
Special Specification 6245

Overheight Vehicle Detection System



1. DESCRIPTION

Furnish and install Overheight Vehicle Detection Systems (OHVeD) as shown on the plans or as directed by the Engineer.

The system will detect any overheight components of the vehicle and any load hauled by the vehicle. Overheight components of the vehicle or hauled load must be detected despite material type, density, size, or shape. The system will include warning devices that direct the operators of overheight vehicles to take appropriate action to avoid a collision with any conflicting structures. Any necessary connections with the system must be integrated as part of this Item. The system must communicate operational information with a communication network as specified by the engineer.

Ensure the system is comprised of all items of hardware, software, interconnect cabling, and cabinets and enclosures required to provide an operational system to detect and warn overheight vehicles upstream of a potential clearance violation. The equipment furnished and installed under this section must include the following:

- infrared transmitters and receivers, or approved equal,
- local controller,
- Fiber Optic I/O, where specified,
- controller enclosure and ancillary equipment,
- mounting hardware, and
- cabling as required.

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

2. MATERIALS

Ensure that the materials and construction methods comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following Items:

- Item 421, "Hydraulic Cement Concrete,"
- Item 440, "Reinforcement for Concrete,"
- Item 442, "Metal for Structures,"
- Item 445, "Galvanizing,"
- Item 449, "Anchor Bolts,"
- Item 618, "Conduit,"
- Item 620, "Electrical Conductors,"
- Item 624, "Ground Boxes,"
- Item 627, "Treated Timber Poles,"
- Item 628, "Electrical Services,"
- Item 636, "Signs,"
- Item 656, "Foundations for Traffic Control Devices,"
- Item 685, "Roadside Flashing Beacon Assemblies,"
- Item 687, "Pedestal Pole Assemblies," and
- Special Specification "Intelligent Transportation Systems (ITS) Solar Power System"

3. EQUIPMENT

3.1. Overheight Detection.

3.1.1. **Detector Performance.** Provide a complete system that will detect objects that dynamically cross a user-created horizontal elevated plane at a user-determined height above the roadway surface. The detection system will be positioned so that it only detects objects moving in one travel direction. The detection system will utilize infra-red or 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 range of 10 ft. to 200 ft. 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.

3.1.2. **Overheight Detector Unit.** Furnish units that are solid state with printed circuit boards and regulated power. Furnish units that do not exceed a maximum overall size of 18 in. Width x 19 in. Length x 10 in. Depth, or as approved by the Engineer.

3.1.3. **Housings.** Provide medium duty anodized aluminum, fiberglass, or equivalent housing not less than 1/8 in. thick, rated National Electrical Manufacturer's Association (NEMA) 3R or better.

3.1.4. **Access.** Provide transmitter, remote, receiver, and master units required to operate the equipment. The enclosure will 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.

3.1.5. **Controller Unit.** Provide a local controller unit that controls the system at the design location shown on the plans. The local controller unit will continuously monitor detector inputs for a positive overheight detection reading. When the detectors sense an overheight vehicle, the controller will activate the warning components of the system. Circuit breaker protection must be incorporated into the controller. Provide user-configurable settings on the controller for adjusting the duration of the activation of the warning components to accommodate anticipated travel conditions. The controller unit may be located in the detection unit housing or in a separate enclosure.

3.2. Mounting Poles.

3.2.1. **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 will not stress or deform the unit and will prevent the movement of the unit in any direction by the force of developed wind. 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 $\pm 5^\circ$.

3.2.2. **Unit Mounting.** Provide structural member that supports 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 new metal pole, a timber pole in accordance with Item 627, "Treated Timber Poles," or a bridge mount as shown in the plans. New metal poles will conform in all structural aspects of Item 610, "Roadway Illumination Assemblies," and will not include any aspects related to illumination. Support structure will be approved by the Engineer.

3.2.3. **Mounting Location.** Install all poles and foundations outside of the clear zone or behind barrier protection as shown on the plans.

