations.

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

Follow the Temporary Queue Detection 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.

- 4.3. **Performance.** In the event that the system displays the default message or unrealistic values for more than 4 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).
- 4.3.1. **Report.** Provide a System capable of generating a daily report that documents equipment stoppages and resumptions, and activations of all warning messages 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:
- 4.3.1.1. 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 Queue Detection 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.
- 4.3.1.2. Total number of times each queue alert message type was active and its duration per week. The data must be gathered for the entire duration the System is operational. The report must indicate the date, time, message, and location of each posted message.
- 4.3.2. **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.
- 4.4. **Experience Requirements.**
- 4.4.1. **Contractor Experience Requirements.** Contractor or designated subcontractor must meet the following experience requirements:
- 4.4.1.1. **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. **Documentation Requirements.** Provide a compliance matrix documenting conformance to this specification.

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 Queue Detection 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 Department 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.

6. MEASUREMENT

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

When this Item is measured by the day and more than one Temporary Queue Detection System 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.

7. PAYMENT

- 7.1. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for "Temporary Queue Detection System" of the type and 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 Queue Detection 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.

- 7.2. **Relocation.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for "Relocate Temporary Queue Detection System."

This price is full compensation for removal, relocation, installation calibration and making the system fully operational; and for all materials, transportation, labor, tools, and incidentals.

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