July 3, 2017

REVISION OF SECTION 614

BLANK OUT SIGN (LED) (SPEED RADAR)

**NOTICE**

This is a standard special provision that revises or modifies CDOT’s *Standard Specifications for Road and Bridge Construction.* It has gone through a formal review and approval process and has been issued by CDOT’s Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT’s Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

**Instructions for use on CDOT construction projects:**

Use in projects having Blank out Sign (LED) (Speed Radar)

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

**DESCRIPTION**

This work consists of furnishing and installing a Light Emitting Diode (LED) Blank Out Sign (Speed Radar) 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**

LED Blank out signs 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 5 x 7 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.

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 detailed in this specification shall be grounds for rejection of the equipment.

The radar unit shall operate with the Blank out Sign 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.

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.

All Materials furnished, assembled, fabricated or installed shall be new, corrosion resistant, and in strict accordance with the Contract, and the NEC.

The blank out signs 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 message shall turn on and once a speed threshold is reached a secondary message shall be illuminated intermittently. The intermittent display of the secondary message shall illuminate the message for a period of two seconds on, and then one second off, repeating for a period of 30 seconds or once it does not detect a vehicle exceeding the trigger speed. Once the 30 second period has been reached the display shall return to the static primary message being illuminated for an additional 30 seconds before being turned off completely or back to the second message if another vehicle approaches in excess of the selected speed. 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 prior to fabrication of the blank out sign. When turned on, the blank out sign shall show the appropriate message and when turned off the sign shall be completely blank when not energized. No phantom words or legends shall be seen under any ambient light conditions when turned off.

The blank out signs shall be capable of dimming at night or during other low ambient light conditions.

The blank out sign shall be fully functional while operating over an ambient temperature range of –30 to +165 ° F including a relative humidity of 0 – 100 percent, condensing; and it shall be capable of withstanding wind speeds up to 120 mph in accordance with AASHTO *Standard Specifications for Structural Supports for Highway Signs Luminaires and Traffic Signals*.

1. *Certifications.* Prior to start of the installation of the LED Blank out Signs the Contractor shall provide the following documentation to the Engineer:
2. Shop drawings showing the sign housing and mounting brackets. Shop drawings shall be submitted in accordance with subsection 105.02.
3. Documentation and information on sign software and hardware.
4. *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 mph 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 in accordance with 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 surfaces shall be finish 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 0.100 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 – 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 water tightness. 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 ½ 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.

1. *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.

1. *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 amber and shall be 40 candelas at 20 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 ± 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 Blankout Sign. 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.

1. *Communication.* The controller software shall be capable of displaying the following types of messages:
2. Static messages capable of displaying one of two fixed messages
3. Flashing messages with the following ranges of adjustable timing:
4. Message time on from 0.5 to 60 seconds in 0.5 second increments.
5. Message time off from 0.5 to 60 seconds in 0.5 second increments.
6. Alternating messages capable with the following ranges of adjustable timing:
7. Primary message time on from 0.5 to 60 seconds in 0.5 second increments.
8. Primary message time off from 0 to 60 seconds in 0.5 second increments.
9. Alternate message time on from 0.5 to 60 seconds in 0.5 second increments.
10. Alternate message time off from 0 to 60 seconds in 0.5 second increments.

It shall be possible to flash the design message in an alternating message at the adjustable frequencies listed above for flashing messages. The flashing period shall be a sub-multiple of the associated alternating on time. It shall also be possible to flash the design message in a static message. The sign shall also be capable of showing no messages (fully blank) until a radar trigger is registered by the system.

(f) *Radar.*  The Blank out Sign 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 2000 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 Blank Out Sign 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 shall be mounted outside of the sign. The radar gun shall be mounted on an adjustable bracket, allowing for minor adjustment of both azimuth and elevation.

(g) *Warranty.*  The Contractor shall ensure that the manufacturer will warranty 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.

(h) *Maintenance and Support.* The supplier shall maintain an adequate inventory of parts to support maintenance and repair of the blank out signs. 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 blank out signs. 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:

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

In-cabinet wiring diagram of the blank out sign shall be provided in each sign enclosure.

**CONSTRUCTION REQUIREMENTS**

The Contractor shall install the blank out sign as shown on the plans.

The Contractor shall conduct all tests described herein, which include the following operational tests:

The following blank out sign functions shall be demonstrated for each of the signs installed on the project prior to acceptance:

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

# METHOD OF MEASUREMENT

The Blank Out Sign (LED) (Speed Radar) will be measured by the actual number that are furnished, installed and accepted.

# BASIS OF PAYMENT

Payment will be made under:

### **Pay Item Pay Unit**

Blank Out Sign (LED) (Speed Radar) Each

Payment will be made in accordance with the following:

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