DVSS-101 Installation Manual and Users Guide

This is the Installation Manual and Users Guide for the SpeedInfo DVSS-101 Doppler Speed Sensor

October 31, 2008

Revision History

ECN/ECO	Rev.	Date	Author	Page	Description
N/A	1.0	12/15/04	MD, RG, JB	All	First Draft
N/A	2.0	1/10/05	RG	All	Format, grammatical, spelling
N/A	2.1	2/18/05	JB	11	Deleted Reference to Canadian certification
N/A	2.2	3/2/05	RG	9,10	Added torque spec, Update record keeping
N/A	2.3	7/13/05	RG	6,7,8	Update photographs, capture zone fixes, pole size limitation removed
N/A	2.4	8/13/05	RG	8	Update solar panel sub-assembly description
N/A	2.5	1/11/06	RG	6	MOT update, contractor requirements, and sensor antenna profile for targeting
N/A	2.6	12/21/06	RG	10	Add silicone gel during antenna install
N/A	2.7	10/31/08	CA	All	Format, grammatical, and installation guideline additions

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1. Introduction

This document covers the pole-mounted installation and activation of the SpeedInfo DVSS-101 Doppler speed sensor. These instructions will guide the installer in most cases, but the user will find the sensor extremely flexible and suited to a broad range of mounting options. The DVSS-101 is installed and operated only by SpeedInfo and/or SpeedInfo trained personnel.

Note: Appropriate structural and encroachment permits may be required prior to installation.

2. Sensor Functional Overview

The SpeedInfo DVSS-101 Doppler Speed Sensor is an autonomous, remotely operated traffic speed sensor. It is battery powered and solar-recharged. It uses Doppler radar technology to measure the speed of vehicles in its field of view, calculates the requested traffic information, and other relevant data, and transmits that data back to the SpeedInfo server using a wireless GPRS communications link.

Figure 1 - Installed Sensor

The unit is controlled and operated remotely from the SpeedInfo server using the GPRS data link to send commands and receive data. Placement of the unit is critical to insure accurate targeting of the radar system and accurate positioning of the solar panel. The sensor must be installed by qualified contractors and SpeedInfo-trained personnel.

3. Contractor requirements

The DVSS-101 is installed and operated only by SpeedInfo and/or SpeedInfo trained personnel. Some jurisdictions may require the use of Maintenance of Traffic, or MOT professionals to provide traffic control. Regional requirements will be addressed during contract negotiations.

Minimum equipment requirements:

Cellular phone w/in-car battery charger
State compliant safety vests and hard hats
Regional roadway maps
Hand tools:

- 5/16" open-end wrench for GPRS antenna
- ½", and ¾" sockets and ratchet for nylon nuts
- ¾" Stainless steel strapping tool – BAND-IT clamping system

4. Description

The DVSS-101 is shown in Figure 1 and includes the following components:

1. The DVSS sensor – this is an aluminum cylinder about 4.4 inches in diameter and about 14.4 inches long. It contains a radar element with integrated horn antenna; a 12V sealed lead-acid battery, associated DC-DC power converters, and electronics that perform signal processing, control and communications.
2. Mounting bracket assembly shown in Figure 2 attaches directly to an existing pole and supports the sensor and solar panel.

Figure 2 – Mounting Bracket Sub- assembly

3. Solar Panel – This provides power for charging the internal battery, attaches to the solar panel bracket, and connects electrically to the sensor via a three-pin connector on the backend of the sensor.
4. GPRS antenna – This is a dual mode 850MHz/1900MHz omni-directional antenna for the integrated GPRS radio. The antenna attaches to the sensor via an SMA bulkhead connector on the top of the sensor enclosure. For more difficult installations where radio coverage may be limited, the solution may include a directional GPRS antenna with higher gain. Use only antennas supplied by SpeedInfo specifically for use with the DVSS-101.
5. Pole mounting straps – these are ¾" stainless steel bands that wrap around the pole and secure the bracket on the pole.

5. Installation Procedure

The DVSS-101 is to be installed only by professional installation personnel who have been trained by SpeedInfo and approved by the local Department of Transportation (DOT).

