Project # C-07-10

BRIDGE VEHICLE IMPACT ASSESSMENT

Task 4: Identify Specific Bridge Hit Prevention

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Security Classification
None

University Transportation Research Consortium
New York State Department of Transportation
INTRODUCTION

The PI visited four regions of NYSDOT (Region 5, Region 8, Region 10 and Region 11 (NYC)) to identify prominent factors responsible for high rates of truck impacts to bridges and possible preventive measures. A detailed report on visits to selected bridges in these 4 regions is presented in the Task 3 report. Based on these field visits, specific measures to reduce bridge hits in these 4 regions are presented in this Task 4 report.

SPECIFIC BRIDGE HIT PREVENTION FOR REGION 5

As described in the Task 3 report, bridges that typically get impacted by vehicles in Region 5 are railroad bridges that carry the CSX Railroad. The following measures may be effective in reducing frequencies of hits at these locations.

(A) Outreach and Education

Typically, bridges that have been hit multiple times in Region 5 are located over roads that have businesses involved in significant trucking activities. This area is also close to the Canadian border and many truck drivers may be confused between SI or US units and the height of the truck.

Education and outreach to businesses in this area about the risks and economic impacts caused by impacts to low-clearance CSX bridges may be a helpful tool for educating drivers. These outreach activities may include:

• Raising awareness about the frequency of bridge hits in the area through meetings with leading trucking industries.

• Educating the trucking industry about any confusion or misunderstanding that may be leading to increased hits.

• Flyers and posters about damages caused by bridge hits and the detrimental impact on their businesses.

• Requiring truck drivers to post the exact height of their truck (including cargo) in US units in the cabin so that it is within eyesight of the driver.

(B) Signage and Lighting:

Most of the CSX bridges hit multiple times had vertical under-clearance signs on the bridge itself. These signs aren’t sufficient due to poor visibility during nights when the trucking activity is likely to be significant. The recommended Signage and Lighting measures are:

• Locate low vertical under-clearance signs both on the bridge and at least before the safe stopping distance from a bridge.

• Lighting to illuminate signs at night.

• Locate low vertical under-clearance warning signs and ‘No Left Turn’ or ‘No Right Turn’ signs on roads from driveways of trucking businesses or businesses with trucking activities in the direction of low under-clearance bridges. These signs should be designed to comply with MUTCD, while conveying intended messages to drivers.

(C) BIN 1022810 has been hit because of a bump in the road, although the vertical under-clearance is 14’10”’. It is possible that the under-clearance of this bridge became smaller because of paving. Measures should be taken to:

• Verify under-clearance.

• Smooth bump near the bridge.
• Increase under-clearance by milling down the pavement.

SPECIFIC BRIDGE HIT PREVENTION FOR REGION 8

Almost all hits to bridges in Region 8 can be attributed to the illegal presence of trucks on Parkways. The following measures are recommended in order to reduce incidents of bridge hits in the region:

(A) Enforcement: Almost all hits are caused by the illegal presence of trucks on Parkways. This behavior can be discouraged by imposing penalties (e.g., civil penalties by the NYSDOT enforcement division) that will make the use of parkways economically unattractive for trucks. The level of penalties must be decided by local and state agencies. Trucks causing multiple hits because of their presence on parkways should be penalized more strictly.

(B) Signage: It has been observed that most of the signs on low under-clearance bridges are located on the bridge itself. Most of the impacts occur because of a truck entering a Parkway ramp and facing the bridge within 50 yards after exiting the ramp. Many of these incidents can be prevented by:

(i) Installing low vertical under-clearance signs at the entrance of a Parkway that are clearly visible to truck drivers before entering the ramp. This is in addition to the sign installed on the bridge.

(ii) Installing “No Commercial Vehicles” and “No Trucks or Tractors” signs at the entrance of the ramp, that are clearly visible to truck drivers before they enter the ramp.

(iii) Installing “TRUCKS STOP ON SIDE” or an equivalent sign complying with the MUTCD 50 yards before the bridge. It should be noted that this sign is not in the MUTCD. Hence, the NYSDOT Traffic and Safety Division must decide on an equivalent sign in the MUTCD or seek a waiver to install this sign.

(iv) The bridge carrying King St over Hutchinson Parkway has been impacted 62 times. Bridges on either side of this bridge over Hutchinson Parkway have been impacted less frequently. This may be occurring due to a misleading “No Left for Trucks” sign, which may imply that a right turn is allowed (See Figure 1 below). This confusion should be corrected by installing a “No Trucks or Tractors” sign at the ramp of the Parkway.

Figure 1: Signs on King Street near the Entrance of Hutchinson (Merritt) Parkway (Photo from Google Maps).
(C) Over-Height Detection Systems (OHDS): Although improved signage may help in reducing the number of multiple hits on bridges, over-height detection systems may be necessary near some bridges to provide additional warning signs to negligent drivers.

A detailed description of some of the most effective over-height detection systems based on the Phase II survey of various state DOTS is presented in Appendix A. Technical specifications of some selected OHDS are presented in Appendix B. Desirable features of an over-height detection system should be:

(i) Automatic detection, with minimum false positives.
(ii) Applicable for low speed highways.
(iii) Capability to activate red light and warning message.
(iv) Relaying of warning message to police dispatch.
(v) Automatic video-recording during activation.

It is not necessary to install OHDS on all ramps. Ramps to the Hutchinson Parkway in the vicinity of frequently hit bridges may be the best candidates. It should be noted that the installation of an OHVD System with the features described above will facilitate in developing a better understanding of factors contributing to multiple hits (e.g., reasons a truck entered a ramp of parkway, out of state or in-state trucking companies, etc.). This may be helpful in designing effective mitigation strategies (e.g., enforcement policies, outreach materials, etc.) to reduce bridge hits.

SPECIFIC BRIDGE HIT PREVENTION FOR REGION 10

Although Region 10 has extensive signage on routes leading to ramps of the Northern State Parkway (NSP) and on the ramps of the Parkway, low vertical under-clearance bridges in this region are still being impacted. Figure 2 shows the histogram of annual hits on bridges in this region. It is observed that after a maximum of 68 impacts in 2005, the number of impacts in 2006 and 2007 decreased to 48 and 39, respectively. The impacts for 2008 are only for part of the year. The significant decrease in impacts in 2006 and 2007 could be attributed to increased signage in Region 10, since most of the signs in Region 10 were installed after 2005.

Based on visits to various bridges in Region 10, the following three prevention measures are proposed:

(A) Over-Height Vehicle Detection Systems: It has been observed that ramps to both the NSP and I-495 from the Seaford Oyster Bay Expressway are within 0.25 miles of each other. The resulting confusion due to their proximity to each other results in many trucks entering the NSP and hitting the Seaford Oyster Bay Expressway. An over-Height Vehicle Detection System (OHVDS) with red light and warning message, as described previously for Region 8, may help the truck drivers, which illegally enter the ramp, stop before impacting the bridge.

(B) Enforcement: As described for Region 8, enforcement is necessary to discourage truck drivers entering Parkways.
(C) **Signage Message:** All Signs in Region 10 prohibit vehicles with a height more than 7’10” from entering Parkways. Truck drivers, knowing that bridge clearances are higher than this, may not be taking these signs seriously. Signs showing posted legal height of the bridge may be more effective in preventing truck drivers from entering parkways.

![Figure 2: Annual Bridge Hit Frequencies in Region 10 of NYSDOT.](image)

**SPECIFIC BRIDGE HIT PREVENTION FOR REGION 11**

Based on visits to various bridges, the following specific measures are recommended for Region 11:

(A) **Enforcement:** Like Regions 8 and 10, a significant numbers of impacts occur on bridges over parkways. One proposed measure that would aid in deterring truckers from entering the Parkways is increased enforcement as described for Region 8.

