1. **DESCRIPTION:**

This work shall consist of furnishing and installing an over-height vehicle detection (OHVD) system in accordance with the contract documents and as directed by the Engineer. This work shall include all detectors, electronics, relays, wiring, mounting devices, hardware, radios, antennas, cellular modems/gateways, switches, software, etc., necessary to furnish and install a complete, operational, and reliable OHVD system.

The OHVD system includes the communications with the Hudson Valley Traffic Management Center (HVTMC). OHVD system field sites shall send data and video to and receive commands from the HVTMC staff. It may utilize existing network and workstations within the HVTMC; however, integration with existing Intelligent Transportation System application software in the HVTMC is not required.

2. **MATERIALS:**

Each OHVD System shall include all required materials to meet the functional requirements listed below, and as required for a complete, operational, and reliable OHVD system.

2.01 **Functional Requirements**

A. Detect over-height vehicles with OHVD sensor transmitter/receiver pairs
   1. Dual-beam, Visible Red / Infrared, direction discerning OHVD sensors
   2. Automatic switchover to single beam mode if sunlight or other source saturates one detector.
   3. Maximum Range 700’, suggested range for optimum performance 200’
   4. Reaction speed 1 to 75 mph for a 2.5 inch diameter object 1 inch above detection height.
   5. Minimize false alarms by requiring both beams be broken to detect an over-height vehicle
   6. Provide capability to add loop detectors in the future to further minimize false alarms.
      a) Under this scenario, both beams and loop detector activation would be required to detect an over-height vehicle.
      b) Loop detectors are not required for the initial installation and would be paid under separate items or installed by others.
   7. Input Power: 115V +/- 20%, 60Hz
   8. Outputs:
      a) Minimum of two relay outputs to indicate when an over-height vehicle is detected
      b) User can adjust the time the relay output is open/closed after detection from 1 to 30 seconds.
      c) Minimum of one relay output to indicate when the sensor has failed.
   9. Enclosure NEMA 6P
   10. Three axis mount and pole mount bracket.
   11. Remote cabinet and master cabinet housing control panel.
a) Local alarm counter for manual validation of alarm logs
b) Direction selection switch.

12. OHVD sensors and control panel shall be Trigg Industries Dual Beam or equal.

B. Communicate the OHVD sensor’s relay outputs to local devices
   1. Local devices include DMS, flashing beacons, and cameras as shown on the contract documents.
   2. Unlicensed wireless communications. May be point to point or multi-point configuration.
   3. If wired communications is proposed by the Contractor, then any required cable, conduit, conduit installation, excavation, erosion control, backfill, and restoration are to be performed in accordance with NYSDOT standard specifications and standard details and be suitable for the application and service conditions. These items would not be paid separately and their cost should be included in the price bid for the Over-height vehicle detection system. Contractor shall submit any proposed conduit routing as shop drawings for approval of the Engineer.

C. Activate OHVD Message on local Dynamic Message Sign (DMS)
   1. Maximum of 1.5 seconds from the time the OHVD senses an over-height vehicle to the time the over-height vehicle warning message is fully displayed on the DMS.
   2. User can configure the specific OHVD warning message to be displayed.
   3. After OHVD alarm timer expires, DMS goes back to blank or to its default message as programmed by the user.
   4. In the initial installation, the DMS are to be blank except when an OHVD warning message is displayed.
   5. DMS are paid under a separate item.

D. Activate local flashing beacons
   1. Maximum of 1.5 seconds from the time the OHVD senses an over-height vehicle to the time flashing beacons begin operation.
   2. Flashing beacons are paid under a separate item.

E. Capture images on local cameras
   1. Upon receipt of OHVD alarm, camera 1 (attached to OHVD sensor pole) captures a minimum of 4 images showing the over-height vehicle in the scene.
   2. Size/resolution of images shall be user configurable as per the camera specification.
   3. Images shall be in JPG format that does not require a proprietary media player to view as per the camera specification.
   4. Utilize camera’s pre and post alarm video buffering features and edge storage to enable the captured images to clearly show the specific vehicle that was detected by the OHVD sensor.
   5. Camera 2 (located at truck pulloff) Camera shall be capable of being hailed from the HVTMC to receive immediate verification of activity at the truck pull off.
6. The camera shall be capable of video analytic motion detection features. In the initial installation, this function will not be required.