5.1 Introduction

1. The sensor is typically pole-mounted on existing roadside or median infrastructure (e.g. light standard, sign post, gantry signs, CCTV pole, call box, etc).
2. The sensor uses Doppler radar to detect the speed and direction (approaching and receding) of each vehicle within a capture zone.
3. The typical capture zone is an oval-shaped area. The target area will increase as the sensor is pointed further down range. At a range of 400 feet, the capture zone will be approximately 90 feet wide and 75 feet long (six traffic lanes X five car lengths).
4. As required, the capture zone may be adjusted through mounting geometry (height and tilt angle) and lens selection.

5.2 Site Selection

Site selection will generally be determined prior to installation. If not, use the guidelines below.

1. Spacing between sensors is typically about one mile on freeways and ½-mile on arterials.
2. Avoid curved road segments.
3. Avoid locations where on/off ramps will be in the capture zone, or where they will affect speed measurements.
4. Confirm GPRS communications coverage prior to install if possible. Signal strength (RSSI levels) should be at least –95dBm.
5. The pole should be within 101 feet of the traffic lanes.

6. The pole should be tall enough to support a sensor mounted within the recommended range:
    a. Freeways: 20feet to 30feet
    b. Arterials: 15feet to 20feet
7. The sensor must have unobstructed "line-of-sight" to the capture zone.
8. The sensor may be aimed in either direction from the pole
9. The distance between the sensor and the capture zone may range from 200 to 1500 feet, upstream or downstream from the pole location.
10. The solar panel must have unobstructed exposure to the sun for as much of the day as possible. Avoid locations where the solar panel could become shadowed during any part of the day, or year. Keep in mind that the sun's east-to-west track through the sky will be directly overhead in the summer, and move southward through the winter months.
11. At the mounting location, any pole diameter is acceptable. Specific notes are to be taken that indicate pole diameter for estimating strapping material requirements.
12. The sensor should never be mounted where it is accessible to the public.

5.3 Sub-Assembly

Prior to ascending pole, complete the following sub-assembly. Refer to Figure 3 below.

Figure 3 - Sensor Sub-assembly showing solar panel tilt angle

1. Attach solar panel to the solar panel bracket:

2. Lay solar panel flat (do not scratch panel surface) and attach pole bracket assembly. (The pole bracket arm is between the sensor bracket and the solar panel bracket.) Tighten bolt to prevent free movement of the assembly but allow for final adjustment and tightening after the assembly is attached to the pole. (See Figure 3 above)
3. Position solar panel bracket at the proper angle (see Figure 4 below)
4. Tighten small solar panel bolts to twelve (12) foot pounds of torque.

Figure 4 - Solar panel angle table

Latitude	Tilt angle
0 – 15 deg	15 deg
15 – 25 deg	same as lat
25 – 30 deg	lat + 5deg
30 – 35 deg	lat + 10 deg
35 – 40 deg	lat +15 deg
> 40 deg	lat +20 deg
Examples	
Miami	25 degrees
San Diego	42 degrees
San Francisco	52 degrees
DC	54 degrees
New York	65 degrees
Seattle	68 degrees

Note: To prevent damage to the GPRS antenna, do not install the antenna until the sensor is mounted on the pole.

5.4 Mounting

1. Prior to ascending the pole, identify the southern exposure (solar panel should face geographic south), and identify the general area of the capture zone.
2. Ascend the pole with the following items:
    a. Sensor
    b. GPRS antenna
    c. Bracket subassembly with solar panel attached
    d. Pre-cut straps for pole bracket
    e. Hand tools
3. Using the pole straps, attach the solar panel/bracket sub-assembly to the pole. Rotate and position the sub assembly such that:

   a. The solar panel is on the south side of the pole and faces south, with unobstructed exposure to the sun. Make sure that the shadow of the pole will never pass over the face of the solar panel.

   b. The sensor bracket is positioned so that the sensor can be attached with a direct line-of-sight to the capture zone.