(B) Road geometry and a bump are causing impacts to a bridge over the Brooklyn Queens Expressway (BQE) near the Brooklyn Bridge. At this site,

- Maximum speed limit should be reduced.
- Bump should be removed and placed away from the bridge if speed control is the objective.
- Measures should be taken to increase the bridge vertical under-clearance by milling down the pavement. An increase of under-clearance by only a few inches can make a significant difference.

Bridges over the BQE and other expressways are frequently impacted by improperly
secured construction equipment/dump trucks, resulting in serious damages. Over-Height Vehicle Detection Systems should be installed before all such vulnerable bridges.

Other General Measures:

(A) It has been observed from data collected by New York State Troopers after an impact that a large number of drivers use general purpose GPS. These systems don’t warn truck drivers about Parkways and associated low vertical under-clearance bridges. Development of a GPS for trucks, that will automatically avoid Parkways and low vertical under-clearance during routing, could have a significant impact on reducing the frequency of vehicle impacts on bridges. Availability of this system will improve the safety of bridges statewide.

(B) It is possible that truck drivers may not know the exact height of their cargo, or may not be able to make a decision whether their cargo is higher than the vertical under-clearance of the bridge based on their recollection of the cargo height. A requirement to post the vehicle height inside the truck cabin, within the eyesight of the driver, may be helpful in making a decision to stop the truck before impacting the bridge.

(C) Many drivers, knowing that the posted under-clearance may be less than actual one, may not trust posted vertical under-clearance signs. Posting both legal and actual clearances, combined with education and outreach, may be helpful in reducing any doubts the drivers may have.

OVER-HEIGHT DETECTION SYSTEMS

Several effective over-height detection systems were identified through the stage-2 survey during Task 2. Two systems, HISIK 450 by SICK and Double Eye Z-Pattern by Trigg Industries, have been found to perform extremely well on highways by many state DOTs. A product survey has been done to identify important features of these two systems. In addition to these two systems, a survey of systems similar to these two systems has also been carried out. It should be noted that a majority of bridge hit incidences in Regions 8 and 10 might be prevented by systems with lesser features than those of HISIK 450 and Double Eye Z-Pattern systems (e.g., unidirectional, low speed applicability, red light with passive sign to stop on red, etc.). In addition to automatic over-height detection systems, a vehicle height clearance detector manufactured by Han-D Man & Co has also been investigated. The vehicle height clearance detector system costs $875 (without installation) and operates on the principle that an over-height vehicle will hit a flexible arm to activate an alarm. Hence, the system is guaranteed to be successful. However, legal liability issues related to damages caused to a vehicle or injury to occupants caused by the retracting arm needs to be considered by NYSDOT before selecting this system. If acceptable, the system can be installed on the ramps of all parkways to drastically minimize bridge hits on parkways.

Appendix A presents the table showing a comparison of different systems. Table B shows specifications of systems presented in Appendix A.
### APPENDIX A

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>SICK</td>
<td>HISIC 450</td>
<td>Parallel sub-systems. Alarm and red light activated by an interruption of the light beam by an overheight vehicle</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>N.A.</td>
<td>MD</td>
<td>$4,300 (for a system)</td>
<td>Nearly Maint. Free</td>
<td>Insuff. space</td>
<td>Good</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Double Eye Z-Pattern</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>MO</td>
<td>$10142-$11892</td>
<td>Depend on the Environment</td>
<td>Systems hit by lightening and by a vehicle</td>
<td>Good</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Model # 3400-Z20</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$10142</td>
<td>Depend on the Environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Model # 3401-Z22</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$11892</td>
<td>Depend on the Environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Model # 3402-Z22</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$11892</td>
<td>Depend on the Environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Model #</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes²⁴</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$5434</td>
<td>Depend on the Environment</td>
<td>-</td>
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</tr>
<tr>
<td>TRIGG IND.</td>
<td>Model # DB-R/IR-3200</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes²⁶</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$7634</td>
<td>Depend on the Environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Single Eye without fault</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$3404</td>
<td>Depend on the Environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TRIGG IND.</td>
<td>Single Eye with fault</td>
<td>Detects Overheight vehicle, warning by alarm bell and sign</td>
<td>Selection switch. No tools required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>-</td>
<td>$3652</td>
<td>Depend on the Environment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Han-D-Man &amp; Co</td>
<td>Vehicle Height Clearance Detectors</td>
<td>Pile mounted on a pillar, the arm hits the vehicle exceeding clearance.</td>
<td>Yes</td>
<td>Yes (Sign post on arm)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Long Beach harbor Dept (In Progress)</td>
<td>$875</td>
<td>About $25 per Year</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
</tbody>
</table>
The alarm activates a warning sign with alternating flashers and/or an audible alarm.

The red beam can be Infrared Light and Visible Red Light.

The object must be at least 5cm (2’’) in diameter, 2.5 cm (1’’) above the line of detection and moving between 1km/h (1 MPH) and 120 km/h (75 MPH).

The transmitter and receiver may be direction discerning, which triggers the alarm only when vehicles traveling in a certain direction are considered overheight.

Changeable message signs have two or three predetermined messages that become visible when activated. Variable message signs are fully variable and when activated will display a predetermined message (e.g. “WARNING-HEIGHT RESTRICTION”).

A video component can be added to the system to capture and store video images of vehicles which trigger the overheight detector.

Each are fitted with a sender and a receiver.

The light beams across the road at required monitoring height.

The vehicle with a minimum diameter of 100mm, travelling at a speed of up to 100km/h can be reliably detected.

Usually they can discern the direction via intelligent PLC programming.

Traffic lights switch to red.

They installed this system in front of a Tunnel.

Because of fitting to existing tunnel approach.

It is effective at reducing damage in the tunnel from overheight vehicles. It is effective enough that operations place a high demand on the system being functional.

The arm will swing back very soon, and it will cause some legal issues.

A. Overheight vehicle is detected by OVDS
B. First Alarm Bell activated
C. Warning Sign activated
D. Vehicle driver is alerted—first by sound, then by sight
E. Second Alarm Bell activated

Alarm time can be adjusted by customer:
DE-Z/3400 from 2 to 30 seconds
DE-Z/3401, 3402, 3403 from 5 to 60 seconds

Response from Missouri Department of Transportation.

Response from Missouri: Before this system come into use there are 78 hits for 3 years. After they installed this system, they only have a couple of hits in the first 3 years.

Double Eye Z-Pattern (Visible Red/Infrared)
Adjustable by customer from 1 to 30 seconds

Double Eye Z-Pattern (Infrared/Infrared)

Double Eye Infrared
Adjustable by customer from 1 to 30 seconds. Custom alarm times available.

Dual beam
Adjustable by customer from 1 to 30 seconds. Other options available.
Appendix B

International Road Dynamics System

Overheight Vehicle Detection System (OHVDS)
Are your overhead structures being damaged by overheight vehicle collisions? We can help you!

OVERVIEW
IRID is an integrator and supplier of an Overheight Vehicle Detection System (OHVDS) that reduces collisions between motorists and overhead structures. An Overheight Vehicle Detection System detects overheight vehicles moving toward overhead obstacles, such as bridges, tunnels and other structures, and individually warns drivers. The system provides the driver with the opportunity to actively avoid a collision with an overhead structure.