3.3. Warning Components.

3.3.1. **Warning Signs.** Integrate (a) static sign(s) as shown on the plans that directs detected overheight vehicles to take appropriate action. Provide four flashing beacons with each static sign, as shown in the plans.

Flashing beacons will conform to Roadside Flashing Beacon Assembly. The static sign assembly will conform all essential elements of the sign to Texas MUTCD standards.

Physical Hard-Wired Connection. Provide a Fiber Optic I/O system between the OHVeD controller and the flashing beacons, as shown on the plans, and is supported by the OHVeD system.

3.4. Environmental Requirements.

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

- Temperature: -40°F to 135°F (-40°C to 57°C),
- Relative Humidity: 0 to 100%,
- Rain: 2 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."

3.4.2. **Metrological Conditions.** 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.

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.

3.5 System Communication Requirements.

3.5.1. **Fiber Optic I/O System.** Where shown on the plans, provide an Industrial grade fiber optic I/O communications link between the OHVeD controller and flashing beacon assembly. The fiber optic I/O unit must meet the following:

- Outdoor rating of IP 67, or better,
- ,
- Support Type C outputs (normally open and normally closed),
- Support 3 terminals per relay (common, NO, NC),
- Support multiple user-programmable channels,
- Support single-mode ST fiber connectors
- Require a maximum of 7W power supply.

The fiber optic I/O device must be compatible with the manufacture of the OHVeD system.

3.5.2. **Physical Hard-Wired Connection.** Where shown on the plans, provide hard-wired communication using twisted-wire pair to communicate with the OHVeD unit. This configuration is typically utilized for long-term equipment deployment and supplies both power and communications.

3.5.3. **Communication Requirements.** Consistent with Section 3.5 of this Item, and consistent with the plans, the OHVeD will include a communications port, rs232 and/or Ethernet port, for future integration with the traffic management center. construction

- 3.6. **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.
- 3.7. **Foundations.** Construct all foundations for detecting units, and other system support structures in accordance with Item 416, "Drilled Shaft Foundations."
- 3.8. **Mounting Height.** Mount the transmitter/remote and receiver/master unit to detect the presence of vehicles that exceed the specified vertical height.
- 3.9. **Installation.** Install OHVeD system in accordance with the manufacturer's specifications to achieve specified accuracy and reliability. Install OHVeD 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 by the Engineer.

Install pole, breakaway base, local control cabinet, connectors, wiring, signal beacons, sign, and foundation as shown on the plans, or as directed by the Engineer. Install the flasher controller assembly in the ITS cabinet. Install watertight breakaway electrical fuse holders in all line and neutral conductors at the breakaway base.

Install foundations, poles, and associated cabinets outside of the clear zone or behind barrier protection.

Use established industry and utility safety practices to erect assemblies near overhead or underground utilities. Contractor to coordinate with local utility companies. Contact information is identified in the General Notes. Consult with the appropriate utility company before beginning such work.

If such a system is shown on the plans, install solar power system in accordance with Special Specification "Intelligent Transportation Systems (ITS) Solar Power System."

- 3.10. **Testing.**
- 3.10.1. **New Installations.** Unless otherwise shown on the plans, perform the following tests on the applicable equipment or systems.
- 3.10.1.1. **Test Procedures Documentation.** Provide 5 copies of the test procedures and target values, as well as blank data forms 30 days prior to testing for each test required in this specification. Include the sequence of the tests in the procedures. The Engineer will comment, approve, or reject test procedures within 30 days after Contractor submission of test procedures. Contractor to resubmit, if necessary, rejected test procedures for final approval within 10 days to the Engineer. Review time is calendar days. Contractor to conduct all tests in accordance with the approved test procedures.
- Record test data on the approved data forms. The Engineer will have the opportunity to witness all testing. Provide the Engineer a minimum of 10 working days advance notice of all testing. The manufacture, or authorized representative of the Contractor, must sign and date each test conducted.
- Provide written notice to the Engineer within 48 hr. of discovery of any testing discrepancy identified during testing by the Contractor. Furnish data forms containing the acceptable range of expected results as well as the measured values.
- 3.10.1.2. **Demonstration Test.** Conduct a demonstration test on the following equipment at an approved Contractor facility: applicable detection and warning elements including, but not limited to infrared technology, beacons and dynamic message sign (if used).
- 3.10.1.2.1. **Operational Test.** Power on all components of the OHVeD system and run for at least 15 min. Ensure that all components contained within the project requirements are operating correctly. Perform the following tests:

Detection. Set up the detection equipment at a mutually agreed upon location to represent a field installation. Set up the detection equipment (infrared sensors) at a separation distance of at least 100 feet apart. Mount the detection equipment at a height of at least 5 ft. above the pavement but no more than 7 ft. above the pavement. Align the sensors for proper operation. Using a test vehicle of sufficient height and mass pass through the detection beam. Monitor the OHVeD system controller to identify that the test vehicle was registered by the system. Repeat this component test per the manufactures recommendation, but not less than 20 times. Record the results on the approved data forms.

Warning Signs. Test the OHVeD system using the configuration setup above. For each passing of the test vehicle the controller should trigger the visual warning device, such as the flashing beacon. Monitor the results and record the results on the approved data forms.

Other tests. Additional tests should be performed based on the Vendor's recommendations that support the OHVeD system meets the functional requirements of this specification.

- 3.10.1.3. **Field Acceptance (Stand-Alone) Test.** Conduct a field acceptance test for each unit after installation as required by the Engineer in order to demonstrate compliance with the functional requirements with this Specification. Ensure Vendor is present throughout field acceptance test to provide support. Exercise all stand-alone (non-network) functional operations. Notify the Engineer 5 working days before conducting this test. The field acceptance test will consist of the following:
- 3.10.1.3.1. **Physical Construction.** Document physical construction is completed in accordance with the plans and specifications.
- 3.10.1.3.2. **Electrical and Communication.** Document that all connectors for grounding, surge suppression, and electrical distribution are tightened correctly. Document all power supplies and circuits are operating under the proper voltages. Document all power and communications cables are terminated correctly, secured inside the cabinet, and fitted with appropriate connectors in accordance with the latest version of the National Electrical Code (NEC).
- 3.10.1.3.3. **Proper Equipment Function.** Document that all OHVeD system equipment is operating and functioning in accordance to this Specification. This includes: detection, communication between the detection units and the controller, controller functions, warnings, and data logging. Ensure that the detection beam height(s) are in accordance with the plans.
- 3.10.1.4. **Final Acceptance Test.** Following completion of the demonstration test, and stand-alone test, , provide completed data forms containing all collected data, including quantitative results for all tests, a set of "as built" working drawings, and a written request to begin a data communication and final acceptance test. Provide "as built" working drawings to the Engineer indicating the actual material, equipment, and construction of the various subsystem components, including established and calculated XY coordinates based on project control points provided by the Engineer, when shown on the plans.

Within 10 calendar days of the request, execute a data communications test using a Department supplied software program or Contractor supplied software approved by the Department. The data communications test may be executed by the Engineer or the Contractor with the prior approval of the Engineer. The purpose of this test is to verify that the communications plant will operate with application software provided by the State.

Perform the data communications test for a period of 72 hr. If a message error or component failure occurs anywhere in the network, resume the test once repairs are completed for a new 72 hr. period. All components of the communications network must operate as an integral system for the duration of the test.

A message error is defined as the occurrence of a parity error, framing error, or data error in any component of the message. The error free message rate is defined as the ratio of the number of messages in which no message error occurs to the number of messages transmitted. The error free message rate must exceed 99.99% for acceptable transmission quality, both for the system as a whole, and for each component of the network.

Provide all additional test results to the Engineer for review once a successful data communications test has been completed.