7. Cameras are paid under a separate item.

F. Record digital video on local cameras
   1. Upon receipt of OHVD alarm, record a user-defined length of digital video, in H.264 format and not to exceed 20 seconds in length at 30 fps.
   2. Resolution/format of digital video shall be user configurable.
   3. Recorded digital video shall be in H.264 format that does not require a proprietary media player to view.
   4. Utilize camera’s pre and post alarm video buffering features and edge storage to enable the recorded digital video to clearly show the specific vehicle that was detected by the OHVD sensor.
   5. Provide capability to record digital video when there is activity at the truck pull off area. This activity would be identified using the video analytic motion detection features within the camera. In the initial installation, this function will not be required.
   6. Cameras are paid under a separate item.

G. Communications from each OHVD local site to/from the HVTMC via Verizon Wireless cellular data service
   1. Verizon Wireless cellular data service shall be ordered by and paid by NYSDOT through an existing agreement.
   2. Contractor shall coordinate with NYSDOT and Verizon Wireless to define service, modem/gateway and configuration requirements.
   4. Provide dual antennas or directional antennas if required to maximize the cellular service signal level.
   5. Furnish application software that is capable of being installed on HVTMC computers to remotely access the modem/gateway configuration and status.
   6. Furnish and install additional switches and ancillary devices as required to meet the functional and performance requirements and for a complete and operational system.

H. Send OHVD alarm message and captured images from cameras to the HVTMC
   1. Upon receipt of an OVHD alarm, send an alarm message and the captured images to the HVTMC.
   2. Use Event/Action functionality within the camera – see separate camera specification.
   3. May be achieved using email with attached files, or with an alarm message that appears on an operator workstation to notify of the alarm and the transmitted files.
   5. Images will be sent to HVTMC staff – coordinate with NYSDOT to obtain addresses.
I. Remote upload of stored images and video
   1. HVTMC staff shall be able to remotely communicate with the camera through the Verizon Wireless data network and upload stored video and images.

J. Send H.264 streaming video to the HVTMC on demand
   1. When requested by HVTMC staff, stream live H.264 digital video from the camera. Stop streaming on request.
   2. Continuous streaming of video is not required.

K. Send text message or pre-recorded voice messages to HVTMC staff
   1. Upon receipt of an OVHD alarm send a predetermined user-configurable text or voice message to a predetermined user-configurable email addresses over the Verizon Wireless network.
   2. The messages shall be sent to HVTMC telephone numbers – The contractor shall coordinate with the EIC to obtain telephone numbers.

L. Send failure alarm to HVTMC
   1. Upon OVHD sensor failure, send an alarm message to the HVTMC.
   2. Alarm message sent to the HVTMC using email, or with an alarm message that appears on an operator workstation to notify of the alarm and the transmitted files.
   3. Communications over the Verizon Wireless data network.
   4. Images will be sent to HVTMC staff – coordinate with NYSDOT to obtain email or other address.

M. Log detections and notifications
   1. Electronically log time-stamped OHVD alarms, OHVD failures, emails, and text/voice messages sent.
   2. Log shall be in delimited text or other open and documented format.
   3. Store log for remote upload by HVTMC staff.

N. Operation without cellular service
   1. The OHVD system shall operate locally when cellular service is out of service.
   2. Local operation shall at a minimum include the automatic display of DMS messages, activation of flashing beacons due to detection of an over height vehicle
   3. The system shall log and store photos with time stamps.

O. Recovery after electric power and / or communication network failure
   1. The OHVD system shall completely recover from power failure and resume normal operations without user intervention.
   2. The OHVD system shall completely recover from communications failure and resume normal operations without user intervention.

2.02 Environmental
A. All material shall be environmentally ruggedized, suitable for year-round, outdoor, roadside service conditions in the project area without the use of air conditioning.
B. Minimum operating temperature range of equipment shall be from -30 deg F to +122 deg F.

2.03 **Spare Parts**

A. Furnish one spare OHVD sensor pair complete with three axis mounts, pole mount bracket, cabinet, and control panel
B. Furnish one spare Verizon Wireless cellular data modem/gateway complete with power supply, antennas, and antenna cables. If utilized, furnish the separate Ethernet switch, complete with power supply and cables.
C. Furnish one each of any surge protection devices utilized.

3 **CONSTRUCTION DETAILS**

3.01 Install the OHVD system as referenced in this specification, in accordance with the manufacturer’s instructions and as shown on the contract documents.

3.02 Coordinate details, including alarm inputs and outputs, and connect the Over-height Detector System with the camera, DMS, flashing beacons, and the cellular data communications system.

3.03 Coordinate with NYSDOT to obtain cellular data service and fully configure OHVD system elements.

3.05 All incidental parts and services which are necessary to complete the installation but are not specified herein or on the contract documents, shall be provided as necessary to complete a complete, properly operating, and reliable system. Furnish and install surge suppression devices on the power and communications cabling.