The OHVDS is comprised of a transmitter and receiver. The transmitter contains either an infrared or high intensity, visible red light source that is pulsed across the highway from the transmitter to the receiver. The receiver is designed to issue an alarm if the red beam is blocked by an object at least 5 cm (2") in diameter, 2.5 cm (1") above the line of detection and moving between 1 km/h (1 MPH) and 120 km/h (75 MPH). The transmitter and receiver may be direction discerning, which triggers the alarm only when vehicles traveling in a certain direction are considered overheight.

The alarm activates a warning sign with alternating flashers and/or an audible alarm. In the event of a failure, the system will not activate the flashers on the sign, but will display a constant message, such as "WARNING - HEIGHT RESTRICTION". This system reduces damage to structures by overheight vehicles. The driver is made aware of the danger ahead and is provided with the opportunity to take alternate action or an alternate route.

APPLICATIONS
To provide overheight warning detection for:
- Overpasses
- Traffic tunnels
- Bridges
- Warehouse entrances

BENEFITS
- Driver: Reduces damage to trucks/trailers and occupant injuries
- Government/Owner: Decreases damage to public structures
- Public: Decreases traffic backups due to a reduction of vehicle collisions with overhead structures
- Insurance Companies: Reduces accident claims due to a reduction of truck-overhead structure accidents

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OVERHEIGHT VEHICLE DETECTION SYSTEM

SENSOR TECHNOLOGY AVAILABLE
- Infrared Light
- Visible Red Light

OPTIONAL SIGNS
As an alternative to flashing warning signs, changeable message signs (CMS) or variable message signs (VMS) may be incorporated into the system. Changeable message signs have two (2) or three (3) predetermined messages that become visible when activated. Variable message signs are fully variable and when activated will display a predetermined message (e.g. "WARNING - HEIGHT RESTRICTION"). During times when the message sign is not activated, the sign may display any operator-defined message or image.

OPTIONAL VIDEO
As an option, a video component can be added to the system to capture and store video images of vehicles which trigger the overheight detector.

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>115 VAC +/- 10%, 60/60 Hz</td>
</tr>
<tr>
<td></td>
<td>Other options include 24 VDC solar power on 230 VAC on special order for certain models of transmitter and receiver</td>
</tr>
<tr>
<td>Output</td>
<td>Form C, dry relay contact closure</td>
</tr>
<tr>
<td></td>
<td>Contacts rated 115 VAC 10A, protected by an 8A circuit breaker</td>
</tr>
<tr>
<td>Climatic Operating Range</td>
<td>-40 to + 58°F (-40 to +135°F)</td>
</tr>
<tr>
<td>Environmental Control</td>
<td>Internal thermostat controls: air flow which reduces moisture and maintains internal temperatures during cold weather (on some models)</td>
</tr>
<tr>
<td>Alarm Time</td>
<td>Adjustable between 2 and 30 seconds</td>
</tr>
<tr>
<td>Maximum Range*</td>
<td>Suggested maximum range 60 meters (200 feet) to allow for bad weather and lens contamination. Absolute maximum range of 215 meters (700 feet)</td>
</tr>
<tr>
<td>Reaction Speed</td>
<td>1 to 120 km/h (1 to 75 MPH) for a 5 cm (2&quot;) diameter object 2.5 cm (1&quot;) above the established height of detection</td>
</tr>
<tr>
<td>Housing</td>
<td>External housing is heavy ALMAG casting and sheet aluminum (not less than 1/3cm (1/8&quot;) thickness) to minimize vandalism and provide rigid mounting</td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>14 to 23 kg (30 to 50 lbs)</td>
</tr>
</tbody>
</table>

* Maximum range refers to maximum distance the detector eyes will perform
Detection of vehicles with overheight

The HISIC450 detects vehicles which are too high – at tunnel entrances, low underpasses or bridges, for example. Stop and alarm signals are immediately activated when a vehicle infringes the light beam.

The HISIC system is typically of a redundant design consisting of two subsystems, installed parallel to each other. Each is fitted with a sender and a receiver. The light beams across the road at required monitoring height. Any interruption of the light beam by an overheight vehicle sets off an alarm signal, and traffic lights switch to red for instance.

Response- and OFF-delay times are selectable across a wide range allowing moving obstructions with a minimum diameter of 200 mm, travelling at a speed of up to 100 km/h to be reliably detected.

The usual operating distance of the HISIC450 is 100 m (330 ft) with a scanning range of 300 m (980 ft). As a rule, the width of carriageways is less than 25 m (80 ft), so the received signal strength is enhanced and there is sufficient light in reserve to cope with difficult weather conditions, i.e. rain, snow or dust clouds. However, these atmospheric influences can not cause a false alarm.

Complete systems from one source

Our measurement systems for use in traffic, road or tunnel control are based on the perfect combination of precise optics and high-speed intelligent electronics.

The systems are characterized by:
- high reliability
- robust and weather proof construction,
- easy to operate and low maintenance requirements
- modular and extendable design

Key Features

- Robust cast aluminium housing, sealed to IP 67
- Built-in lens heaters to prevent condensation or icing (option)
- Weather protection against snow, rain and dust clouds
- Optical alignment equipment
- Sensitivity adjustment
- Ambient light insensitivity
- Wide power supply range from 24 up to 240 V AC (universal)
HISIC450 components

Dimensions HISIC450 in mm (in)

Possible adjustments

Connection diagramm

Dimensions Dust protection

Dimensions Ball joint bracket

Technical data

<table>
<thead>
<tr>
<th></th>
<th>HISIC450 (W6/WE45)</th>
<th>HISIC460 (W5/WE Transistor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning range</td>
<td>300 m (984 ft)</td>
<td>300 m (984 ft)</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>24 ... 240 V UC (universal)</td>
<td>10 ... 60 V DC</td>
</tr>
<tr>
<td>Current/power consumption</td>
<td>250 mA/6 VA</td>
<td>≤ 500 mA</td>
</tr>
<tr>
<td>Light transmitter</td>
<td>LED, infrared, pulsed</td>
<td>LED, infrared, pulsed</td>
</tr>
<tr>
<td>Average lift time</td>
<td>100,000 h</td>
<td>100,000 h</td>
</tr>
<tr>
<td>Switching outputs</td>
<td>SPDT, electrically isolated</td>
<td>PNP, N and Q</td>
</tr>
<tr>
<td>Max. switching voltage</td>
<td>120/250 V AC/DC</td>
<td></td>
</tr>
<tr>
<td>Max. switching current</td>
<td>2/4 A AC/DC</td>
<td>200 mA</td>
</tr>
<tr>
<td>Max. braking capacity</td>
<td>120 W/750 VA AD/UC</td>
<td></td>
</tr>
<tr>
<td>Max. response time</td>
<td>≤ 10 ms, max. switching frequency 10/s</td>
<td>≤ 500 μs, max. switching frequency 1000/s</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 67</td>
<td>IP 67</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 800 g (1.7 lb)</td>
<td>approx. 800 g (1.7 lb)</td>
</tr>
<tr>
<td>Contamination signal</td>
<td>100 mA, open collector</td>
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Overheight Vehicle Detection and Warning Systems (OVDS)

What Does Trigg Industries OVDS Do?
- Detects overheight vehicles and warns drivers of an impending problem.
- Directs the driver via warning signs and warning balls to take corrective action.
- Provides secondary warning beyond existing signage in the interest of public safety.
- Reduces exposure to costs associated with incidents or accidents.
- Proven to minimize or eliminate the occurrence of accidents and incidents caused by overheight vehicles.

Industry Standard
- The standard for quality and performance in all environments for thirty-five years.
- Integral to hundreds of state, county and municipal infrastructures coast to coast.
- System of choice for Boston Central Artery Tunnel Project, Cumberland Gap Tunnels, Queens Tunnel and 28 DOTs.
- We provide technical support and documentation from the planning stage through installation.

