CHAPTER 4U. IN-ROADWAY WARNING LIGHTS

Section 4U.01 Application of In-Roadway Warning Lights

Support:

01 In-Roadway Warning Lights are special types of highway traffic signals installed in the roadway surface to warn road users that they are approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the road users to reduce their speed and/or come to a stop. This includes situations warning of marked school crosswalks, marked midblock crosswalks, marked crosswalks on uncontrolled approaches, marked crosswalks in advance of roundabouts as described in Chapter 3D, and other roadway situations involving pedestrian crossings.

Standard:

02 **In-Roadway Warning Lights shall not be used for any application that is not described in this Chapter.**

03 **When used, In-Roadway Warning Lights shall be flashed and shall not be steadily illuminated.**

Support:

04 Steadily illuminated lights installed in the roadway surface are considered to be internally illuminated raised pavement markers (see Section 3B.14).

Option:

05 In-Roadway Warning Lights may be flashed in a manner that includes a continuous flash of varying intensity and time duration that is repeated to provide a flickering effect (see Section 4U.02).

Guidance:

06 *If used, In-Roadway Warning Lights should not exceed a height of ¾ inch above the roadway surface.*

Section 4U.02 In-Roadway Warning Lights at Crosswalks

Option:

01 In-Roadway Warning Lights may be installed at certain marked crosswalks, based on an engineering study or engineering judgment, to provide additional warning to road users.

Standard:

02 **If used, In-Roadway Warning Lights at crosswalks shall be installed only at marked crosswalks with applicable warning signs. They shall not be used at crosswalks controlled by YIELD signs, STOP signs, traffic control signals, or pedestrian hybrid beacons.**

If In-Roadway Warning Lights are used at a crosswalk, the following requirements shall apply:

- **A. Except as provided in Paragraphs 7 and 8 of this Section, they shall be installed along both sides of the crosswalk and shall span its entire length.**
- **B. They shall initiate operation based on pedestrian actuation and shall cease operation at a predetermined time after the pedestrian actuation or, with passive detection, after the pedestrian clears the crosswalk.**
- **C. They shall display a flashing yellow light when actuated. The flash rate shall be at least 50, but not more than 60, flash periods per minute. If they are flashed in a manner that includes a continuous flash of varying intensity and time duration that is repeated to provide a flickering effect, the flickers or pulses shall not repeat at a rate that is between 5 and 30 per second to avoid frequencies that might cause seizures.**
- **D. They shall be installed in the area between the outside edge of the crosswalk line and 10 feet from the outside edge of the crosswalk.**
- **E. They shall face away from the crosswalk if unidirectional, or shall face away from and across the crosswalk if bidirectional.**

Support:

02a Refer to FHWA's List of Known Errors for error in paragraph numbering in this section. Refer to Section 1A.04 for more details.

Standard:

03 **If used on one-lane, one-way roadways, a minimum of two In-Roadway Warning Lights shall be installed on the approach side of the crosswalk. If used on two-lane roadways, a minimum of three In-Roadway Warning Lights shall be installed along both sides of the crosswalk. If used on roadways with more than two lanes, a minimum of one In-Roadway Warning Light per lane shall be installed along both sides of the crosswalk.**

Guidance:

04 *If used, In-Roadway Warning Lights should be installed in the center of each travel lane, at the center line of the roadway, at each edge of the roadway or parking lanes, or at other suitable locations away from the normal tire track paths.*

05 *The location of the In-Roadway Warning Lights within the lanes should be based on engineering judgment.*

Option:

06 On one-way streets, In-Roadway Warning Lights may be omitted on the departure side of the crosswalk.

07 Based on engineering judgment, the In-Roadway Warning Lights on the departure side of the crosswalk on the left-hand side of a median may be omitted.

08 Unidirectional In-Roadway Warning Lights installed at crosswalk locations may have an optional, additional yellow light indication in each unit that is visible to pedestrians in the crosswalk to indicate to pedestrians in the crosswalk that the In-Roadway Warning Lights are in fact flashing as they cross the street. These yellow lights may flash with and at the same flash rate as the light module in which each is installed.

