# SPECIAL SPECIFICATION

# XXXX

# In Roadway Lighted Crosswalk Warning System

**Description.** Furnish and install roadway flashing LED lights at a crosswalk that are activated by pedestrians with a pedestrian push button. The System shall be installed to manufacturer's recommended specifications and conform to federal, state or local regulations. The installed system shall comply with National Electric Code (NEC) Article 300, Chapter 7, Section 725-3 rated as "Low Voltage".

**1. Materials:** The in-pavement signal modules will be hard wired according the manufacturer's requirements.

**1) Logic Control Device:**

The system shall include a Power Control Unit (PCU) logic control device designed to run all timing parameters, keep count of the number of valid activations received and monitor the system for basic faults. The logic device shall include a 2 line by 20-character LCD display.

The device shall be capable of displaying different messages to help the user determine the status of the system such as flashing, waiting for pedestrian, or in a stuck mode. Messages are displayed on the screen based on the priority that they are given in the software. If two logic states exist that have user messages occur at once, and then the highest priority message shall be displayed. The user shall be able to view messages being displayed. Each fault message must be cleared by correcting the fault and proceed to the next fault message.

A RS232 serial port shall be available in the PCU built into the microprocessor logic control device to allow for data down load.

When triggered by a push button input, the unit will commence operation. The LCD shall indicate that the output is enabled. Run time shall be re-trigger able, meaning that if another button input is received while the system is in the run mode, the elapsed time function shall be reset to 0, and the count started over again which has the effect of extending the run time of the unit.

The normal flash rate for the lamps will be set to 50-60 flash cycles per minute. The device shall allow the user to modify the timing parameters for run time by using the LCD screen and the user buttons on the face of the microprocessor. User activations for crosswalk applications shall allow for the programming of run times from 1-99 seconds in duration. The device shall provide a minimum of one-10A circuit to drive the flasher circuit. The device shall also be capable of accepting replacement module for field upgrade of the software.

When an audible sound system is incorporated into the IRWL system activation devices an appropriate sound card shall be installed into the PCU by the manufacturer. Specific instructions regarding the audible sound (messages, noises, sounds, etc.) shall be submitted to the manufacturer prior to PCU assembly.

The logic control device software shall be capable of running diagnostics from a user key board located on the control panel. During the diagnostic mode, the unit will display a message on the LCD screen indicating it is in this mode. The software shall also allow one input to be a manual override function for special event use in which continuous operation would be needed. During manual override, the system shall display a message to this effect on the LCD screen so that the user is aware of the operational mode.

For crosswalk applications, the unit shall be capable of incorporating time clock based operation of the flashers for applications such as school crossings. The software shall allow a basic program to be run that provides up to 3 on cycles per day.

### 2) Solar Power and Enclosure:

The system shall also have the capability to utilize a solar power unit such that it can be incorporated into the system to permit stand-alone IRWL system operation. The system should maintain continuous operation between recharges for approximately six (6) days. An appropriate solar system shall meet the following criteria.

**General Performance Specifications**

| Parameter | Value |
|---|---|
| Power consumption | 1 Watt (In Standby Mode) |
| Operating Temp | 0ºC to +50ºC |
| Input Operating Voltage | 17 VDC Solar Panel (Peak Sun) |
| Input Current Protection | 10A Fast Acting Circuit Breaker |
| Input Solar Panel Power | 80 Watts @ 4.7A (Peak Sun) |
| Output Operating Voltage | 13.5 VDC to 15VDC |
| Output DC Load maximum | 10 Amps |
| Enclosure Type | NEMA 3R Aluminum (Lockable) |
| Enclosure Color | White (Standard) |
| Enclosure Size | 45” x 15” x 15” |

### 3) In-pavement Lighting Fixtures and Mounting Bases

The signal head module shall be uni-directional with a clear acrylic “dove” prism lens installed in front of the LED modules. The signal head module shall be completely sealed thereby preventing external moisture intrusion from the roadway or from internal condensation.