3.06 All work shall be performed by qualified staff experienced in this type of work, and shall be in accordance with the National Electrical Code, National Electrical Safety Code, and all applicable local codes.

3.07 **Certification and Testing:**

A. **Submittals:**
   1. **Data Sheets:** Submit data sheets for approval to confirm that the proposed equipment meets the material requirements. The components shall be thoroughly tested before shipping from the manufacturer’s facility. Submit documentation of these tests.
2. Shop Drawings and Schematics: Submit shop drawings and schematics for approval. NYSDOT shall provide samples for the required format and level of detail.
   a) OHVD sensor, control panel, and mount detail drawings
   b) Assembly drawing of OHVD sensors and cabinets mounted to poles
   c) Block diagrams showing all wired connections to/from all devices that comprise the OHVD system. Identify individual wire terminations.
   d) Configuration settings and programming information for all devices to a level of detail such that replacement hardware can be programmed and configured for any location within the project.

3. Operations and Maintenance Manuals: Submit manufacturer-provided operations, maintenance and troubleshooting manuals for all components in hard copy and PDF format.

4. All submissions shall be complete and clearly indicate the item number for which the submission is being made and the model or part number for which approval is being sought. Incomplete submissions will be returned for resubmission. The Contractor shall allow the Engineer a minimum of ten (10) working days for review of each complete submission, unless noted otherwise in the Contract Documents.

B. Testing:
   1. Test Procedures: Submit detailed procedures for each required test to the Engineer. The procedures shall include pass/fail criteria based on the requirements herein. The test procedures shall be submitted to the Engineer for approval prior to the test. Only approved test procedures shall be used for the tests. The Engineer shall be notified in writing at least two weeks in advance of the time these tests are to be conducted. Failure to conform to the requirements of any test shall be counted as a defect, and the equipment shall be subject to rejection by the Engineer. Rejected equipment may be offered again for retest provided all non-compliance’s have been corrected and re-tested and evidence thereof submitted to the Engineer.

   2. Design Approval Test (DAT): The DAT is a functional test to demonstrate that the OHVD system components operate separately as required herein and when connected operate as a system to provide the functions required by these specifications and the contract documents. Assemble, connect, and configure all components in a test setting. Components to be included in the test include but are not limited to the Low Light Network Camera with alarm inputs and outputs, the OHVD sensors with alarm outputs, the OHVD control panel, the cellular data modem, the DMS and controller with alarm inputs, the central video management software system to view streaming video, and devices to receive alerts, email messages, and texts/voice messages with attached captured images. The Design Approval Tests shall be conducted within 50 miles of the project site at an agreed-upon location.
3. Stand-Alone Test (SAT): The SAT may only be performed after a successful and approved DAT. The SAT is a functional test to demonstrate that the OHVD system operates when installed at its proposed site, prior to connection to the communications network. This test shall demonstrate OHVD sensor height and alignment, all device configurations, installation, and required functionality. The Contractor shall submit the Stand Alone Test Plan including test procedure, schedule, and test anticipated results and acceptance or failing threshold, to the Engineer for review and approval at least 30 days before tests are to begin.

If a unit fails its Stand-Alone test, the unit shall be corrected or another unit substituted in its place and the test successfully repeated, until successful results are achieved.

If a unit has been modified/repaired/reinstalled as a result of a Stand-Alone test failure, a report shall be prepared and delivered to the Engineer prior to retesting of the equipment. The report shall describe the nature of the failure and corrective action taken. If a failure pattern, as defined by the Engineer, develops, the Engineer can direct that design and construction modifications be made to all affected units by the Contractor without additional cost to the State or any extension of the contract period.

4. Central Test: The Central Test may only be performed after successful and approved Stand-Alone Tests at all field locations. The Central Test is a functional test to demonstrate that the OHVD system, after it has been connected to the communications network, operates as required. The Central Test shall be conducted at the Hudson Valley Traffic Management Center.

The Central Test shall, as a minimum, exercise all functional operations of each unit of equipment in the field and in the control center as an integrated system. This test shall be performed using Contractor furnished test equipment and software with the equipment operated by HVTMC operators.

In the event of a failure of any Contractor supplied equipment, that portion of the system affected by the failure shall be subjected to an additional 30 day test period. The Engineer will make the determination as to which equipment is affected by the failure.