Guidance:

09 *If used, the period of operation of the In-Roadway Warning Lights following each actuation should be sufficient to allow a pedestrian crossing in the crosswalk to leave the curb or shoulder and travel at a walking speed of 3.5 feet per second to at least the far side of the traveled way or to a median of sufficient width for pedestrians to wait. Where pedestrians who walk slower than 3.5 feet per second, or pedestrians who use wheelchairs, routinely use the crosswalk, a walking speed of less than 3.5 feet per second should be considered in determining the period of operation.*

10 *An audible information device should be used with In-Roadway Warning Lights to provide assistance for pedestrians with vision disabilities.*

Standard:

11 **If pedestrian push buttons (rather than passive detection) are used to actuate the In-Roadway Warning Lights, a PUSH BUTTON TO TURN ON WARNING LIGHTS/WAIT FOR GAP IN TRAFFIC (R10-25) sign (see Section 2B.58) shall be installed explaining the purpose and use of the pedestrian push button detector.**

Support:

11a Refer to FHWA's List of Known Errors for error in Paragraph 11 text. Refer to Section 1A.04 for more details.

Standard:

12 **Where the period of operation is sufficient only for crossing from a curb or shoulder to a median of sufficient width for pedestrians to wait, median-mounted pedestrian actuators shall be provided.**

13 **If an audible information device is used in conjunction with In-Roadway Warning Lights, the audible information device shall not use vibrotactile indications or percussive indications.**

Guidance:

14 *If an audible information device is used in conjunction with In-Roadway Warning Lights, the audible message during the time that the lights are flashing should be a speech message that says, "Warning lights are flashing." The audible message should be spoken twice.*

Standard:

15 **The following shall be considered when evaluating the need for In-Roadway Warning Lights:**

- **A. Whether the crossing is controlled or uncontrolled.**
- **B. An engineering traffic study to determine if In-Roadway Warning Lights are compatible with the safety and operation of nearby intersections, which may or may not be, controlled by traffic signals or STOP/YIELD signs.**
- **C. Standard traffic signs for crossings and crosswalk pavement markings are provided.**
- **D. At least 40 pedestrians regularly use the crossing during each of any two hours (not necessarily consecutive) during a 24-hour period.**
- **E. The vehicular volume through the crossing exceeds 200 vehicles per hour in urban areas or 140 vehicles per hour in rural areas during peak-hour pedestrian usage.**
- **F. The critical approach speed (85th percentile) is 45 mph or less.**
- **G. In-Roadway Warning Lights are visible to drivers at the minimum stopping sight distance for the posted speed limit.**
- **H. Public education on In-Roadway Warning Lights is conducted for new installations.**

Option:

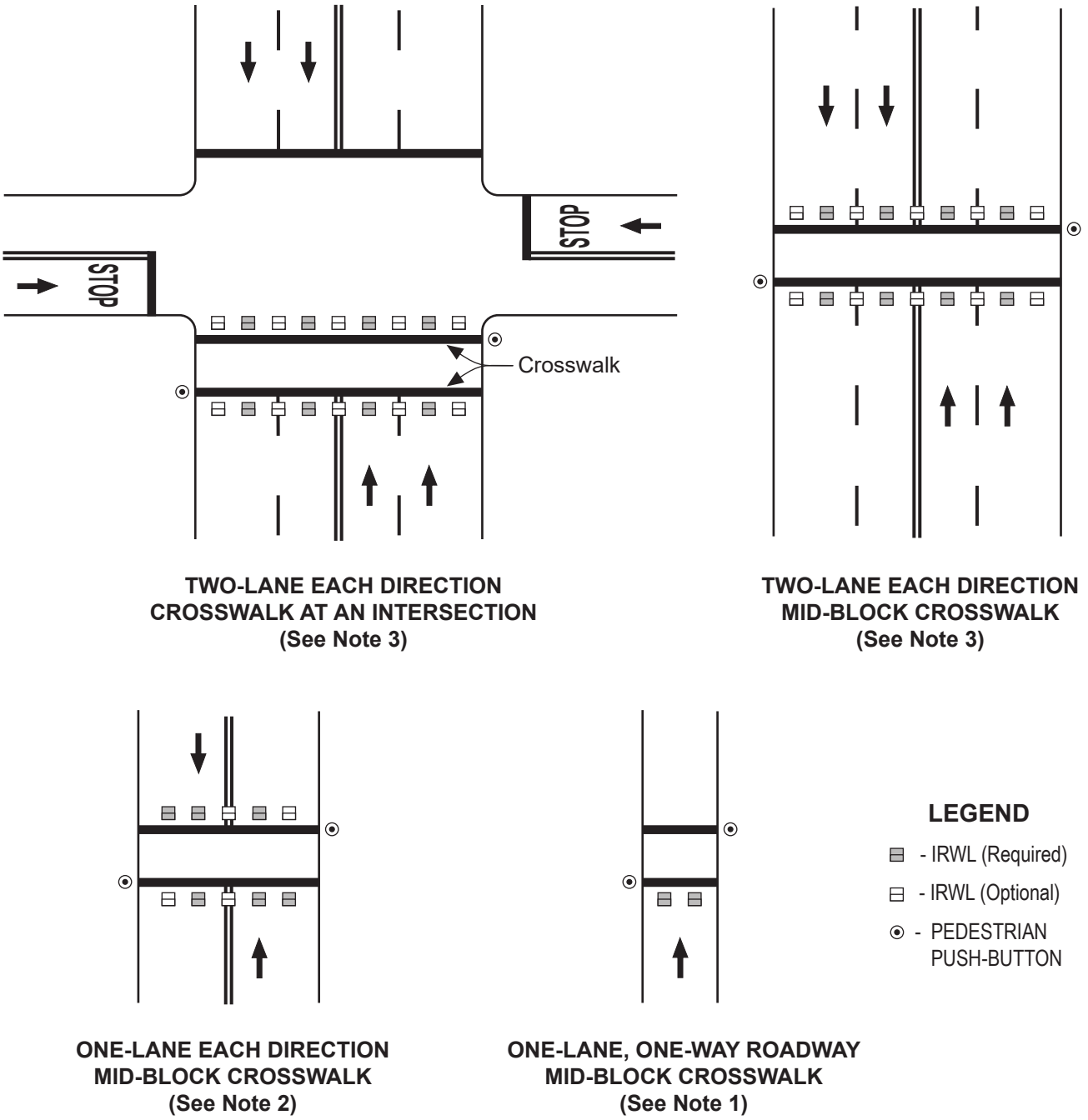
16 Overhead or roadside Flashing Yellow Beacons may be installed in conjunction with In-Roadway Warning Lights. In-Roadway Warning Lights may be installed independently, but are not necessarily intended to be a substitute for standard flashing beacons. Engineering judgment should be exercised.

Guidance:

17 *Typical applications of In-Roadway Warning Lights are shown in Figure 4U-101(CA).*

18 *Where In-Roadway Warning Lights are located 200 feet or less from a grade crossing, an engineering study should be made to evaluate the placement and determine if queuing could impact the grade crossing.*

Figure 4U-101(CA). Typical Layout for In-Roadway Warning Lights (IRWLs)



TWO-LANE EACH DIRECTION CROSSWALK AT AN INTERSECTION (See Note 3)

TWO-LANE EACH DIRECTION MID-BLOCK CROSSWALK (See Note 3)

ONE-LANE EACH DIRECTION MID-BLOCK CROSSWALK (See Note 2)

ONE-LANE, ONE-WAY ROADWAY MID-BLOCK CROSSWALK (See Note 1)

NOTES:

1. One-Lane, One-Way Roadways, a minimum of two IRWLs shall be installed on the approach side ot the crosswalk.
2. One-Lane each direction, a minimum of three IRWLs shall be installed along both sides of the crosswalk.
3. Two-Lanes each direction, a minimum of one IRWLs per lane, shall be installed along both sides of the crosswalk.
4. IRWLs should be located off the tire tracks.