B3.2.5 Flash Sequence for Rectangular Rapid Flashing Beacons

**Standard**

When activated, the two amber indications in each RRFB must flash in a rapidly alternating “wig-wag and simultaneous” (WW+S) flashing sequence (left light on, then right light on). The flash cycle is a total of 800 milliseconds and must follow the timing sequence set out in Table B3-3.

The light intensity of the amber indications must meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles).

<table>
<thead>
<tr>
<th>Step</th>
<th>Cumulative Time (milliseconds)</th>
<th>Flash On/Off Duration (milliseconds)</th>
<th>Left Beacon</th>
<th>Right Beacon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-50</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>2</td>
<td>50-100</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>3</td>
<td>100-150</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>4</td>
<td>150-200</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>5</td>
<td>200-400</td>
<td>200</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>6</td>
<td>400-450</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>7</td>
<td>450-500</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>8</td>
<td>500-550</td>
<td>50</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>9</td>
<td>550-800</td>
<td>250</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
</tbody>
</table>

Note: The yellow cells above are “flash-on” periods while the white cells are “Flash-off”
B3.3 NUMBER AND LOCATION OF SIGNAL HEADS

Signal heads may be mounted on poles, mast-arms or gantries, or suspended over the roadway by cables. The primary signal head is the main signal head provided on each approach to the intersection. A secondary signal head is used to supplement the primary signal head. The secondary signal head includes all the indications shown on the primary signal head. Primary and secondary signal heads must be used to provide duplicate indications on each approach for vehicular traffic. The signal displays should be visible to the driver at all times.

The precise location of signal heads in the three dimensional plane should be based on horizontal and vertical angles of sight toward the signal heads as defined by the position of the driver’s eye and the vehicle design. The optimum placement of signal heads must be based on the driver’s visibility requirements (see Section B3.2).

Required signal head assemblies for any one approach should be mounted no less than 3.0 m apart, measured horizontally between the centre of the faces.

Other criteria that should be considered in locating signal heads are as follows:

(a) Where the nearest signal head is more than 30 m and less than 45 m beyond the stop line, either 300 mm red lenses should be used in the primary signal head, or an auxiliary signal head should be positioned at a near-side location; and

(b) An auxiliary near-side signal head should be used in all cases where the primary signal head is more than 45 m beyond the stop line.

Typical signal layouts for a variety of applications are shown in Figures B3-4 to B3-8.

B3.3.1 Primary Signal Head Location

The primary signal head must be mounted on the far right side of each intersection approach and should be within a 10 degree cone of vision directly over the travelled portion of the road. It should be positioned a minimum of 4.5 m and maximum of 6.0 m above the road, and at a distance of more than 15 m from the near-side stop line.
B3.3.2 Secondary Signal Head Location

The secondary signal head must be mounted on the far side of each intersection approach and should be within the 40 degree cone of vision. When the secondary signal head is mounted clear of the travelled roadway, the bottom of the signal head should not be less than 2.5 m above the sidewalk. Where a sidewalk does not exist, it may be necessary to mount the signal head 4.5 m above the road surface where vehicles may encroach beyond the travelled lane. In these situations, the measurements refer to the road surface of the nearest travelled lane. The location of the secondary signal head should be carefully designed to ensure that it does not interfere with the visibility of the primary signal head for the opposing direction, and that the visibility of it is not blocked by the primary signal head.

B3.3.3 Auxiliary Signal Head Location

The function of an auxiliary signal head is to supplement the primary and secondary signal heads with a display which includes the same signal indications. An auxiliary signal head may be located in any other appropriate position. If the primary or secondary signal head is not visible to a pedestrian from any position within a crosswalk, auxiliary signal heads should be mounted at one or both ends of the crosswalk as may be necessary, or pedestrian signal heads may be installed.

An auxiliary near-side signal head should be used where the primary signal head is more than 45 m beyond the stop line. Near-side auxiliary signal heads should be located as near as possible to the stop line.