Applications
- Bridges
- Tunnels
- Overpasses
- Age Airport Overhangs/Walkways
- Temporary Falsework
- Parking Structures
- Equipment Yards
- Railroads
- Car Carriers
- Logging Trucks

Cost Benefit
- One accident usually exceeds the cost of a complete detection and warning system. Trigg Industries OVDS adds an additional layer of protection and helps to minimize or eliminate costs associated with:
  - Injury or loss of life
  - Emergency Response
  - Traffic Delays
  - Administrative costs
  - Structural Repair
  - Insurance Premiums
  - Dispute or Litigation
  - Media Publicity

Highest Reliability and Quality Control Standards
- Installed in some of the most adverse conditions worldwide. Proprietary cabinet design and internal environmental control allows continuous operation in fog, ice, snow, dust and heat. Systems meet ISO/IEC Guide 22 Compliance, CE Mark, NEMA 3R Cabinet Enclosure Rating, CALTRANS lightning and high voltage parameters. We provide extensive documentation and Factory Acceptance Testing protocols.

Innovation
- The Trigg Industries Patented Z-Pattern™ Red/Infrared dual beam array provides the most advanced ability to reject ambient light and virtually eliminates false overheight alarms. Fault Detection and Alert Function notifies Control Optional when system is operating in Single Eye Mode (temporary condition) or has experienced a line power failure. Double and Single Eye systems also offer Fault Detection and Alert Function.

Ease of Use
- Trigg Industries provides specialized mounting brackets for all systems and all elements of the system that allow it to be attached to any sturdy structure. Installation instructions are direct and easy to follow.
**Descriptions**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVDS</td>
<td>Point of detection and direction discernment. Four categories of systems, encompassing ten different models for a wide range of applications.</td>
</tr>
<tr>
<td>Audible Alarm</td>
<td>Sweep of sight is attracted by alarm. First alarm after detection and second above message sign.</td>
</tr>
<tr>
<td>Warning Signs</td>
<td>Standard Warning Sign with alternating flashers includes custom message providing directions to drivers of overhead vehicles.</td>
</tr>
<tr>
<td>Extras</td>
<td>Variable LED Message Signs (VMS) available in two, three and four line formats. PC programmable.</td>
</tr>
<tr>
<td></td>
<td>Poles, sirens, bells, strobes, solar power, loop detector, radio frequency link and alternate mounts available.</td>
</tr>
</tbody>
</table>

**Concept**

A. Overheight vehicle is detected by OVDS
B. First Alarm Bell activated
C. Warning Sign activated
D. Vehicle driver is alerted - first by sound, then by sight
E. Second Alarm Bell activated
Applications

Trigg Industries manufactures complete systems, including detectors, warning signs, alarms, mounting poles and all needed accessories. We build to meet US and international power requirements, as well as AC and solar (DC) configurations.

Trigg Industries offers technical options to meet varying requirements and can provide cost effective solutions for virtually any overheight warning requirement. Custom systems can be provided as required.

- Bridges
- Tunnels
- Overpasses
- Temporary Fasewark
- Railroad Tunnels
- Airport passenger drop-off
- Overhange and pedestrian walkways

- Weigh Stations
- Load Height Verification for:
  - Equipment Yards
  - Car Carriers

OVDS: Detects overheight vehicles.

Parabolic Bell: Alerts and Warns vehicle driver of approaching danger.

Warning Sign: Alerts vehicle driver and provides proper direction.

Parabolic Bell: Alerts and Warns bridge workers of approaching danger.

OVDS: Detects Overheight Vehicles

Warning Sign: Alerts vehicle driver to stop so inspector can provide direction.

Inspection Station
Metro Economy OVDS installed inside parking structure detecting a single height.

Dual Single Eye OVDS installed outside parking structure detecting two different heights.

**EXAMPLE:**
- If vehicle is detected by OVDS #1, driver is instructed by VMS to park where clearance is adequate.
- If vehicle is detected by OVDS #2, driver is instructed by VMS to stop and await further direction.

If a vehicle is overheight, the Variable Message Sign (VMS) displays a sequence of messages instructing driver where or where not to park. The gate can be delayed from opening while messages are displayed.

**EXAMPLE:**
- Message 1: "STOP"
- Message 2: "VEHICLE TOO TALL"
- Message 3: "PARK LEVEL 1 ONLY" or "DO NOT ENTER"
Double Eye Z-Pattern™
Visible Red and Infrared

Model #: 3400-Z, 3401-Z, 3402-Z, 3403-Z

*Patented Visible Red / Infrared Mixed
*Environmental control
*Enhanced rejection of ambient light
*Fault detection and reporting
*Nema 3R cabinet rating
*Direction discerning
*Proprietary ALMAG cabinet design

| INPUT POWER | 115VAC, +/- 10%, 50/60Hz. Other options include 24VDC solar or 230VAC, +/-10%, 50/60Hz operation. |
| OUTPUT | Two Form C, dry relay contact closures for Overhead Alarm Functions. One Form C, dry relay contact closure for Fault Reporting. Contacts rated 115VAC 10A, protected by BA circuit breakers. |
| FAULT REPORTING | DE-Z/3400 - Fault reporting output upon loss of source/detector power or total failure. DE-Z/3401, 3402, 3403 - Fault reporting output upon loss of source/detector power or total failure. Fault Relay toggles at one-second intervals during Single Eye Mode of operation. |
| ALARM TIME | DE-Z/3400 - Adjustable by customer from 2 to 30 seconds. DE-Z/3401, 3402, 3403 - Adjustable by customer from 5 to 80 seconds. |
| ELECTRONICS | Sensors are NEMA 6P enclosure rated. |
| EFFECT OF AMBIENT LIGHT | Use of Dual Beam 'Z' Pattern provides automatic switch to Single Beam Detection Mode of Overheight Protection if the sun or other interference saturates one detector. |
| MAXIMUM RANGE | 700 feet (213 m). Suggested maximum range 200 (61 m) feet to allow for bad weather and lens contamination. |
| DIRECTION SELECTION | Selection switch. No tools or adjustment required. |
| ALIGNMENT | Four LEDs and meter (GO-NOGO functions) provided for ease of alignment and testing. |
| REACTION SPEED | 1 to 75 MPH (1 to 121 km/h) for a 2 inch (50 cm) diameter object 1 inch (2.5 cm) above the detection height. Custom speed/size available. |
| TEMPERATURE RANGE | -40° to +155° F (-40° to +74° C). |
| ENVIRONMENTAL CONTROL | Internal thermostat controls air flow which reduces moisture and maintains internal temperature during cold weather. |
| HOUSINGS | External housing is heavy ALMAG casting and sheet aluminum (not less than 1/8 inch or .318 cm thickness) for rugged durability and extended life. Cabinet design minimizes effects of vandalism and provides rigid mounting. The pole cap serves as a mounting bracket and sighting base with our poles. NEMA 3R Certified. |
| DIMENSIONS | Remote Cabinet: 12¼ x 16½ x 8½ inches (31 x 42 x 22 cm). Master Cabinet: 12¼ x 19¼ x 8½ inches (31 x 49 x 22 cm). |
| SHIPPING WEIGHT | 60 lbs (27 kg). |

West Coast Order: 323-645-9390  East Coast Order: 757-351-3744  Order Online: www.triggindustries.com
# Double Eye

Visible Red or Infrared

**Model #: DE-R/3110 or DE-IR/3111**

- Visible Red or Infrared systems
- Fault detection and reporting
- Environmental control
- Meets Nema 3R Intent
- Direction discerning
- Proprietary ALMAG cabinet design

## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INPUT POWER</strong></td>
<td>115VAC, +/-10%, 50/60HZ. Other options include 24VDC solar or 230VAC, +/-10%, 50/60HZ operation.</td>
</tr>
<tr>
<td><strong>OUTPUT</strong></td>
<td>Form C, dry relay contact closure, contacts rated 115VAC 10A, protected by an 8A circuit breaker. System switches to Single Eye Mode of operation upon loss of either detector.</td>
</tr>
<tr>
<td><strong>FAULT REPORTING</strong></td>
<td>Optional fault reporting output upon loss of power, transmitter failure or either eye blocked for more than 13 seconds. Single Eye mode of operation implemented.</td>
</tr>
<tr>
<td><strong>ALARM TIME</strong></td>
<td>Adjustable by customer from 1 to 30 seconds. Custom alarm times available.</td>
</tr>
<tr>
<td><strong>ELECTRONICS</strong></td>
<td>Sensors are NEMA 3P enclosure rated. Electronic printed circuits for years of reliable operation.</td>
</tr>
</tbody>
</table>
| **EFFECT OF AMBIENT LIGHT** | **DE-R/3110** - Sunlight immunity of 10,000 foot-candles.  
**DE-IR/3111** - Very high noise immunity. |
| **MINIMUM RANGE**      | 10 feet (3 m)                                                              |
| **MAXIMUM RANGE**      | **DE-R/3110** - 800 feet (244 m). Suggested maximum range 200 feet (61 m) to allow for bad weather and lens contamination.  
**DE-IR/3111** - 700 feet (213 m). Suggested maximum range 200 feet (61 m) to allow for bad weather and lens contamination. |
| **DIRECTION SELECTION**| Selection switch. No tools or adjustment required. |
| **ALIGNMENT**          | Two LEDs and meter (GO-NO-Go functions) provided for alignment. No special tools required. |
| **REACTION SPEED**     | 1 to 75 MPH (1 to 121 km) for a 2 inch (5 cm) diameter object 1 inch (3 cm) above the detection height. Custom speed/size available. |
| **COUNTER**            | Records the number of activations.                                          |
| **TEMPERATURE RANGE**  | -40° to +135° F (40° to +57° C).                                            |
| **ENVIRONMENTAL CONTROL** | Internal thermostat controls air flow which reduces moisture and maintains internal temperature during cold weather. |
| **HOUSINGS**           | External housing is heavy ALMAG casting and sheet aluminum (not less than 1/8 inch or .318 cm thickness) for rugged durability and extended life. Cabinet design minimizes effects of vandalism and provides rigid mounting. The pole cap serves as a mounting bracket and sighting base with our poles. Meets NEMA 3R intent. |
| **DIMENSIONS**         | Transmitter: 15½ x 10 x 8¼ inches (39 x 25 x 22 cm).  
Receiver: 12½ x 18½ x 8½ inches (32 x 42 x 21.59 cm). |
| **SHIPPING WEIGHT**    | 45 lbs (20 kg).                                                             |

*West Coast Order: 323-645-8390  East Coast Order: 757-851-3744  Order Online: www.triggindustries.com*
Single Eye
Visible Red or Infrared

Model #: SE-R/3110 or SE-IR/3311

- Visible Red or Infrared systems
- Environmental control
- Fault protection and reporting
- Non-direction discerning
- Meets Nema 3R Intent
- Proprietary ALMAG cabinet design

INPUT POWER
115VAC, +/- 10%, 60/60HZ. Other options include 24VDC solar or 230VAC, +/-10%, 50/60HZ operation.

OUTPUT
Form C, dry relay contact closure, contacts rated 115VAC 10A, protected by an BA circuit breaker.

FAULT REPORTING
Optional fault reporting output upon loss of power, transmitter failure or either eye blocked for more than 13 seconds

ALARM TIME
Adjustable by customer from 1 to 30 seconds. Custom alarm times available.

ELECTRONICS
Sensors are NEMA 6P enclosure rated. Electronic printed circuits for years of reliable operation.

EFFECT OF AMBIENT LIGHT
SE-R/3110 - Sunlight immunity of 10,000 foot-candles.
SE-IR/3111 - Very high noise immunity.

MINIMUM RANGE
6 feet (2 m)

MAXIMUM RANGE
SE-R/3110 - 800 feet (244 m). Suggested maximum range 200 feet (61 m) to allow for bad weather and lens contamination.
SE-IR/3111 - 700 feet (213 m). Suggested maximum range 200 feet (61 m) to allow for bad weather and lens contamination.

ALIGNMENT
One LED and mister (GO-NOGO functions) provided for alignment. No special tools required.

REACTION SPEED
1 to 75 MPH (1 to 121 km) for a 2 inch (5 cm) diameter object 1 inch (3 cm) above the detection height. Custom speed/size available.

COUNTER
Records the number of activations.

TEMPERATURE RANGE
-40° to +135° F [-40° to +57° C].

ENVIRONMENTAL CONTROL
Internal thermostat controls airflow which reduces moisture and maintains internal temperature during cold weather.

HOUSINGS
External housing is heavy ALMAG casting and sheet aluminum (not less than 1/8 inch or .316 cm thickness) for rugged durability and extended life. Cabinet design minimizes effects of vandalism and provides rigid mounting. The pole cap serves as a mounting bracket and sighting base with our poles. Meets NEMA 3R intent.

DIMENSIONS
Transmitter: 15 1/2 x 10 x 6 3/4 inches (39 x 25 x 22 cm).
Receiver: 12 1/4 x 18 1/4 x 6 1/4 inches (32 x 46 x 16 cm).

SHIPPING WEIGHT
40 lbs (18 kg).

West Coast Order: 323-645-8280  East Coast Order: 757-651-3744  Order Online: www.triggindustries.com
# Metro Economy

**Visible Red**

**Model #: ME-R/301**

**Model #: ME-R/305 or ME-R/310**

- Visible Red system
- Nema 6P rating
- Light weight PVC cabinet

<table>
<thead>
<tr>
<th>INPUT POWER</th>
<th>115VAC, +/- 10%, 50/60Hz. Other options include 12/24VDC solar or 230VAC, +/-10%, 50/60Hz operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>Two form C dry relay contact closures. Contacts rated 115VAC 5A, protected by 5A fuses.</td>
</tr>
<tr>
<td>ALARM TIME</td>
<td><strong>ME-R/301 &amp; ME-R/305</strong> - Adjustable by customer from 2 to 30 seconds. Other times available on request.</td>
</tr>
<tr>
<td></td>
<td><strong>ME-R/310</strong> - Duration equal to time beam is broken.</td>
</tr>
<tr>
<td>ELECTRONICS</td>
<td><strong>ME-R/301 &amp; ME-R/305</strong> - Sensors are NEMA 6P enclosure rated. Electronics use printed circuit board for reliable operation.</td>
</tr>
<tr>
<td></td>
<td><strong>ME-R/310</strong> - Sensors are NEMA 6 enclosure rated.</td>
</tr>
<tr>
<td>EFFECT OF AMBIENT LIGHT</td>
<td>Sunlight immunity of 10,000 foot candles.</td>
</tr>
<tr>
<td>MINIMUM RANGE</td>
<td><strong>ME-R/301</strong> - 6 feet (2 m)</td>
</tr>
<tr>
<td></td>
<td><strong>ME-R/305 &amp; ME-R/310</strong> - 1 foot (3 m).</td>
</tr>
<tr>
<td>MAXIMUM RANGE</td>
<td><strong>ME-R/301</strong> - 800 feet (244 m). Suggested maximum range 200 (61 m) feet to allow for bad weather and lens contamination.</td>
</tr>
<tr>
<td></td>
<td><strong>ME-R/305 &amp; ME-R/310</strong> - 80 feet (24 m). Suggested maximum range 40 (13 m) feet to allow for bad weather and lens contamination.</td>
</tr>
<tr>
<td>ALIGNMENT</td>
<td>GO-NOGO green LED indicator provided for alignment. No special tools required.</td>
</tr>
<tr>
<td>REACTION SPEED</td>
<td><strong>ME-R/301</strong> - 1 to 75 MPH (1 to 121 km) for a 2 inch (5 cm) diameter object 1 inch (3 cm) above the established height of detection.</td>
</tr>
<tr>
<td></td>
<td><strong>ME-R/305 &amp; ME-R/310</strong> - 1 to 11 MPH (1 to 121 km) for a 2 inch (5 cm) diameter object 1 inch (3 cm) above the established height of detection.</td>
</tr>
<tr>
<td>HOUSINGS</td>
<td>Schedule 40 PVC shell and NEMA 6P eye enclosure.</td>
</tr>
<tr>
<td>SHIPPING WEIGHT</td>
<td>20 lbs (9 kg).</td>
</tr>
</tbody>
</table>
## one line or two line half scale VMS sign