4. Starting at the rear of the sensor, slide sensor side channels over the sensor bolt heads until the sensor is weight balanced, about 1/3 the length of the sensor. Tighten the bolts firmly but do not fully torque the nut until final sighting of the sensor.
5. Rotate and tilt the sensor such that the front end is aimed directly at the center of the capture zone. The grooves on the top of the sensor body can be used as aiming sights.
6. Confirm direction, tilt angles of sensor and solar panel.
7. Tighten all hardware being sure to maintain the correct aim of both the sensor and solar panel while doing so.
   a. 1/2″-18 Bolt/Nut – Twelve (12) Foot pounds
   b. 12mm (Same as 3/4″ Hex Head) Bolt/Nut – Forty-seven (47) Foot pounds
8. Install GPRS antenna with clear silicone applied into the antenna connector and then tighten with 5/16″ open-ended wrench.
9. Dress the solar panel cable around the bracket to insure that it cannot interfere with the Doppler beam, and that it cannot cast a shadow on the face of the solar panel.
10. Connect solar panel cable to sensor. The connector is "keyed" – align, press and twist. There should be a firm snap when the connector is fully seated.

Once the solar panel cable is connected, the sensor is automatically activated and will automatically sign on to the SpeedInfo server. After signing on it will immediately begin taking Doppler samples and transmitting them to the SpeedInfo server.

NOTE: DO NOT STAND IN FRONT OF THE SENSOR OR BLOCK THE RADAR LENS DURING THE INSTALL PROCESS. THE RADAR SIGNAL WILL BE REDUCED AND THE SYSTEM WILL BE UNABLE TO MEASURE VEHICLES DURING THE SETU PROCESS. THERE IS NO DANGER FROM THE LOW POWER PULSED RADAR EMMISSIONS, BUT LOOKING DIRECTLY INTO THE RADAR LENS DURING OPERATION SHOULD BE AVOIDED.

5.5 Network Attachment and Aim Verification

1. Sensor beam profiles/targeting zones:
   - ✓ Target distance @ 500 feet – beam width = 100 feet
   - ✓ Target distance @ 750 feet – beam width = 150 feet
   - ✓ Target distance @ 1000 feet – beam width = 200 feet
2. Contact SpeedInfo Operations to verify:
   a. The unit has signed on successfully and has adequate RSSI levels.

   b. The Doppler power levels are acceptable.
   c. The returns and speeds match current road conditions.
   d. Solar panel voltage, current and battery voltage are acceptable.
3. Do not leave the install site without clearance from SpeedInfo Operations.

5.6 Record Keeping

Record the following data:

1. Installation Date
2. Installation Technician
3. Sensor location Lat/long coordinates
4. D.O.T. pole number
5. Street name, highway number, mile marker, cross street as appropriate
6. Installed solar panel serial number and date code
7. Sensor position:
   a. Side of roadway, i.e., north, south, east, or west
   b. Distance from fog-line
   c. Sensor attachment height
   d. Sensor aiming direction
   e. Approaching and receding lane direction
8. Capture zone description (location of center of target zone on roadway) including:
   a. Sensor distance along center line from the sensor
   b. Lane number that is at the center of the target zone
   c. Distance from sensor to centerline measured perpendicular to centerline
9. Traffic control set up/condition; characterize ease of install 1-3, easy to difficult.

6. Operation and Maintenance

The DVSS-101 is normally operated and maintained by SpeedInfo. Control of the sensor requires access to the SpeedInfo server installed at a securely managed co-location site.

Typical operations activities include, but are not limited to:

1. Collecting regular data transmissions that contain speed, speed bin counts, system status, and diagnostic data.
2. Adjusting measurement and reporting schedules.

3. Downloading new operating code.

Maintenance activity is expected to be minimal. Other than repair or replacement of failed components, there is normally no maintenance activity required. The batteries are zero-maintenance sealed lead-acid and will normally require replacement only once every 5-7 years. All other components are expected to last the lifetime of the product and require no on-going maintenance.

7. FCC Notice

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or locate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC ID: SVL-DVSS101

NOTE: Changes or modifications not expressly approved by SpeedInfo could void the user's authority to operate the equipment.