The following conditions may require the use of auxiliary signal heads:

(a) Approach widths in excess of three through lanes;

(b) Intersecting street width in excess of 25 m;

(c) Driver uncertainty as to proper location to stop;

(d) High percentage of large vehicles which tend to block a driver’s view of signal heads in their normal location;

(e) Approach geometry that makes it impossible to ensure continuous visibility of the signal heads; or

(f) Accommodation of right or left-turn signal phasing.
**TRAFFIC CONTROL SIGNAL LENSES**

1. Red Ball - 200 mm or 300 mm (shown)
2. Amber Ball - 200 mm or 300 mm (shown)
3. Green Ball - 200 mm or 300 mm (shown)

4. Green Arrow (through) - 200 mm or 300 mm (shown)
5. Flashing Green Arrow (left) - 200 mm or 300 mm (shown)
6. Flashing Green Arrow (right) - 200 mm or 300 mm (shown)

7. Amber Arrow (left) - 200 mm or 300 mm (shown)
8. Amber Arrow (right) - 200 mm or 300 mm (shown)
9. Wide Fibre-Optic Green/Ambiguous Arrow - 200 mm or 300 mm (shown)
10. Transit Signal (Lunar White) - 200 mm (shown) or 300 mm
11. Transit Signal (Lunar White - left) - 200 mm (shown) or 300 mm
12. Transit Signal (Lunar White - right) - 200 mm (shown) or 300 mm

13. Lane Control Green Arrow - 300 mm x 300 mm (shown) or 450 mm x 450 mm
14. Lane Control Red X - 300 mm x 300 mm (shown) or 450 mm x 450 mm

15. Rectangular Rapid Flashing Beacons - 125 mm (min. width) x 50 mm (height)

16. Red Bicycle - 200 mm (shown) or 300 mm
17. Amber Bicycle - 200 mm (shown) or 300 mm
18. Green Bicycle - 200 mm (shown) or 300 mm

**Typical Dimensions of Lenses and Symbols**

Note: Refer to Section B3.4 for other lens sizing.

**FIGURE B3-9A**
PEDESTRIAN SIGNAL LENSES

1. Walking Person (Lunar White) - Solid
2. Walking Person (Lunar White) - Outline
3. Walking Person (Lunar White) - Solid
4. Walking Person (Lunar White) - Outline
5. Hand (Portland Orange) - Solid
6. Hand (Portland Orange) - Outline
7. Pedestrian Countdown Signal (Portland Orange)

* Note: Symbol size shall be at least 2/3 of the lens size with a minimum symbol height of 150 mm.
B3.3.4 Pedestrian Signal Head Location

Pedestrian signal heads should be mounted at a lower level than the signal heads for vehicles, but should not be less than 2.5 m above the sidewalk. The pedestrian signal head should be placed directly in line with the pedestrian crosswalk which it controls.

When illuminated, the pedestrian signal indication must be clearly visible for a minimum distance of 30 m under normal conditions of visibility.

B3.3.5 Bicycle Signal Head Location

A single bicycle signal head should be mounted within the cone of vision of cyclists and preferably no more than 30 m beyond the stop bar.

It is preferable to vertically mount bicycle signal heads. However, the practitioner may recommend a horizontal installation depending on jurisdictional practices.

Where bicycle signal heads overhang the travelled portion of the roadway, they should be installed at a minimum height of 4.5 m. Where bicycle signals are side mounted and do not overhang the travelled portion of the roadway, it is recommended to install the signal at a height less than 4.5 m but not less than 2.5 m above the sidewalk.

B3.4 SIZE, COLOUR AND SHAPE OF TRAFFIC CONTROL SIGNAL LENSES

Lenses used for traffic control signals are illustrated in Figure B3-9A. Signal lenses for vehicular traffic are normally round, with a diameter of not less than 200 mm.

Two sizes of lenses are used for signal displays; 200 mm and 300 mm. The 300 mm lens yields a maximum centre luminance two or more times higher than the maximum centre luminance of the 200 mm lens.

Where the speed limit is 80 km/h or greater, a 300 mm lens must be used for the red ball indication. However, consideration should be given to using a 300 mm lens for all red ball indications.

The 300 mm lens is also recommended for the following uses:

(a) All arrow indications;

(b) For signal heads located more than 30 m beyond the stop line;
(c) All intersection approaches where drivers may be confused when both traffic control and lane control signals are viewed simultaneously;

(d) For specific problem locations, such as those with conflicting or competing background light; or

(e) Where engineering studies indicate a requirement for increased visibility of the traffic control signal indications.

Lenses used for pedestrian signals are illustrated in Figure B3-9B. The illuminated symbols must be similar in shape and size to those illustrated. The symbols may be either solid or outline. Symbol size shall be at least 2/3 of the lens size with a minimum symbol height of 150 mm.

