1.0 General

1.1 Summary
This specification sets forth the minimum requirements for a Video Imaging Vehicle Detection System (VIVDS), which monitors vehicles on a roadway via processing of video images and provides detector outputs to a traffic signal controller for purposes of stop-bar detection and/or data collection.

The VIVDS shall consist of the following components: Camera assembly, machine vision processor (MVP), detection algorithms, application software, and all associated equipment required to setup and operate in a field environment including a field setup computer (if required), connectors and camera mounting hardware.

The VIVDS provided shall be an Aldis GridSmart (Oak Ridge, TN), or City-approved equivalent.

1.2 Definitions

1.2.1 **VIVDS:** One VIVDS system shall be defined as all components required to effectively monitor and provide vehicle detection for a single intersection or data collection site.

1.2.2 **MVP:** The Machine Vision Processor is the electronic unit that converts the video image provided by the cameras and generates vehicle detections for defined zones and collects vehicular data as specified.

1.2.3 **Field Setup Computer:** A portable microcomputer (PC) used to set up and monitor the operation of the MVP.

1.2.4 **Field Communication Link:** The communications connection between the camera and the VIVDS processor unit.

1.2.5 **Remote Communication Link:** The communications connection between the VIVDS processor unit and the central ATMS (Advanced Traffic Management Systems) central control software system.

1.2.6 **Camera Assembly:** The complete camera assembly used to collect the visual image data. The camera assembly consists of a complementary metal-oxide semiconductor (CMOS) camera, minimum 5 megapixels, environmental enclosure, sun shield, temperature control mechanism, and all necessary mounting hardware.

1.2.7 **Occlusion:** The phenomenon when a vehicle passes through the detection zone but the view from the sensor is obstructed by another vehicle or object. Occlusion can result in the vehicle not being accurately detected by the sensor.

1.2.8 **Detection Zone:** The detection zone is an area created by the user in the application software, and monitored through the MVP such that when occupied by a vehicle, sends vehicle detection to the traffic controller or other system. Detection zones also enable the collection of traffic data.
1.2.9 **Live Video:** Video being viewed and/or processed at a minimum rate of 5 frames per second, in high definition (HD) video format.

1.2.10 **Tracking:** Recognition of a moving vehicle and anticipating its arrival into the detection zone in advance of the vehicle passing the trip line of the detection zone.

### 2.0 Requirements

#### 2.1 VIVDS System

2.1.1 The VIVDS shall utilize downward facing, high definition (HD) camera assembly(ies) to collect video image data for the MVP for purposes of detecting vehicle presence and generating traffic data.

2.1.2 The VIVDS shall utilize and demonstrate tracking-based algorithms (in lieu of trip-line) to provide real-time vehicle detection outputs (within 400 milliseconds (ms) of vehicle arrival).

2.1.3 The VIVDS shall be able to detect either approaching or departing vehicles in multiple traffic lanes simultaneously.

2.1.4 The VIVDS shall provide flexible detection placement anywhere within the field of view of the camera assembly(ies). A single detection zone shall be able to replace one or more conventional detector loops.

2.1.5 The VIVDS shall provide complete visibility to the intersection at all times, including the center of the intersection, for situational awareness and incident monitoring.

2.1.6 The VIVDS shall incorporate the use of three-dimensional vehicle modeling for purposes of improving system performance across various image perspectives.

2.1.7 The VIVDS shall operate at a level of performance comparable to properly operating inductive loops, excluding issues of occlusion due to limitations imposed by camera placement.

2.1.8 The VIVDS shall trigger a state of “all call” to the controller in the event of an equipment failure or system malfunction.

2.1.9 The VIVDS provides both presence and pulse detection for each detection zone. In presence detection, the detection zone is active as long as a vehicle occupies the zone. In pulse detection, the detection zone provides a momentary, on/off detection that does not remain active, even if the vehicle stays within the zone.

2.1.10 The entire VIVDS system must be assembled in the United States of America.

#### 2.2 Camera Assembly

2.2.1 The camera shall connect to the MVP with a single Power-over-Ethernet (PoE) connection.

2.2.2 The camera shall utilize complementary metal-oxide semiconductor (CMOS), minimum 5 megapixels, high definition (HD) digital imagery.
2.2.3 The camera, when properly installed and configured, shall be able to simultaneously monitor up to 5 lanes of traffic per approach.

2.2.4 The camera shall be able to simultaneously monitor more than one approach.

2.2.5 The camera shall feature an ultra-wide-angle lens to maximize field-of-view.

2.2.6 The camera shall feature a heater or other mechanism to prevent the formation of ice and condensation. This shall not interfere with the operation of the camera electronics, and it shall not cause interference with video signal.

2.3 Machine Vision Processor (MVP)

2.3.1 The MVP shall save configurations and zone plans locally to support operation with or without monitoring equipment (monitor, laptop, remote connection) connected.

2.3.2 The MVP shall be rack or shelf mountable, measuring no more than 13” wide, 12” deep, and 5” tall.

2.3.3 The MVP shall be designed to operate reliably in the adverse environment found in the typical roadside traffic cabinet.