The in-pavement LED signal light source shall be visible above the roadway surface no less than by $1/8^{th}$ inch and oriented towards approaching traffic. The signal head module shall rise not more than .5 inch above the roadway surface. The signal head module shall be securely attached to the roadway base plate by 4 recessed stainless steel socket head ¼"-20 screws tighten to no more than 4 PSI.

A watertight connector shall be installed at the factory which connects the sealed solid-state signal head module LED electronic components and the cabling wiring to the IRWL system.

The fixture shall operate on 12V DC. Gel plug connectors shall be provided by the manufacturer for the installer to connect the IRWL system wiring cable to the signal head module connector wiring.

The signal head module shall be fabricated from high strength reinforced fiberglass composite of polyurethane/nylon, and the lighting fixture shall have a black finish.

### 4) Photometric Performance

In-roadway lighting fixtures shall be light emitting diode (LED) type. The light source shall be amber AlInGaP, non-diffused LED lamps. The number of internal signal head module LED lamps shall be 16. The lights shall be visible at a minimum of 400 feet in advance of the crosswalk. The LED signal head module lamps shall flash at the Enlighten1™ flash rate which meets or exceeds standards established by the Federal Highway Administration Manual on Uniform Traffic Control Devices, Section 4L.

**General Performance Specifications**

| Parameter | Value |
|---|---|
| Visibility | ± 20 ° |
| Operating Temp | −20° to +80°C |
| Operating Voltage | 9VDC to 15VDC |
| DC Current @ 12VDC | 0.2 Amps |
| Avg Power Dissipation | 2.5 Watts |
| Luminous Intensity | 252,000 mcd |
| Material | Polyurethane/Nylon |
| Color | Black |

### 5) In Roadway Conductor (cable)

Unless otherwise specified by a qualified electrical design engineer, in-roadway conductors for IRWL system lighting fixtures shall be stranded #14 AWG, Type RHW (600 V power cables, 90°C dry, and 75°C wet). The In-roadway conductors shall be YEL, RED, and BLK in color, **maximum OD 0.17"** can be provided to connect the In- Roadway Warning Signal assemblies to the System PCU. The in-roadway conductors shall be installed according to National Electric Code (NEC) Article 300, Chapter 7, Section 725-3 standards.

In-roadway conductors may be direct buried (No min. depth required per NEC). The in-roadway conductors for activation devices, pedestrian crossing or traffic symbol signs, and additional components shall be multi-stranded #18 AWG/ 8 Conductor (Type TC, UL 1277 600-volt cables, 90°c) with TFN insulation and PVC jacket. In-roadway conductors may be direct buried (No minimum depth required per NEC).

### 6) Non-In Roadway Conductors

Non in-roadway conductors shall be stranded #18 AWG, Type RHH or RHW-2 (Type EPR/Hypalon 600-volt power cables, 90°C dry and 75°C wet), unless installed in conduit.

**7) Conduit**
When required, shall be NEC compliant.

**8) Base Plate Adhesive** The adhesive used to fasten the LED signal module base plates to the asphalt or concrete must be a two-part epoxy supplied by the manufacture.

**9) LED Enhanced Signage**
All signage shall comply with MUTCD standards. The signs shall be manufactured from minimum .08- inch high-grade aluminum coated with 3M Diamond Grade Reflective Sheeting, meeting, or exceeding, ASTM standards for Type III, IV, and IX sheeting.

Each LED module shall operate on 12 V DC and shall employ the Enlighten 1™ flash rate operating at a 50% duty cycle. Each LED module shall be placed in a metal conduit weatherproof housing and securely attached to the sign.

**10) Manually Activated Push Button Device**
System shall also be capable of utilizing a pedestrian operated push button device to activate the system. The push button device shall have the capability of provide audible sounds. The pedestrian activation push button device shall be installed as recommended in the MUTCD.

## 2. IRWL Signal Head Module And Base Plate Installation Guidelines

***NOTE:*** *Correct Placement of Bases is CRITICAL to System Performance*

Place the lights in the middle of each lane where the signal light module would be positioned between the vehicle tires wheel-well and at the edge of each lane. The lights must be uni-directional (light from each fixture emitting away from crosswalk marking).