Notify the Engineer of any defects suspected in integration or function of material or equipment. Investigate any suspected defects and correct if necessary. Provide a report of finding within 2 calendar days of notice of any suspected defects. Describe the nature of the any defects reported and any corrective action taken in the report. The integrated subsystems must operate defect free as a single complete system for a minimum of 72 continuous hours during a 30 calendar day review period. If the number of defects or frequency of failures prevents any subsystems from operating as described above, the Engineer may reject the entire subsystem(s) integration test results and resume contract time. Provide any necessary corrections and resubmit subsystem(s) integration test results and a request to begin a final acceptance test which may include "as built" plans and a data communications test.

The system under this Item will not be accepted until the system, inclusive of all subsystems, has operated satisfactorily for a period of 90 days and in full compliance with the plans and specifications after approval of all submitted test results and reports.

- 3.10.1.5. **Consequences of Test Failure.** If a unit fails a test, submit a report describing the nature of the failure and the actions taken to remedy the situation prior to modification or replacement of the unit. If a unit requires modification, correct the fault and then repeat the test until successfully completed. Correct minor discrepancies within 15 days of written notice to the Engineer. If a unit requires replacement, provide a new unit and then repeat the test until successfully completed. Major discrepancies that will substantially delay receipt and acceptance of the unit will be sufficient cause for rejection of the unit.

Failure to satisfy the requirements of any test is considered a defect and the equipment is 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.

- 3.10.1.5.1. **Consequences of Design Approval Test Failure.** If the equipment fails the design approval test, correct the fault within 30 days and then repeat the design approval test until successfully completed.
- 3.10.1.5.2. **Consequences of Demonstration Test Failure.** If the equipment fails the demonstration test, correct the fault within 30 days and then repeat the demonstration test until successfully completed.
- 3.10.1.5.3. **Consequences of Field Acceptance (Stand-Alone) Test Failure.** If the equipment fails the stand-alone test, correct the fault within 30 days and then repeat the stand-alone test until successfully completed.
- 3.10.1.5.4. .
- 3.10.1.5.5. **Consequences of Final Acceptance Test Failure.** If a defect within the system is detected during the final acceptance test, document and correct the source of failure. Once corrective measures are taken, monitor the point of failure until a 30 consecutive day period free of defects is achieved.

If after completion of the initial test period, the system downtime exceeds 72 hr. or individual points of failure have not operated for 30 consecutive days free of defects, extend the test period by an amount of time equal to the greater of the downtime in excess of 72 hr. or the number of days required to complete the performance requirement of the individual point of failure.

- 3.11. **Experience Requirements.**

- 3.11.1. **Contractor Experience Requirements.** Contractor or designated subcontractor must meet the following experience requirements:

- 3.11.1.1. **Completed Projects.** Demonstrate experience from one completed project where the personnel installed, tested and integrated various network 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, or similar applications of technology requiring specialized equipment, electrical, and networking. If these requirements cannot be met, the Contractor must have completed a minimum of 3 projects consisting of ITS equipment installation and integration and must work closely with the OHVeD System Manufacturer to perform the installation to meet all the requirements in this Item. The completed system installation must have been in continuous satisfactory operation for a minimum of 1 yr.
- 3.11.1.2. **Equipment Experience.** Demonstrate experience from one ITS project (may be from one of the three projects in the preceding paragraph) in which contractor personnel worked in cooperation with technical representatives of equipment suppliers to perform specific stages of work. If these requirements cannot be met, the Contractor must work closely with the Manufacturer to ensure the system equipment meets the requirements in this Item. The Contractor can submit experience of the manufacturer as one of the ITS projects provided that the manufacturer must be on-site during installation, operational turn-on, and acceptance of the completed OHVeD system.
- Submit the names, addresses and telephone numbers of the references that can be contacted to verify the experience requirements given above.
- 3.12. **Training.** Conduct a training class for a minimum of 16 hr., unless otherwise directed, for up to 10 representatives designated by the Department on procedures of installation, operations, programming hardware settings, IP programming, port settings, testing, maintenance, troubleshooting, and repair of all equipment specified within this specification. Submit to the Engineer for approval, 10 copies of the training material at least 30 days before the training begins. Conduct training within the local area unless otherwise authorized by the Engineer. Provide 4 hr. of training to Department Personnel in the operation, setup, and maintenance of the fiber optic I/O system supplied within this Item. Provide instruction and materials for a maximum of 10 individuals. The User's Guide is not an acceptable substitute for practical classroom training.
- All training is subsidiary to this Item.
- 3.13. **Documentation and Warranty.**
- 3.13.1. **Documentation Requirements.** Provide a minimum of 2 complete sets of operation and maintenance manuals in bound hard copy format, as well as an electronic copy in Adobe PDF format on a CD/DVD or removable flash drive that include the following:
- complete and accurate wiring schematic diagrams,
 - complete installation procedures,
 - compliance matrix documenting conformance to this specification,
 - complete performance specifications (functional, electrical, mechanical and environmental) on each unit of the system,
 - complete parts list including names of vendors for parts not identified by universal part number such as JEDEC, RETMA, or EIA,
 - pictorial of component layout on circuit board,
 - complete maintenance and trouble-shooting procedures,
 - complete stage-by-stage explanation of circuit theory and operation,
 - testing procedures and blank test forms,
 - recovery procedures for malfunction,
 - instructions for gathering maintenance assistance from manufacturer, and
 - provide the Department with certification documentation verifying conformance with environmental and testing requirements contained in this special specification. Certifications may be provided by the manufacturer or through independent certified labs.