2.3.4 The MVP shall operate at 120-240 VAC, requiring 150W or less power.

2.3.5 The MVP shall feature at least 24 detector outputs.

2.3.6 The MVP shall not require shielding from other electronic devices, such as power supplies and communication equipment.

2.3.7 The MVP shall feature input/output interface to Model 170E, Model 2070L, TS1 (type 90) controllers, and TS2 type controllers via a Port 1 SDLC data interface.

2.3.8 The MVP shall feature a USB on the front surface for simple data collection on non-networked systems.

2.3.9 The MVP shall feature both LAN and WAN RJ-45 interface ports on the front surface of the unit.

2.4 Application Software

2.4.1 The application software shall support the creation and modification of at least twenty-four (24) polygonal detection zones within the graphical user interface.

2.4.2 The application software will show images of the detection zones superimposed on the video image of traffic.

2.4.3 The application software shall support the assignment of a detector output to each zone. These assignments can be modified at any time through the software.

2.4.4 The application software shall support direction of travel assignment within detection zones. The vehicle detection zone shall not activate for objects traveling any direction other than the one specified for detection. Cross-street and wrong way traffic shall not cause detection. Programming delay timings (within the MVP or controller) will not be allowed to correct for cross-street or wrong way detection.
2.4.5 The application software shall support the import and export of configurations and zone plans.

2.4.6 The application software shall change the color of the zone within the graphical user interface as vehicles enter or exit a detection zone, changing its occupancy status. This will be required for real-time or historical monitoring, and may be turned on or off by the user at any time.

2.4.7 The application software shall feature the ability to digitally pan, tilt, and zoom within the camera’s field of view without physical movement of the camera, lens, or other moving parts.

2.4.8 The application software shall maintain a database of current and historical traffic data, and allow for the user to run reports against this data to include traffic counts, turn movements, speed, and classification at a minimum.

2.4.9 The application software shall feature the ability to mask objects that occlude the camera field of view and/or disrupt the camera automatic gain and exposure control.

3.0 Other Requirements

3.1 Installation and Set-Up

3.1.1 The camera assembly(ies) shall be capable of accurate detection when mounted greater than 30 feet above the road surface.

3.1.2 The camera assembly(ies) shall be capable of accurate detection when mounted up to 150 feet from the stopbar.

3.1.3 With proper equipment and infrastructure, the entire VIVDS system shall be installed and operational in less than 6 hours.

3.1.4 Installation of the camera shall require no aiming or focusing of the camera assembly.

3.1.5 The minimum VIVDS set-up system, as needed for detector setup and viewing of vehicle detections, shall consist of a field setup computer with application software and/or a video monitor with interface software built-in to the VIVDS processor unit. The field-setup computer as a minimum, shall have an Ethernet port for connection to the MVP.

3.1.6 The system shall be installed by technicians that have been trained and certified by the manufacturer.

3.2 Warranty and Maintenance

3.2.1 The VIVDS shall be warranted to be free of defects in material and workmanship for at least one (1) year following installation, During the warranty period, the supplier shall repair with new or refurbished materials, or replace at no charge, any product containing a warranty defect. The local product dealer, Western Pacific Signal (510-276-6400), shall arrange to pick any material up onsite within 5 working days of a warranty service notification. This warranty does not apply
to products damaged by accident, improper operation, abuse, serviced by unauthorized personnel or unauthorized modification.

3.2.2 The camera shall feature an additional warranty to require no aiming or focusing for a period of five (5) years, following successful installation and configuration by trained and certified installers. This excludes any changes required due to lane shifts or due to extraordinary impact or duress on the camera.

3.2.3 Ongoing software support by the supplier shall include updates of the application software and detection algorithms. These updates shall be provided free of charge during the warranty period or while under an active maintenance contract.

3.2.4 The supplier shall maintain an adequate inventory of parts to support maintenance and repair of all systems under warranty or extended warranty agreement.

3.3 Environmental and Certifications

3.3.1 The system shall be designed to operate reliably in an operating temperature ranging from -34°C (-30°F) to +74°C (+165°F) degrees Celsius at 0 percent to 95 percent relative humidity, non-condensing.

3.3.2 The camera, mounting hardware, and any related material, when properly installed, can withstand 150 mph wind speeds.

3.3.3 The camera enclosure shall be waterproof and dust-tight to the latest (National Electrical Manufacturers Association) NEMA-4 specifications.

