ITEM 683.03080010 - VIDEO-BASED AUTOMATIC INCIDENT DETECTION SYSTEM

DESCRIPTION
Under this item, the Contractor shall furnish and install a Video-based Automatic Incident Detection (AID) System at the traffic management center (TMC). The purpose of this system is to continuously monitor and analyze the existing video feeds that come into the TMC from the area’s roadways in order to automatically identify oversize vehicles and wrong-way vehicles. After these incidents are identified, the system shall automatically alert the TMC operations staff, and require the operators to acknowledge these alarms.

The work shall include all hardware, software, ancillary items and services necessary to furnish, install, and test a complete, operational, and reliable AID System. Furnish new video encoders, decoders, transcoders, AID processors, workstations, and/or servers. Integrate the AID system with the existing video system at the TMC to perform the required functions. The AID System may utilize the existing local area network and workstations within the TMC in order to alert TMC operations staff to incidents. The AID system shall provide the means for future additional integration with the existing Advanced Traffic Management System (ATMS) application software in the TMC by third parties.

Existing Video System
The existing video images are typically produced from analog pan/tilt/zoom (PTZ) cameras attached to roadside poles and field cabinets. A PTZ camera then connects a video hub cabinet in the field using a point-to-point fiber optic video/data transmitter/receiver pair. Multiple cameras connect to a video hub. At the video hub multiple incoming analog video feeds are then multiplexed onto the fiber optic trunk cable; in addition, these incoming analog feeds are digitized into mJPEG format using Axis encoders. Multiple video hubs connect to the TMC. Both the multiplexed video and the digitized video are transmitted from the video hub to the TMC over the fiber optic cable plant. At the TMC, the multiplexed video is demultiplexed and input to an existing analog matrix switch.

MATERIALS

Acceptable Manufacturers and Systems
Econolite - Image Sensing Systems (ISS): Autoscope Rackvision - ISS pn530
Citilog: VisioPAD, MediaRoad, and MediaTD
Iteris: Abacus
or approved equal.

Experience Requirements
The manufacturer of the AID System shall have a minimum of ten years of experience in the manufacture of video image detection systems for traffic applications. The proposed AID system shall have been deployed, accepted, and currently is in operation at a minimum of three transportation agencies in North America or Europe (provide references and contact information). Each of these three systems shall include a minimum of twelve cameras.
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**Functional Requirements:**
The AID System shall include all materials needed to meet the functional requirements listed below, and as required for a complete, operational, and reliable system.

**Video Inputs**
Use the analog or compressed digital video formats currently available at the TMC. Furnish all video encoding/decoding and/or transcoding hardware and software needed for the AID to meet the functional requirements. Use existing cameras that were initially installed for general traffic surveillance, and were not specifically located to support AID.

Receive and processes 160 simultaneous video feeds. Allow for future expansion for up to 320 simultaneous feeds without replacement or major rework of the initial system’s components.

Operate with pan/tilt/zoom cameras with presets. Automatically determines when a PTZ camera is at the preset, or at an appropriate scene to be used for AID (i.e., does not require an operator to manually restart AID after the camera is returned to the correct preset.) Integrate with the existing video systems as needed to meet this requirement. Coordinate with the Engineer and TMC Operations to define and optimize presets to support AID.

**Detection Zones**
Video inputs are configurable by the user. User can add, delete, and change inputs. Different detector types (e.g., wrong-way, oversize, etc.) are selectable by user. For systems that require user to define detection zones:

- Detection zones are user-definable through interactive graphics.
- Able to update previously defined detection zones for fine-tuning.

User can verify the real-time detection operation by observing the detectors’ states as vehicles pass them. User can download and upload configurations, apply one configuration to multiple locations, retrieve the current configuration, and back up configurations by saving to a configuration file.

**Vehicle Detection**
Simultaneously detect approaching and receding vehicles in eight traffic lanes per camera. Analyze video images, identify incidents, and generate alarms in real-time. Provide non-volatile data storage for later downloading and analysis. Switch any of the video inputs to a workstation monitor for viewing. Show detector output activity as an overlay on the video. Detect when the quality of the video input from the image sensor is not sufficient for incident detection.

Capture individual or multiple video images (snapshots) or video clips from the input video and transmit these images for display or storage in a file. Image capture and video clip function can be triggered by an incident detected by the AID, or manually by the operator.

**Incident Detection**
Oversize Vehicle Detection:
Calculate vehicle length (may be based on known or measured image feature lengths such as lane widths.) Classify vehicles by length or height. Identify vehicles that are oversize for the roadway they are traveling on, based on user-defined size criteria. Size criteria can be defined by camera, by direction of travel.

Wrong-way Vehicle Detection:
Identify vehicles that are traveling the wrong way on the roadway, based on user-defined direction criteria.

