Revision of Section 614

# Radar Speed Feedback Sign (RSFS)

**Revise Section 614 of the Standard Specification for this project as follows:**

**Delete subsections 614.15 through 614.24 and replace with the following:**

## Description

**614.15** This work consists of furnishing and installing a Light Emitting Diode (LED) Radar Speed Feedback Sign (RSFS) equipped with a directional radar unit for changing the message on the sign for oncoming traffic. The sign shall face one direction and shall display a primary and a secondary message.

## Materials

**614.16** RSFS shall meet the requirements shown on the plans and detailed in this specification. The display shall be a character matrix configuration of two lines of 5x7-pixel matrix characters that will allow the display of a pre-determined message defined in this specification. All display elements and modules shall be solid state. No mechanical or electromechanical elements or shutters shall be used.

The RSFS shall include the “YOUR SPEED” legend and should be a black legend on a retro-reflective yellow background. For school zones the RSFS shall include the “YOUR SPEED” legend and should be a black legend on a retro-reflective fluorescent yellow-green background. Retro-reflective sheeting shall conform to the requirements of subsection 713.04. The minimum “YOUR SPEED” letter height should be 4 inches for posted speed limits of 25 miles per hour or less and 6 inches for posted speed limits greater than 25 miles per hour. The format of the message to be displayed in the changeable message sign (CMS) portion of the RSFS shall be “XX” in miles per hour. The color of the CMS shall be a yellow legend on a black background. The minimum “XX” LED letter height should be 12 inches for posted speed limits of less than 45 miles per hour and 18 inches for posted speed limits of 45 miles per hour or higher.

All materials furnished, assembled, fabricated or installed under this item shall be new, corrosion resistant and in strict accordance with the Contract. All details and functionality listed in this specification will be thoroughly inspected and tested by the Department. Failure to meet all details and functionality shown in this specification shall be grounds for rejection of the equipment.

The RSFS shall be powered with an AC power system or solar powered depending on site conditions.

1. *AC Power System.*
	* The power cabinet shall house a universal AC power supply capable of operation from 85-254VAC/47-440Hz. The power supply shall be rated for 60W and a 15VDC output. AC wiring input shall terminate on DIN-rail-mounted components, which includes a 4A circuit breaker.
	* The universal power supply, the DIN-rail assembly, and a separately mounted ground connection busbar shall be mounted to an aluminum base plate within the power cabinet**.**
	* Fluctuations in line voltage within normal limits shall not affect luminous intensity of the display.
	* AC power supply shall be field-replaceable.
2. *Solar Powered.*
	* The solar panel shall have the capability of being mounted in a top-of-pole, or side-of-pole configuration.
	* The solar charge controller must provide four-stage battery charging via pulse width modulation (PWM) and shall have the following features:
		+ Temperature compensation
		+ Low-voltage-disconnect (LVD) – to prevent complete battery discharge.
		+ Battery, state-of-charge and battery fault LED indicators.
		+ Reverse polarity, short circuit, and over-voltage protection.
	* The charge controller must also be impervious to water and dust ingress and have an operating temperature range from minus 40 to 60 °C (minus 40 to 140 °F).
	* The charge controller shall meet all requirements of Underwriters Laboratories UL 1741 and must be Class B Part 15 FCC certified.
	* The charge controller shall be connected to the solar panel and battery inside a weatherproof (NEMA 3R or better) enclosure in natural aluminum or light colored paint to reflect sunlight for increased battery life.
	* Charge controller shall be field-replaceable.

The radar unit shall operate with the RSFS to turn on and then change the primary sign message to a secondary message for the oncoming vehicles. The sign shall include a lockable power shut off mounted to the sign structure within 6 feet of ground level. The sign shall be fully compatible with the mounting hardware and support structure shown on the plans. The sign shall have a minimum design life of 20 years.

1. Materials shall conform to the applicable requirements of the National Electrical Code (NEC) and shall be a type currently recommended and approved by Underwriters’ Laboratories, Inc.
2. All Materials furnished, assembled, fabricated or installed shall be new, corrosion resistant, and in strict accordance with the Contract, and the NEC.

The RSFS shall be able to alternately display two fixed sign messages from a single housing in one direction. The primary message shall be a static message illuminated when a radar indication is triggered. When the radar indication is triggered, the primary static message shall turn on and once a speed threshold is reached a secondary static message shall be illuminated. The display format shall not include animation, rapid flashing, or other dynamic elements. The entire message shall be able to be switched on or off. The sign layouts provided in the plans list the details for the message. The Contractor shall provide final message layouts to the Engineer for review and approval before fabrication of the RSFS. When the RSFS is turned on, the appropriate message shall be displayed and will stay blank when turned off. No phantom words or legends shall be seen under any ambient light conditions when turned off.

The RSFS shall be capable of providing 50 percent dimming at night or during other low ambient light conditions.

The RSFS shall be fully functional while operating over an ambient temperature range of minus 30 to 165 °F including a relative humidity of 0 – 100 percent, condensing.

The RSFS shall come equipped with a global positioning system (GPS) that is equipped with the solar power system capable of operating the GPS continuously for 10 days without any sunlight.