Each signal light module shall be oriented towards a "zone of convergence" approximately 200'–400' feet in advance of the crosswalk. This is a zone where all the uni-directional in-pavement signal light beams merge. The location of the zone is determined by the posted speed limit to provide reaction time and stopping distance for the motorist when the in-pavement signal lights are activated by a pedestrian. Refer to the manufacturer's suggested guidelines for determining the proper location for this zone.

Conform to the standards set forth in the 2011 Texas Manual of Uniform Traffic Control Devices under section 4N.01, "Application of In-Roadway Lights," and section 4N.02, "In Roadway Warning Lights at Crosswalks."

### 2.1 Installation Procedure.

**Step 1)** Prior to installation determine placement and angle of each in-pavement signal light module to intersect at optimum driver viewing zone (also called the zone of convergence) as specified by project drawings.

**Step 2)** Provide depression cut-out for base plates approximately 1 3/8 inch (+/- 1/8 inch) inch deep on concrete or asphalt. Depression cut-out should be.25 to .5 inches, slightly larger than base plate. Depression cut-outs should be level, or even, to conform to the existing approach grade of the roadway.

**Step 3)** Perform saw cuts using pavement cutting device in accordance with predetermined layout to facilitate hook-ups through bottom of base plate to terminal connection points. Cuts to be 0.5 inch width in accordance with local standards, with a depth of 2 – 2½ inches for direct burial of wire.

**Step 4)** Dig out for traffic electric hand hole boxes and install boxes for wiring access points at predetermined locations in accordance with local standards.

**Step 5)** Install all necessary wire to predetermined connection points and lay in cleared roadway cuts. Using duct seal or equivalent, create a temporary "epoxy dam" at the interface where the saw cuts enter/exit the depression cut area. The epoxy dam will temporarily hold down the wires & simultaneously dam the core drill area to prevent flow of epoxy back into the saw cut.

**Step 6)** Check for proper site distance angles and level depth of base plate, mark alignment on roadway for base plate focus direction. Top of base plate should be flush or slightly below (less than .10 inch) roadway surface AND free from excess adhesive.

**Step 7)** Mix only enough 2-part epoxy (BONDO 7084) for 2 to 3 base plates, since Epoxy working life is approximately 10 minutes. Surfaces should be cleaned of dirt or debris and dry before applying adhesive. Ensure that wires are vertical in the center of the depression cut. Pour epoxy into depression cut (approximately ¼" depth). Pull wire through center hole in base plate. Secure base plates to roadway surface by pressing the base plate into the epoxy in the depression cut. Ensure that epoxy flows around the outside diameter of the base plate and slightly around the wires emerging from the center hole of the base plate, but DOES NOT fill the base plate. Ensure that epoxy fills outside diameter of base plate up to grade level. Ensure that the base plate is aligned with the mark made in step 6 above and is aimed vertically toward the zone of convergence *prior to epoxy curing*. Allow minimum of 30 minutes of epoxy cure time prior to moving wires for connecting pigtail gel plugs.

**Step 8)** Allow minimum of 1 hour cure time (above 70°F & 2 hours if colder temperatures) before opening traffic lanes to vehicles travelling over recently epoxied base plates. Signal heads can be secured to base plates as soon as epoxy has sufficiently hardened.
***NOTE: Temperature is critical.***

**Step 9)** Secure in-roadway warning signal to base plates using socket head cap screws using Allen Wrench or equivalent. Socket head cap screws are to be coated with anti-seize compound for maintenance purposes to ensure that screws can be removed after exposure to the environment & additionally contain an embedded nylon thread-lock bead to prevent the screws from backing out while exposed to the roadway environment.

**Step 10)** Complete "dress-up" saw cuts with Loop Sealant etc. DO NOT use Loop Sealant to "dress up" outside diameter of base plate to level epoxy surface with grade.