Alarms
Generate alarms based on user selectable criteria, including but not limited to: oversize vehicle detection, wrong-way vehicle detection, video quality, and stoppage of AID due to movement of a camera off of its defined preset or off of a useable video scene.

Transmit alarms to operator workstations and email addresses. User can customize alarm messages.
User can filter alarms by type, schedule, and user/operator/email address. Provide function requiring the acknowledgement of alarms by operators.

Logging
Data logging shall be selectable by the user by type, and shall include the following types:

- Incidents: Log all incidents, alarms and acknowledgements.
- Status: Log malfunctioning system components and processes.
- Operations Data: Log user activity on the system including sign-on, sign-off, etc.

All records shall be time stamped. Store logs for a minimum of 90 days. Provide a user interface for selection, scheduling, and upload/export of logs.

Reports
Reports are the means through which the logged data is summarized and presented. At a minimum, support pdf, text, and spreadsheet formats. Coordinate with the Engineer and TMC Operations to develop a minimum of 5 custom reports from the logged data. Anticipated report types include: a maintenance report summarizing system component status, an operation report summarizing user activity, and an incident report summarizing the incidents detected and alarms generated/acknowledged. Provide a user interface for selection of reports to run by type, by location or device, and by time period.

Video Encoders/ Processors / Servers
Furnish and install video encoders, AID processors and/or AID servers (including any required video input cards) at the TMC in order to process the required number of simultaneous video inputs to the AID system. Processors and/or servers shall communicate with the AID workstation via an Ethernet network connection. Furnish and install network equipment as required including adapters, Ethernet switch, patch panels, cabling, power distribution units, power supplies, and
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cords for a complete and operational system. All equipment shall be mounted in EIA standard 19” racks that are provided by NYSDOT. Provide a 1-RU slide out console with 19-Inch LCD monitor, full keyboard, and pointing device with the server.

**Workstation**
Furnish and install a desktop computer system at the TMC for configuration, testing and monitoring and operation of the AID system. Desktop includes minimum: processor 3.4GHz 4 core, RAM - 8GB, internal hard drive - 500GB, keyboard, mouse, USB 2.0, DVD-RW, Gb Ethernet network adaptor, 24” LED monitor, operating system, MS-Office type suite, anti-virus, and Web browser (coordinate types with NYSDOT requirements). Desktop graphics shall be capable of displaying at least four simultaneous 30 fps, 4CIF compressed digital video streams from the existing cameras with no visible image degradation.

**Future Third Party Integration**
Furnish a software developer’s kit (SDK) to facilitate future third party integration with the ATMS system.

**Software License**
Licenses shall be granted to the Contractor and then transferred to NYSDOT upon final acceptance. Provide licenses for all commercial off the shelf (COTS) software. Provide a license for all AID application software that supports 160 camera inputs. The license shall not expire and there shall be no periodic renewal fee. Provide licenses that allow relocation or re-hosting of server and workstation software by NYSDOT, installation on redundant servers, and installation of the workstation software on additional clients. Provide licenses for the SDK for future third party integration.

**Manuals**
Operations and Maintenance manuals (three digital copies and three paper copies) shall be provided. The manuals shall, as a minimum, include the following:

- List of all hardware and software components installed
- List of all cameras, locations, inputs, detectors, lanes
- Configuration settings and programming information for all devices to a level of detail such that replacement hardware can be programmed and configured.
- Schematic and assembly diagrams for this installation
- Maintenance and trouble-shooting procedures for this installation
- Manufacturer-provided data sheets and specifications for each component
- Manufacturer-provided operations and maintenance manuals for each component
- Manufacturer-provided installation manuals for each component

**CONSTRUCTION DETAILS**
Contractor shall furnish, install, and fully configure the AID system for 160 camera inputs. Fully configure the required detector zones, logs reports, etc. to fulfill the system requirements.

Coordinate with the Engineer and TMC Operations as required to fulfill the system requirements.
Submittals

- 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.
- Shop Drawings and Schematics: Submit shop drawings and schematics for approval. Block diagrams showing all wired connections to/from all devices that comprise the AID system, proposed connections to the existing video system, proposed connections to the existing TMC LAN and power distribution system.

Quality Assurance Provisions
Three (3) types of tests shall be required: Design Approval Test, Stand Alone Test, and Central Test. Each of these tests is described in the following sections. Following a successful Central Test, a 90-day Operational Period shall commence.

The Contractor shall be responsible for developing detailed test procedures for the equipment and for conducting the specified tests to verify satisfactory operation of the equipment. The test procedures shall be submitted to the Engineer for approval prior to the tests. Only approved test procedures shall be used during the tests. A minimum of ten (10) work days shall be allowed for the Engineer's review and approval of the test procedures.

The Engineer shall be notified in writing a minimum of ten (10) work days in advance of the time when these tests are to be conducted.

The results of each test shall be compared with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and equipment shall be subject to rejection by the Engineer.