- Programmable messages
- Bright LED display
- Custom sizes available
- Available in Horizontal (H) or Vertical (V) Configurations
- *V2 available in 3552-H Only

---

**V1 Format -** Message lines cannot be merged for larger characters.

**V2 Format -** Message lines can be merged for larger characters.

**Input Power**

| 117 VAC, +/- 10%, 50/60Hz at 1A. Other options include 24VDC or 230VAC, +/- 10%, 50/60Hz operation. |

**Display**

- 18-Character lines with 2 inch (50 mm) high brightness, Red or Amber LED characters, message input provided by RS232 port. Up to 36,000 characters can be stored. Customer choice of 1200 msd up to 2000 msd brightness LEDs.

**Input**

- Isolated LED on control from contact closure. Rapid turn-on of LED display.

**Effect of Ambient Light**

- Acrylic non-glare face for greater readability.

**Temperature Range**

- -30°F to +130°F (-34 to 54°C) (with heater)

**Environmental Control**

- Optional internal thermostat and heater maintains internal temperature during cold weather. Add 2A (200W) at 117VAC for heater power.

**Housings**

- Weather proof epoxy powder coated steel enclosure. IP65 rating.

**Mounting**

- Well mount standard. Pole mounting or other styles available.

**Dimensions**

- **3551** - 43 x 7.5 x 4 inch (109 x 19 x 10 cm)
- **3552** - 43 x 10.5 x 4 inch (109 x 27 x 10 cm)

**Shipping Weight**

- **3551** - 25 lbs (11 kg).
- **3552** - 30 lbs (14 kg).

---

25 West Coast Order: 323-845-8380  East Coast Order: 757-351-3744  Order Online: www.triggindustries.com
Two Line VMS Sign

Model #: 3505

- Programmable messages
- Bright LED display
- Custom sizes available
- Available in Horizontal (H) or Vertical (V) configurations
- V2 Format for H models only

V1 Format - Message lines cannot be merged for larger characters.
V2 Format - Message lines can be merged for larger characters.

<table>
<thead>
<tr>
<th>INPUT POWER</th>
<th>117VAC, +/- 10%, 50/60Hz at 2A. Other options include 24VDC solar or 230VAC, +/- 10%, 50/60Hz operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISPLAY</td>
<td>12-character line with 4.99 inch (125 mm) high brightness Red or Amber LED characters; message input provided by RS232 port. Up to three messages can be stored for user selection. Customer choice of 1000 cd brightness LEDs with 30 degree viewing angle or 2000 cd brightness LEDs with 15 degree viewing angle. The 2000 cd sign should be mounted so it faces about 15 degrees to the on-coming traffic.</td>
</tr>
<tr>
<td>INPUT</td>
<td>Isolated LED On control from contact closure. Rapid turn-on of LED display.</td>
</tr>
<tr>
<td>FLASHERS</td>
<td>Optional 8 inch (20 cm) LED Yellow Bell with weatherproof enclosure mounted on each side of enclosure. Alternating flasher provides one second On-Off cycle. 8 inch (20 cm) LED Yellow Bell can also be mounted on the top and bottom of the sign if desired.</td>
</tr>
<tr>
<td>EFFECT OF AMBIENT LIGHT</td>
<td>Acrylic non-glare face for greater readability.</td>
</tr>
<tr>
<td>TEMPERATURE RANGE</td>
<td>-30° to +130°F (-34° to 54° C) (with heater).</td>
</tr>
<tr>
<td>ENVIRONMENTAL CONTROL</td>
<td>Optional internal thermostat and heater maintains internal temperature during cold weather. Add 2A (200W) or 6A (600W) at 117VAC for heater power.</td>
</tr>
<tr>
<td>HOUSINGS</td>
<td>Weatherproof epoxy powder coat painted steel enclosure. IP65 rating.</td>
</tr>
<tr>
<td>MOUNTINGS</td>
<td>Well mount standard. Pole mounting or other styles available.</td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td>3505 - 69½ x 18 x 10 inch (173 x 46 x 25 cm) for enclosure. Add 16 inches (41 cm) to each side (or top/bottom) for the alternating flasher LEDs. 3520 - 128 x 84 x 10 inch (320 x 163 x 25 cm) for enclosure. Add 16 inches (41 cm) to each side (or top/bottom) for the alternating flasher LEDs.</td>
</tr>
<tr>
<td>SHIPPING WEIGHT</td>
<td>3505 - 125 lbs (57 kg). 3520 - 250 lbs (113 kg).</td>
</tr>
</tbody>
</table>
Three Line VMS Sign

Model #: 3510

- Programmable messages
- Bright LED display
- Custom sizes available
- Available in Horizontal (H) or Vertical (V) Configurations
- V1 Format

V1 Format - Message lines cannot be merged for larger characters.
V2 Format - Message lines can be merged for larger characters.

<table>
<thead>
<tr>
<th>INPUT POWER</th>
<th>117 VAC, +/- 10%, 50/60Hz at 3A. Other options include 24VDC solar or 230VAC, +/- 10%, 50/60Hz operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISPLAY</td>
<td>12-character line with 4.62 inch (115 mm) high brightness, Red or Amber LED characters, all lines with V1 format, message input provided by RS232 port. Up to three messages can be stored for user selection. Customer choice of 1000 mcd brightness LEDs with 30 degree viewing angle or 2000 mcd brightness LEDs with 15 degree viewing angle. The 2000 mcd sign should be mounted so it faces about 15 degrees to the on-going traffic.</td>
</tr>
<tr>
<td>INPUT</td>
<td>Isolated LED On control from contact closure. Rapid turn-on of LED display.</td>
</tr>
<tr>
<td>FLASHERS</td>
<td>Optional 8 inch (20 cm) LED Yellow Ball with weather-proof enclosure mounted on each side of enclosure. Alternating flashers provides one second On-Off cycle. 8 inch (20 cm) LED Yellow Balls can also be mounted on the top and bottom of the sign (or omitted) if desired.</td>
</tr>
<tr>
<td>EFFECT OF AMBIENT LIGHT</td>
<td>Acrylic non-glare face for greater readability.</td>
</tr>
<tr>
<td>TEMPERATURE RANGE</td>
<td>-30° to +130°F (-34° C to 54° C) (with heater).</td>
</tr>
<tr>
<td>ENVIRONMENTAL CONTROL</td>
<td>Optional internal thermostat and heater maintains internal temperature during cold weather. Add 2A (2000W) or 6A (800W) at 117VAC for heater power.</td>
</tr>
<tr>
<td>HOUSINGS</td>
<td>Weather-proof epoxy powder coat painted steel enclosure. IP65 rating.</td>
</tr>
<tr>
<td>MOUNTING</td>
<td>Wall mount standard. Pole mounting or other styles available.</td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td>68 x 25 x 10 inch (168 x 65 x 25 cm) for enclosure. Add 16 inch (41 cm) to each side (or top/bottom) for the alternating flasher LEDs.</td>
</tr>
<tr>
<td>SHIPPING WEIGHT</td>
<td>150 lbs (68 kg).</td>
</tr>
</tbody>
</table>