If a unit has been modified as a result of a Central Test failure, a report shall be prepared and delivered to the Engineer detailing the failure corrective actions and retesting procedures. This shall be approved by the Engineer prior to retesting of the equipment. The report shall describe the nature of the failure and corrective action taken. If a failure pattern, as defined by the Engineer, develops, the Engineer can direct that design and
construction modifications be made to all affected units without additional cost to the State or extension of the contract period and after all units have been modified the Central Test shall be repeated for all portions of the system affected by the modified equipment.

5. 90-day Operational Period: The 90-day operational period may only be performed after a successful and approved Central Test. If a failure of Contractor-supplied equipment occurs then the test will be restarted. If a failure of equipment supplied by others occurs then the test will be suspended until the repair is completed by NYSDOT and then the test shall resume for the remainder of the 90-day period.

6. Test Documentation: Submit detailed test documentation for each required test for the approval of the Engineer. The documentation shall identify all configuration parameters for each installation. The documentation shall clearly show which steps passed/failed, include an overall pass/fail grade, and be dated and signed by a minimum of two persons: the performer of the test and the witness of the test. The basis of acceptance is the Engineer’s approval of the documented test results.

In the event of a failure of any Contractor supplied equipment, that portion of the system affected by the failure shall be subjected to an additional 30 day test period. The Engineer will make the determination as to which equipment is affected by the failure.

In the event of failure of equipment or software installed by others, the 30-day clock will be stopped for the affected portion of the system until the problem is corrected. The 30-day period will then resume for the affected portion of the system.

If a unit has been modified as a result of a 90-day Operational Test failure, a report shall be prepared and delivered to the Engineer detailing the failure corrective actions and retesting procedures. This shall be approved by the Engineer prior to retesting of the equipment. The report shall describe the nature of the failure and corrective action taken. If a failure pattern, as defined by the Engineer, develops, the Engineer can direct that design and construction modifications be made to all affected units without additional cost to the State or extension of the contract period and after all units have been modified the 90 Day Operational Test shall be repeated for all portions of the system affected by the modified equipment.”

3.08 Warranties and Guarantees:

A. The Contractor shall provide warranties and guarantees to the State of New York Department of Transportation in accordance with §105-18, Warranties and Guarantees for all material, installation and equipment, except as noted herein;
This warranty shall include repair and/or replacement of all failed components via a factory authorized depot repair service. All items sent to the depot for repair shall be returned within two weeks of the date of receipt at the facility. The depot location shall be in the United States. Repairs shall not require more than two weeks from date of receipt and the provider of the warranty shall be responsible for all return shipping costs. The depot maintainer designated for each component shall be authorized by the original manufacturer to supply this service. A warranty certificate shall be supplied for each component from the designated depot repair site indicating the start and end dates of the warranty. The certificate shall be supplied at the conclusion of the 90 Day Operational Test and shall be in effect for a minimum of one year subsequent to that date. The certificate shall name NYSDOT as the recipient of the service.

3.09 Training:

A. Prior to the installation of any equipment, the Contractor's personnel shall have received training from the supplier on installation, operations, and testing procedures of all equipment. No equipment shall be accepted without written proof of this training prior to installation.

B. In addition, training shall be provided for individuals designated by the Engineer. The training shall be performed within the project area, and shall include materials and manuals for each individual. The training shall be as follows:

1. Engineering Training: A minimum of 8 hours of training for up to ten (10) engineering and operations personnel shall be provided. The training shall include both classroom and hands on demonstration, configuration, software, alarm inputs/outputs, and complete operation and equipment capabilities.

2. Maintenance Training: A minimum of 8 hours of training for up to ten (10) maintenance personnel with an electrical/electronic background shall be provided. The training shall include both classroom and hands on equipment operation and maintenance. It shall include theory of operation, operation instructions, circuit description, troubleshooting, preventative maintenance, field diagnostics, and field adjustments.

4 METHOD OF MEASUREMENT

This work will be measured as the number of complete OHVD field systems (each field system including OHVD sensor pair, control panel, Verizon Wireless modem/gateway, contact closure radio communication devices, configuration and programming) furnished and installed in the field and connected to the HVTMC.
BASIS OF PAYMENT

5.01 The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

5.02 Cameras, DMS, poles, pole foundations, cabinets, conduit, and utility connections are furnished and paid for under other Contract Items unless otherwise indicated on the plans.

5.03 Payment for this item will be made on a partial payment staged basis as follows:

- 25% upon satisfactory completion of the Design Approval Test
- 25% upon satisfactory completion of the Stand Alone Test
- 25% upon satisfactory completion of the Central Test
- 25% upon satisfactory completion of the 90-day Operational Period