When required by the Region Traffic Engineer (RTE) the RSFS shall be capable of real-time data collection and data storage.

**614.17** **Certifications.** Before start of the installation of the RSFS the Contractor shall provide the following documentation to the Engineer for approval:

1. Shop drawings showing the sign housing and mounting brackets. Shop drawings shall be submitted per subsection 105.02.
2. Manufacturer’s documentation and information on sign software and hardware.

**614.18 Sign Housing.** All component parts shall be easily and readily accessible by a single person for inspection and maintenance. Access shall be from the front by lifting the face of the sign. The housing shall be weather tight, and compliant to the NEMA 3R Standard. The sign housing shall be capable of withstanding a wind loading of 120 miles per hour without permanent deformation or other damage. The performance of the sign, including the visibility and legibility of the display, shall not be impaired due to continuous vibration caused by wind, traffic or other factors. The housing shall be designed to accommodate mounting on the rear vertical plane and shall be structurally sufficient to be mounted to the sign support structure. The sign housing and structural components for the tilting system including bolts and welds, shall be structurally sufficient to perform under all applicable loading conditions including gravity, wind, traffic, weather, roadway deicers, maintenance, and other environmental factors. Certified shop drawings supporting the design of the sign housing and mounting system shall be submitted per subsection 105.02.

Except for the housing, all parts shall be made of corrosion resistant materials, such as plastic, stainless-steel, or aluminum. Painted steel is not acceptable. Self-tapping screws shall not be used. The exterior front face surface shall be coated by a system that meets or exceeds the American Architectural Manufacturers Association (AAMA) Specification No. 2605. The finish shall be matte black.

The housing shall be constructed of aluminum (minimum thickness of 0.10 inches) with a natural mill finish. All exterior seams shall be continuously welded by an inert gas process, except for the coated fascia material. The glazing shall be constructed of 0.236 to 0.250-inch-thick clear polycarbonate sheets with surfaces that resist hazing from UV light, abrasion, and graffiti.

The glazing shall be protected by a coated aluminum mask with apertures punched directly in front of each pixel. The coating shall meet or exceed the requirements of AAMA Specification No. 2605.

The external front face panels shall be thermally insulated from the rest of the sign housing. The glazing, aluminum mask, and the external front face panels shall be easily replaceable from within the sign housing.

The bottom panel of the housing shall have a minimum of four drain holes, with snap-in, drain filter plug inserts. The housing shall be rated for NEMA 3R with the door internally gasketed to provide the necessary seal. All corners shall be welded for stability and watertightness. Silicone or other sealant shall not be used to seal joints.

The sign housing shall come equipped with slotted aluminum extrusions mounted horizontally across the back of the sign. Each extrusion shall accept manufacturer supplied 1/2-inch stainless-steel mounting hardware with bolts that slide within the extrusion for complete adjustability in the horizontal direction. This configuration shall allow the sign to be mounted to one round vertical steel post member.

The angular alignment of the sign housing shall be adjustable in the vertical direction to optimize the viewing angle for approach vehicles.

The ventilation system shall be natural convection or forced air. The system shall be designed to adequately cool the LED pixels along with the front and rear of the display module and all other internal components.

**614.19** **Equipment.** The equipment shall be modular in design such that major portions may be readily replaced in the field. Modules of unlike functions shall be mechanically keyed to prevent insertion into the wrong socket or connector.

All modules and assemblies shall be clearly identified with name, model number, serial number, and any other pertinent information required to facilitate equipment maintenance and replacement.

All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color-coded or appropriately marked.

**614.20** **Electronics.** All electronic components, except printed circuit boards, shall be commercially available, easily accessible, replaceable and individually removable using conventional electronics repair methods.

All Printed Circuit Boards (PCBs) shall be completely conformal coated with a silicone resin conformal coat. The exception for this coating shall be the pixels on the front of the PCB of the LED motherboards and any components in sockets.

All discrete components, such as resistors, capacitors, diodes, transistors, and integrated circuits shall be individually replaceable. Components shall be arranged such that they are easily accessible for testing and replacement. A transformer shall be installed inside the casing if required to step down 110V service to 12V for the LED lighting and radar detection. All circuit designs shall utilize high quality electronic components and shall provide a meantime before failure of at least four years.

The color of the pixels shall be yellow and shall be 40 candelas at 20 milliampere(mA). The brightness and color of each pixel shall be uniform over the entire face of the sign within the 15-degree cone of vision from 1,100 feet to 200 feet in all lighting conditions. Each pixel shall contain two strings of LEDs. The pixel strings shall be powered from a regulated DC power source and the LED current shall be maintained at 25 plus or minus 3 mA per string to maximize life of the pixel. The failure of an LED in one string within a pixel shall not affect the operation of any other string or pixel. The LEDs shall be constructed of aluminum, indium, gallium, or phosphide.

Pixel power drawn from the DC supplies shall not exceed 1.5 watts per pixel, including the driving circuitry.

A photocell shall be installed on the sign. This device shall permit automatic light intensity measurement of light conditions at the sign location. The photocell shall be mounted in a manner to measure ambient light conditions.