West Coast Order: 323-845-8390  East Coast Order: 757-651-3744  Order Online: www.triggindustries.com
Four Line VMS Sign

Model #: 3515 & 3520

- Programmable messages
- Bright LED display
- Custom sizes available
- 3515 in V1 Format
- 3520 in V2 Format

V1 Format - Message lines cannot be merged for larger characters.
V2 Format - Message lines can be merged for larger characters.

INPUT POWER
117VAC, +/- 10%, 60/60HZ at 3A. Other options include 24VDC solar or 230VAC, +/- 10%, 50/60HZ operation.

DISPLAY
12-character line with 4.92 inch (125 mm) high brightness, Red or Amber LED characters, all lines, message input provided by RS232 port. Up to three messages can be stored for user selection. Customer choice of 1000 mcd brightness LEDs with 30 degrees viewing angle or 2000 mcd brightness LEDs with 15 degrees viewing angle. The 2000 mcd sign should be mounted so it faces about 15 degrees to the on-going traffic.

INPUT
Isolated LED On control from contact closure. Rapid turn-on of LED display.

FLASHERS
Optional 8 inch (20 cm) LED Yellow Ball with weatherproof enclosure mounted on each side of enclosure. Alternating flashers provide one second On-Off cycle. 8 inch (20 cm) LED Yellow Balls can also be mounted on the top and bottom of the sign (omitted if desired).

EFFECT OF AMBIENT LIGHT
Acrylic non-glare face for greater readability.

TEMPERATURE RANGE
-30°C to +130°F (-34°C to 54°C) (with heater).

ENVIRONMENTAL CONTROL
Optional internal thermostat and heater maintains internal temperature during cold weather. Add 2A (200W) or 8A (800W) at 117VAC for heater power.

HOUSINGS
Weatherproof epoxy powder coat painted steel enclosure. IP65 rating.

MOUNTING
Wall mount standard. Pole mounting or other styles available.

DIMENSIONS
- 3515 - 66 x 34 x 10 inch (168 x 86 x 25 cm) for enclosure. Add 18 inch (41 cm) to each side (or top/bottom) for the alternating flasher LEDs.
- 3520 - 126 x 64 x 10 inch (320 x 163 x 25 cm) for enclosure. Add 18 inch (41 cm) to each side (or top/bottom) for the alternating flasher LEDs.

SHIPPING WEIGHT
- 3515 - 176 lbs (79 kg)
- 3520 - 250 lbs (113 kg)
### Blank Out Signs

**Model #s:** 3500, 3501, 3502 & 3503

- Easy Installation
- Cost Effective
- H = Horizontal configuration
- V = Vertical configuration

#### HOUSING

- **3500:** 63 x 63 inch (160 x 160 cm) reinforced sheet aluminum (NLT .09) [2 cm]. All aluminum and stainless steel with neoprene seals.
- **3501:** 43 x 43 inch (109 x 109 cm) reinforced sheet aluminum (NLT .09) [2 cm]. All aluminum and stainless steel with neoprene seals.
- **3502:** 20 x 102 inch (51 x 259 cm) reinforced sheet aluminum (NLT .09) [2 cm]. All aluminum and stainless steel with neoprene seals.
- **3503:** 12 1/8 x 48 inch (32 cm x 122 cm) reinforced sheet aluminum (NLT .09) [2 cm]. All aluminum and stainless steel with neoprene seals.

#### SUN SHIELD

- **3506 & 3502:** Sheet aluminum (NLT .06) [.15 cm] projects 1/4 inch (35mm) to shield each element individually.
- **3501 & 3503:** Sheet aluminum (NLT .06) [.15 cm] projects 1 inch (25 mm) to shield each element individually.

#### FACINGS

Blank-out with desired message “OVERHEIGHT” plus “STOP” or “TURN RIGHT”, etc. Alternating amber arrows at top and bottom.

#### FLASHERS

Optional flashers with weather proof enclosure (3502 & 3503 ONLY) mounted on either side/top and bottom of enclosure. Alternating flashers provides one second On-Off cycle.

#### ELECTRONICS

- **3500:** 120VAC 50/60 Hz operating four to eight rapid start fluorescent CVH0 [high output] bulbs for message area and two 12 inch (30 cm) alternately flashing amber arrows.
- **3501:** 120VAC 50/60 Hz operating four rapid start fluorescent CVH0 [high output] bulbs for message area and two 8 inch (20 cm) alternately flashing amber arrows.
- **3502:** 120VAC 50/60 Hz operating four to eight rapid start fluorescent CVH0 [high output] bulbs for message area.
- **3503:** 120VAC 50/60 Hz operating four rapid start fluorescent CVH0 [high output] bulbs for message area.

#### MOUNTING

V protections affixed to the back of the sign match upright supports. Heavy duty stainless steel strips provide horizontal stability.

#### SHIPPING WEIGHT

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3500</td>
<td>260 lbs (117 kg)</td>
</tr>
<tr>
<td>3501</td>
<td>160 lbs (73 kg)</td>
</tr>
<tr>
<td>3502</td>
<td>260 lbs (117 kg)</td>
</tr>
<tr>
<td>3503</td>
<td>120 lbs (54 kg)</td>
</tr>
</tbody>
</table>

*Illustrations not to scale.*
Parabolic Bell

Model #: 3600

- Directional
- Light Weight
- Easy Installation

INPUT
120V/AC, 50/60Hz.

OUTPUT
Bells 101 db at 10 feet (3 m) directed by parabolic shield. Sound reduced to 50 - 60% at sides and rear of bell by the parabolic shield, shield diameter: 38 inch (97 cm).

ADJUSTMENT
Adjustable mounting bracket provided. Other brackets provided as needed.

PARABOLIC DIMENSIONS
38 inch (97 cm) diameter.

SHIPPING WEIGHT
50 lbs (23 kg).

DECIBEL TEST RESULTS

<table>
<thead>
<tr>
<th>Distance From Parabolic Shield</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 feet</td>
<td>101 db</td>
</tr>
<tr>
<td>20 feet</td>
<td>03 db</td>
</tr>
<tr>
<td>30 feet</td>
<td>05 db</td>
</tr>
<tr>
<td>40 feet</td>
<td>07 db</td>
</tr>
<tr>
<td>50 feet</td>
<td>09 db</td>
</tr>
<tr>
<td>60 feet</td>
<td>11 db</td>
</tr>
<tr>
<td>70 feet</td>
<td>13 db</td>
</tr>
<tr>
<td>80 feet</td>
<td>15 db</td>
</tr>
<tr>
<td>90 feet</td>
<td>17 db</td>
</tr>
<tr>
<td>100 feet</td>
<td>19 db</td>
</tr>
</tbody>
</table>
Mounting Poles

Model #: 3701 & 3702

- For Detectors, Signs and Bells
- Strong, light-weight aluminum

One piece, seamless round aluminum tube. Hole is centered 16 inch (46 cm) above the bottom of the shaft and the cover is secured by stainless steel screws. Base flange is one piece cast aluminum socket with 1 1/4 inch (21cm) bolt center. Poles are complete with all hardware, brackets, except base mounting bolts and nuts.