Identify material which is copyrighted or proprietary in nature as part of the documentation submittal. The Department will comply with sensitive material and secure submittal documentation to the extent possible under Texas Government Code, Chapter 552 pertaining to Texas Public Information Act.

- 3.13.2. **Warranty.** Warrant the equipment against defects or failure in design, materials, and workmanship for a minimum of 3 yr. or in accordance with the manufacturer's standard warranty if that warranty period is greater. The start date of the manufacturer's standard warranty will begin after the equipment has successfully passed all tests contained in the final acceptance test plan. Only use system equipment with more than 90% of its warranty remaining after the final acceptance test is completed. Guarantee that equipment furnished and installed for this project performs according to the manufacturer's published specifications. Assign, to the Department, all manufacturer's normal warranties or guarantees on all electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project.

Repair or replace OHVeD System equipment at the Contractor's expense prior to completion of the final acceptance test plan in the event of a malfunction or failure. Furnish replacement parts for all equipment within 15 days of notification of failure by the Department.

4. MEASUREMENT

This Item will be measured by each system furnished, installed, made fully operational and tested in accordance with this specification and as directed.

5. PAYMENT

- 5.6. **Furnish and Install.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the following:
- "OHVeD System (Dual-Direction)" – install directional detection units mounted on a new pole,
 - Payment for the installed OHVeD system will be made only after final acceptance,
 - Payment for Fiber Optic I/O will be subsidiary to this item.
 - Construct all new pole foundations in accordance with Item 416, "Drilled Shaft Foundations,"
 - New conduit will be paid for in accordance with Item 618, "Conduit,"
 - Ground boxes will be paid for in accordance with Item 624, "Ground Boxes,"
 - Treated timber poles will be paid for in accordance with Item 627, "Treated Timber Poles,"
 - New warning signs will be paid for in accordance with Item 636, "Signs"
 - Ground mounted signs and support will be paid for in accordance with Item 647, "Large Roadside Sign Supports and Assemblies,"
 - Flashing beacon will be paid for in accordance with Item 685 "Roadside Flashing Beacon Assemblies,"
 - New metal poles will be paid for in accordance with Special Specification, "Intelligent Transportation Systems (ITS) Pole with Cabinet,"
 - Solar power systems will be paid for in accordance with Special Specification, "Intelligent Transportation Systems (ITS) Solar Power System,"

This price will be full compensation for furnishing and installing all new system components including materials, internal electrical conductors, connectors and mounting hardware; integration with existing roadway infrastructure (as required) and communication network; integration with warning signs and for all labor, tools, equipment, testing, documentation and incidentals necessary to complete the work.