Provisions shall be made to prevent perceivable brightening of the sign due to stray light from headlights shining upon the photo sensors at night.

The power supplies shall be paralleled in a diode or configuration such that one supply may completely fail, and the sign will still be supplied with enough power to run 40 percent of all pixels.

All cables shall be securely clamped or tied in the sign housing. Adhesive attachments shall not be used.

The Contractor shall locate the electrical power, as directed, and connect the source to the appropriate termination within the RSFS. A manufacturer’s representative shall be on site for the final inspection for up to three hours and to establish manufacturer’s approval of the installation.

**614.21** **Communication.** The controller software shall be capable of the following:

1. The sign shall be capable of showing no messages (fully blank) until a radar trigger is registered by the system. When a radar trigger is registered by the system the sign shall be capable of displaying one of two static messages.
	1. Primary Message.A message of the vehicle’s actual speed
	2. Secondary Message*.* When the vehicle speed exceeds 10 miles per hour over the posted speed or as specified by the RTE, the RSFS shall display the message “SLOW DOWN”
2. *Radar.* The RSFS shall be equipped with a directional radar unit for sensing and determining the speeds of oncoming traffic only. The radar unit shall be capable of detecting approach speeds from 5 to 100 mph. The radar shall detect average size vehicles from a distance of approximately 1,000 feet. The radar shall be compatible with the remote programming requirements. The radar shall operate in a Radar Trip Mode.

In the Radar Trip Mode, the RSFS shall remain blank until a trigger is received and then display one of two messages under control of the radar: one when the radar indicates a vehicle is traveling above a configurable speed (or “trigger speed”) and a second message when the radar indicates no vehicle traveling over the trigger speed. Note that each of these messages shall allow from one to two pages. To prevent flickering of the message if a vehicle is near the trigger speed, a message dwell time shall keep the message displayed for a configurable number of seconds after the vehicle has dropped below the trigger speed. The dwell time shall default to two seconds.

The radar unit can be externally mounted with tilt and pan adjustments for greater flexibility in alignment or encased in the RSFS unit. The internal radar shall be Federal Communications Commission certified.

1. *Warranty.* The Contractor shall ensure that the manufacturer will guarantee the product for a minimum of one year from the date of shipment. During the warranty period, the supplier or manufacturer shall repair with new or refurbished materials, or replace at no charge, any product containing a warranty defect. Product repaired or replaced under warranty by the manufacturer or supplier shall be returned with transportation prepaid.

During the warranty period, technical support shall be available from the manufacturer via telephone within 8 hours of the time a call is made by the Department, and this support shall be available from factory-certified personnel or a factory- certified installer at no additional charge to the Department.

1. *Maintenance and Support.* The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the RSFS. These parts shall be available for delivery within 30 days of placement of an acceptable order at the supplier's then current pricing and terms of sale for said parts.

The supplier shall maintain an ongoing program of technical support for the RSFS. This technical support shall be available via telephone, or via personnel sent to the installation site upon placement of an acceptable order at the supplier's then current pricing and terms of sale for on-site technical support services.

Installation or training support up to three hours shall be provided by a factory-authorized representative. All product documentation shall be written in the English language.

Four complete sets of operation and maintenance manuals shall be provided. The manuals shall include the following: Complete and accurate schematic diagrams, including a wiring diagram.

* 1. Complete installation procedures.
	2. Complete performance specifications (functional, electrical, mechanical and environmental) on the unit.
	3. Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA or EIA.
	4. Pictorial of component layout on circuit board.
	5. Pin-out and pin-in of connectors.
	6. Complete maintenance and troubleshooting procedures.
	7. Complete stage-by-stage explanation of circuit theory and operation.

In-cabinet wiring diagrams of the RSFS shall be provided in each sign enclosure.

## Construction Requirements

**614.22** The Contractor shall install the RSFS as shown on the plans.

The Contractor shall conduct operational tests, demonstrating these RSFS functions for each sign to be installed, before acceptance by the Engineer:

1. Turning on and off in daytime mode.
2. Turning on and off in nighttime mode.
3. Demonstration of the radar trip to change from the primary message to the secondary message.
4. Demonstration of the dwell and flashing adjustments.
5. Demonstration of the dimming features for the sign.

## Method of Measurement

**614.23** The RSFS will be measured by the actual number furnished, installed and accepted.

## Basis of Payment

**614.24** Payment will be made under:

|  |  |
| --- | --- |
| **Pay Item** | **Pay Unit** |
| Radar Speed Feedback Sign (RSFS) | Each |

Payment will be made per the following:

The Engineer will authorize payment for 90 percent of the unit price bid upon completion of the installation and submission of all certifications.

The Engineer will authorize payment for the remaining 10 percent of the unit price bid upon the successful completion of the testing and according to terms of the Contract.

Payment will be full compensation for all labor, materials, and equipment necessary to complete the work, including the directional radar gun, sign controller, controller interface box, sign housing, electronics, communications, and standard warranty.

Having a manufacturer’s representative on-site will not be measured and paid for separately but shall be included in the work. Testing, training and providing manuals will not be measured and paid for separately but shall be included in the work.