DIMENSIONS

- **3701** - 10 - 18½ feet (3 - 5 m) Pole, Telescoping. Two poles are required for each system.
- **3702** - 10 feet (3 m) Pole, One Piece (for Warning Bell and/or Warning Sign).

SHIPPING WEIGHT

- **3701** - 30 lbs (41 kg)
- **3702** - 60 lbs (27 kg)
Three Axis Mount
Model #: TGZ-MO17

- Designed for the DE-Z Series
- Heavy Duty
- Adjustment in 3 independent axes

Enables independent axis adjustments to match difficult crowns and contours of the roadway.

<table>
<thead>
<tr>
<th>CONSTRUCTION</th>
<th>Three-piece mount of 8mm 5052 aluminum, with stainless steel hardware.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADJUSTMENT</td>
<td>Enables independent adjustment in Pitch +/- 40°, Roll +/- 40° and Heading +/- 60°.</td>
</tr>
<tr>
<td>ATTACHMENT</td>
<td>Designed for pole-top or pole-mount bracket installations via 5/8 inch (2 cm) stainless steel bolt.</td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td>9 x 8 1/4 X 3 3/4 inch (23 x 22 x 9 cm).</td>
</tr>
<tr>
<td>SHIPING WEIGHT</td>
<td>4 lbs (2 kg).</td>
</tr>
</tbody>
</table>

Pole Mount Bracket
Model PMB-405

- Adapts to any size pole or post
- Heavy Duty
- Easy Installation
- Ideal for OVDS and Warning Bell

| SHIPING WEIGHT | 4 lbs (2 kg). |
Loop Detector Interface

Model #: TGL-2001

- Eliminates False Alarms
- Accepts most loop detector outputs
- Internal loop hold adjustments
- Easy installation

The Trigg Industries Loop Detector Interface insures that non-vehicular causes do not false-trigger overhead vehicle alarms. A loop detector (or detectors) in the roadway makes it possible to identify passage so that an overhead alarm is issued only when a vehicle is present. The interface is designed to accept a relay contact opening from a loop detector (or detectors) and a Trigg OVDS relay contact closure. The Model TGL-2001 includes a “Loop Hold” adjustment that allows for slower moving vehicles to be detected.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Specification Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power</td>
<td>115 VAC +/- 10% Hz. Options include 24 VDC solar or 230 VAC +/- 10%, 50/60 Hz.</td>
</tr>
<tr>
<td>Output</td>
<td>Two Form C Dry relay contacts rated at 10A, protected by BA fuses.</td>
</tr>
<tr>
<td>Alarm Time</td>
<td>An Alarm Time adjustment is incorporated that allows a double-pole-throw relay to be energized from 1 to 30 seconds upon receiving a valid alarm. This feature enables the OVDS Alarm Time to be set for a short time (1-2 seconds), which in turn, allows the TGL-2001 control over alarm time.</td>
</tr>
<tr>
<td>Electronics</td>
<td>Heavy duty printed circuit board, terminal strips with Phillips screw connections.</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-40° to +135°F (-40° to +57°C)</td>
</tr>
<tr>
<td>Housing</td>
<td>All electronics are enclosed in PVC NEMA rated cabinet. Cord grips/strain relief connectors are included for cable access. The enclosure need not be mounted near either the loop relay(s) or OVDS but we do not suggest more than 500 feet (152 m) of separation due to the possibility of noise pickup in the cabling. Use of shielded cable may be required in some applications.</td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>20 lbs [9 kg].</td>
</tr>
</tbody>
</table>

West Coast Order: 323-845-8390   East Coast Order: 757-651-3744   Order Online: www.trigging.com
Radio Frequency Link

Model #: RFL-1001

- Wireless cost effective alternative to cable installation
- Mobility - System can be portable
- Antenna options for custom applications
- License-free 900 MHz transmission

### Specifications

<table>
<thead>
<tr>
<th>Input Power</th>
<th>115 VAC +/- 10% Hz. Options include 24 VDC solar or 230 VAC +/- 10%, 50/60 Hz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Two Form C Dry relay contacts rated at 5A, protected by 5A fuses.</td>
</tr>
<tr>
<td>Through-Put</td>
<td>Approximately 1 second.</td>
</tr>
<tr>
<td>Electronics</td>
<td>Heavy duty printed circuit board for years of reliable operation.</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-40° to +135°F (-40° to +57°C)</td>
</tr>
<tr>
<td>Housing</td>
<td>Heavy duty PVC NEMA rated cabinet.</td>
</tr>
<tr>
<td>Range</td>
<td>OMNI Antenna - 1 mile (1.6 km)</td>
</tr>
<tr>
<td></td>
<td>YAGI Antenna - 7 miles (11 km)</td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>20 lbs [9 kg].</td>
</tr>
</tbody>
</table>

West Coast Order: 229-945-8920  East Coast Order: 757-851-3744  Order Online: www.trigginustries.com

30
Solar Power Source

Model #: SELS-2XX

- Cost effective alternative to cable installation
- Can mix AC/DC in installation
- 21 consecutive sunless days capacity standard
- Rechargeable by generator

All Trigg Industries International, Inc., Overhead Vehicle Detection Systems (OVDS) can be operated with solar power. The operating voltage is 24 Volts DC for both the Transmitter and Receiver units. Solar Electric Power Company [SEPCO] is the provider of the solar power system, which is custom configured for each geographic location (at least 7 times US Department of Energy requirements).

The solar power system consists of a solar panel assembly, batteries and solar control electronics. A 24V/DC to 115VAC inverter can be included to supply 115VAC power for the Trigg Industries Warning Sign, Bell or other warning devices. The batteries, solar control electronics and inverter are mounted in vandal proof aluminum enclosures with inside the pole wiring. Mounting poles can be supplied or the customer can supply their own or use existing structures. Proper orientation of the solar panel assembly is necessary.

Solar power is a consideration where costs and/or substantial difficulties (branching, right-of-way, etc.) are encountered in providing 115VAC power to one or both sides of the roadway. The Trigg Industries OVDS can be operated by a combination of solar power and 115VAC without system degradation.

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>24 VDC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRONICS</td>
<td>Enclosed in DOT grade stainless steel cabinet.</td>
</tr>
<tr>
<td>TEMPERATURE RANGE</td>
<td>-40°F to +135°F (-40°C to +57°C)</td>
</tr>
<tr>
<td>SHIPPING WEIGHT</td>
<td>Varies with system requirements.</td>
</tr>
</tbody>
</table>
Features of Our Height Detectors:

- **Spring assembly** guaranteed for life.
- **Four models** from which to choose—available with or without sound detector.
- **Left- or right-hand** installation.
- **Structural steel**.
- **Lettering available for any desired height or language**.
- **No anchor bolts** or templates needed.
- **Direct burial**.
- **Easy to install** to desired height.
- **No shipping delays**. Same-day shipping if order is received before noon, or next-day shipping if order is received after noon. See the [Shipping Crate Dimensions](#).
- **Low maintenance**.
- **Always swings back into position** over traffic lane of drive-thru.
- **Easy ordering**, by fax or [e-mail](mailto:hanndmanco@skoobglobal.net).
- Option of **sign on arm**, available for an additional cost.
- **Custom-designed** height detectors are available, upon request.
- Installation **available worldwide**! (negotiable)