Rejected equipment may be offered again for retest provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer.

Final inspection and acceptance of equipment shall be made after installation at the locations specified on the plans unless otherwise specified herein.

Design Approval Test
After the submittals are approved, a Design Approval Tests (DAT) shall be conducted by the Contractor, as approved by the Engineer, to determine if the design of the equipment meets the requirements of this specification. The tests shall be conducted in accordance with the test procedures prepared by the Contractor and approved by the Engineer as described in the above section.

In a safe and controlled manner, on a closed course set up by the Contractor, the DAT shall at a minimum show:
o The AID can detect 9 out of 10 wrong way vehicles out of a stream of other vehicles, using camera technology, height, and position similar to the existing PTZ analog cameras. This result shall be repeatable after the PTZ is moved off of its preset position and then restored to it, after communications is lost and restored to the camera and processor, and power after is lost and restored to the camera and processor.

o The AID can detect 9 out of 10 oversize vehicles out of a stream of other vehicles, using camera technology, height, and position similar to the existing PTZ analog cameras. This result shall be repeatable after the PTZ is moved off of its preset position and then restored to it, after communications is lost and restored to the camera and processor, and after power is lost and restored to the camera and processor.

If the equipment fails the Design Approval Tests, the design fault shall be corrected and the entire Design Approval Test shall be repeated. All deliverable equipment shall be modified, without additional cost to the State, to include design changes required to pass the Design Approval Tests.

**Stand Alone Test**

Following a successful DAT, the Contractor shall conduct an approved Stand Alone Test (SAT) of the equipment after delivery and installation at the TMC. The test shall, as a minimum, exercise all stand alone functional operations of the equipment. Approved data forms shall be completed and turned over to the Engineer as the basis for review and rejection or acceptance.

If the equipment fails the SAT, it shall be corrected or another substituted in its place and the test successfully repeated. If a unit has been modified as a result of a SAT 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 the corrective action taken. If a failure pattern, as defined by the Engineer, develops, then he may direct that design and construction modifications be made to all equipment without additional cost to the State or extension of the contract period.

**Central Test**

Following satisfactory completion of the SAT, coordinate with the Engineer and TMC Operations to connect the AID system equipment to the existing communications network and video system. Then configure the AID system for all 160 video inputs and detection zones and parameters. Conduct an approved Central Test.

The Central Test shall, as a minimum, exercise all functional operations of the equipment as an integrated system. The test shall demonstrate all features specified herein.

In the event of a failure of any Contractor supplied equipment, the test shall be restarted. In the event of a failure of equipment installed by others, such as the existing fiber optic communications network or the existing video system, the test shall be suspended until the problems have been corrected, and then the test shall be resumed from the point of suspension. The test shall not be suspended due to failures of individual cameras, so long as the AID system is correctly reporting
and responding to their status. If a unit has been modified as a result of a Central 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 the corrective action taken. If a failure pattern, as defined by the Engineer, develops, then he may direct that design and construction modifications be made to all equipment without additional cost to the State or extension of the contract period.

90-day Operational Period
The 90-day operational period shall 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 NYSDOT occurs then the period will be suspended until the repair is completed by NYSDOT and then resume for the remainder of the 90-day period. If a unit has been modified as a result of an Operational Period 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 the corrective action taken. If a failure pattern, as defined by the Engineer, develops, then he may direct that design and construction modifications be made to all equipment without additional cost to the State or extension of the contract period.

Training
Two types of on-site training at the TMC are required: initial training and follow-up training. Each type shall include two 8-hour days of training, for up to 20 trainees per day, to be performed by a qualified technical representative of the AID system manufacturer. They shall address both operator and system administrator functions. The initial training shall be performed after an approved Stand Alone Test and prior to the completion of the 90-day operational period. The follow up training shall be conducted after successful completion of the 90-day operational period, and prior to completion of the Warranty period. Schedule shall be coordinated with the Engineer to accommodate TMC Operations.

Warranty
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 by the original manufacturer, or via a factory authorized depot repair service. All items sent 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 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 Period 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.

The warranty shall include AID system support for one year, including free and unlimited telephone and email support for the AID system software during normal working hours. It shall
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include a free one-time software upgrade if the manufacturer publishes an updated version of the AID software during this warranty period.

**METHOD OF MEASUREMENT**

The Video-based Automatic Incident Detection System will be measured as a lump sum for the complete system furnished, installed, configured, and tested in accordance with the Contract Documents or as ordered by the Engineer.

**BASIS OF PAYMENT**

The unit price bid for the Video-based Automatic Incident Detection System shall include the cost of furnishing all labor, materials, tools and equipment necessary to complete the work. Payment for all hardware, software, licenses, cabling, connectors, adapters, power supplies, surge protection, labeling, configuration, documentation, coordination, testing, training, warranty, and all other necessary material and services shall be included under this bid item.

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.