Signal heads which can display two or more different indications may be used if there is a need or desire to display multiple traffic control signal indications on a common lens. Specific applications include, but are not limited to, arrow signal indications, pedestrian signals and lane control signals.

### B3.4.1 Bicycle Signal Head Lenses

Bicycle signal lenses contain green, amber and red outlines of a bicycle in black circular lenses. The backboard of the bicycle signal head is black to differentiate it from signal heads applicable to motorized vehicles.

Standard bicycle signal lenses are 200 mm. Larger signal lenses (300 mm) may be considered where the mounting location is greater than 30 m from the cyclist or at intersections that are large, complex or visually cluttered.

Light Emitting Diode (LED) displays should be used at all bicycle signal installations.

### B3.4.2 Rectangular Rapid Flashing Beacon (RRFB) Indications

An RRFB shall consist of two rectangular-shaped amber indications, each with an LED-array based light source. Each RRFB indication shall be a minimum of 125 mm wide by 50 mm high.

The two RRFB indications shall be aligned horizontally, facing both directions of travel, with the longer dimension horizontal and with a minimum space of 175 mm between the two indications, measured from inside edge of one indication to inside edge of the other indication. The outside edges of the RRFB indications, including any housing, shall not project beyond the outside edges of the associated RA-4 or RA-3 sign. All other provisions of the MUTCD for Warning Beacons shall apply to RRFBs except as otherwise provided above.
B3.5 POSITION OF TRAFFIC CONTROL SIGNAL INDICATIONS

Whether combined in one unit or mounted separately, the relative vertical or horizontal positions of the various signal indications must be as specified below in Tables B3-4, B3-5 and B3-6 and as illustrated in Figures B3-10 and B3-11. For simplicity and effectiveness, no more than six indications should be combined in one signal head.

**TABLE B3-4**

<table>
<thead>
<tr>
<th>Vertical Mounting From Top to Bottom</th>
<th>Horizontal Mounting From Left to Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Signal</td>
<td>Transit Signal</td>
</tr>
<tr>
<td>Red Ball</td>
<td>Red Ball</td>
</tr>
<tr>
<td>Amber Ball</td>
<td>Amber Ball</td>
</tr>
<tr>
<td>Green Ball/Through Arrow</td>
<td>Amber Left Arrow</td>
</tr>
<tr>
<td>Amber Left Arrow</td>
<td>Flashing Green Left Arrow</td>
</tr>
<tr>
<td>Flashing Green Left Arrow</td>
<td>Green Ball/Through Arrow</td>
</tr>
<tr>
<td>Amber Right Arrow</td>
<td>Amber Right Arrow</td>
</tr>
<tr>
<td>Flashing Green Right Arrow</td>
<td>Flashing Green Right Arrow</td>
</tr>
</tbody>
</table>

**TABLE B3-5**

<table>
<thead>
<tr>
<th>Vertical Mounting From Top to Bottom</th>
<th>Horizontal Mounting From Left to Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand</td>
<td>Hand</td>
</tr>
<tr>
<td>Walking Pedestrian</td>
<td>Walking Pedestrian</td>
</tr>
</tbody>
</table>

**TABLE B3-6**

<table>
<thead>
<tr>
<th>Vertical Mounting From Top to Bottom</th>
<th>Horizontal Mounting From Left to Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Bicycle</td>
<td>Red Bicycle</td>
</tr>
<tr>
<td>Amber Bicycle</td>
<td>Amber Bicycle</td>
</tr>
<tr>
<td>Green Bicycle</td>
<td>Green Bicycle</td>
</tr>
</tbody>
</table>
TYPICAL SIGNAL HEAD ASSEMBLY
VERTICAL LAYOUT (WITH BACKBOARD)
TYPICAL SIGNAL HEAD ASSEMBLY
HORIZONTAL LAYOUT (WITH BACKBOARD)

FIGURE B3-11
B3.5.1 Rectangular Rapid Flashing Beacon (RRFB)

For any approach on which RRFBs are used, two RA-4 (Pedestrian) or two RA-3 (School) crossing signs (each with RRFB and Pushbutton Sign ID-21) shall be installed at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided road, the left-hand side assembly should be installed on the median in the direction of travel of approaching traffic.

An RRFB shall not be installed independent of the crossing signs for the approach the RRFB faces. The RRFB shall be installed on the same support as the associated RA-4 (Pedestrian) or RA-3 (School) crossing sign. The RRFB shall be placed above the Pedestrian (or School) crossing sign.