3.3.4 The camera shall meet FCC class B requirements for electromagnetic interference emissions.

3.3.5 Vibration and shock resistance meet the requirements of Sections 2.1.9 and 2.1.10, respectively, of NEMA TS 2.

3.3.6 System components comply with the environmental requirements detailed in the NEMA TS 2 standard.

3.3.7 Detection system field hardware shall meet the requirements in the Federal Communications Commission (FCC) 2005 Code of Federal Regulation (CFR) Title 47, Part 15, and not interfere with any known equipment.
GridSmart® Controller Components
(GS-3-TS1, TS2, CBP)
For use connecting the GridSmart® Processors to Controller Cabinets

**TS-1 Cable**
(GS-3-TS1)
For use in TS-1 Cabinets

For Input and Output
12 feet (3.66 meters)
Supplies TSI cabinets with 24 active low inputs and outputs

**TS-2 Cable**
(GS-3-TS2)
For use in TS-2 Cabinets

For use with Y connection to SDLC Bus
6 foot (1.83 meters)
Connects directly to an SDLC port and provides the MMU with a Y connector if the SDLC Bus is unavailable

**Controller Breakout Panel**
(GS-3-CBP)
For use in 170/2070 Controllers

For connection to a Type 170 or 2070 Controller
Requires GS-3-TS1 cable (sold separately)
The Breakout Panel exposes the green phase information on the 170/2070 controllers

Made in the USA • 865-482-2112 • www.gridsmartapp.com
GridSmart® Processors
(GS-3-CPV & CPV2, GS-3-CPH & CPH2)

Networkable CPU with NEMA TS1 & TS2 Interfaces

Single Camera Processor - Available in Horizontal & Vertical
(GS-3-CPV & GS-3-CPH)
Well suited for cabinets with limited shelf space

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<th>Connectivity</th>
<th>LAN Interface, Camera interface, WAN interface</th>
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<td>Power Consumption</td>
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<td>Vertical Processor Dimensions &amp; Weight</td>
<td>8.18” x 10.75” x 9” 11 lbs</td>
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Dual Camera Processor - Available in Horizontal & Vertical
(GS-3-CPV2 & GS-3-CPH2)
3U model allowing units to be rack mounted or placed on shelves with minimal overhead space

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<td>9.87” x 10.75” x 5.25” 11 lbs</td>
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GridSmart® Fisheye Camera (GS-3-CAM)

A fisheye, power-over-ethernet camera in the aesthetic, familiar GridSmart® bell

| Connectivity       | Single CAT5 cable to processor  
<table>
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| View               | Always in focus, 360° FOV  
|                    | No aim, no focus required  
|                    | Auto-controlled internal heaters |
| Power              | 5W, 48 VDC (50W heaters) |
| Megapixels         | 5 MP, always in focus |
| Additional Features| Color imager, 2560 x 1920 effective pixels, Dynamic range, 55 dB, Sealed housing |
| Environmental      | -20°F to +155°F (-29°C to +74°C)  
|                    | 0-95% non-condensing |
| Standards          | IP66 |
| Housing Material   | Milled Aluminum |
| Dimensions & Weight| 10" diameter x 9"  
|                    | 9 lbs |

Protected from the Elements
Traditional traffic cameras point straight towards adverse atmospheric conditions, which makes them more susceptible to damage and negative performance in emergency conditions. Only the GridSmart® Fisheye points down, with the novel bell-shaped housing to protect it from the elements. By pointing down instead of out, the bell rim is able to protect the lens, while the lens does not look directly into the sun or weather elements like fog, rain, and snow that traditionally affect traffic camera performance.

See the Entire Intersection
Only the GridSmart® Fisheye gives you the ability to capture 360° views of your intersection at one time, giving you more accurate counts and data so that you can be sure your traffic plan is running at optimal performance. Eliminate the need for costly counting studies with more accurate information, empowering you to make stronger traffic mitigation plans.

Guaranteed Focus for Life
The GridSmart® camera is guaranteed to never need to be aimed or focused. This means you never have to worry about missed calls because the camera is aimed in the wrong place or unfocused, nor will you ever have to send a maintenance team out to adjust the camera-saving you time, stress and money.

Solutions for Cities of All Shapes & Sizes
Only GridSmart® can deliver the camera system that brings more technology to your fingertips than traditional systems, while also helping you stay in budget. Combined with the powerful GridSmart® CPU, your intersection will be running smoother than ever.

See More, Spend Less

Made in the USA  ·  865-482-2112  ·  www.gridsmartapp.com
GridSmart® Mounting Hardware

36” (0.91m) Banded Bracket (GS-3-BND)
Additional sizes available for larger poles

1.9” to 4.5” (0.05m to 0.11m) Tenon Bracket (GS-3-TEN)
Used for mounting on Luminaire Arms

84” (2.13m) Cable Bracket (GS-3-CBL)
Additional sizes available for larger poles

Swivel Bracket (GS-3-SBK)
Recommended for all installations
Allows installers to level the camera on both planes at a single point

84” (2.13m) 90° Mounting Arm Pole (GS-3-A84)
Can be used on a mast arm structure where additional height is needed to achieve the best possible view of the intersection

58” (1.47m) 90° Mounting Arm Pole (GS-3-A58)
Generally used where more height is required to meet the 30’ height requirement

34” (0.86m) 90° Mounting Arm Pole (GS-3-A34)
Generally used where the 30’ height requirement is already met via a Luminaire Arm or other adequate structure
## GridSmart® Processors

**(GS-3-CPV & CPV2, GS-3-CPH & CPH2)**

Networkable CPU with NEMA TS1 & TS2 Interfaces

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