

## CHAPTER 4F. STEADY (STOP-AND-GO) OPERATION OF TRAFFIC CONTROL SIGNALS

### Section 4F.01 Application of Steady and Flashing Signal Indications during Steady (Stop-and-Go) Operation

#### Standard:

- 01 When a traffic control signal is being operated in a steady (stop-and-go) mode, at least one indication in each signal face shall be displayed at any given time.
- 02 A signal face(s) that controls a particular vehicular movement during any interval of a cycle shall control that same movement during all intervals of the cycle.
- 03 Steady and flashing signal indications shall be applied as follows:

A. A steady CIRCULAR RED signal indication:

1. Shall be displayed when it is intended to prohibit traffic, except pedestrians directed by a pedestrian signal head, from entering the intersection or other controlled area. Turning after stopping is permitted as stated in Item C.1 in Paragraph 1 of Section 4A.03.
2. Shall be displayed with the appropriate GREEN ARROW signal indications when it is intended to permit traffic to make a specified turn or turns, and to prohibit traffic from proceeding straight ahead through the intersection or other controlled area, except in protected only mode operation (see Sections 4F.06 and 4F.13), or in protected/permissive mode operation with separate turn signal faces (see Sections 4F.08 and 4F.15).

B. A steady CIRCULAR YELLOW signal indication:

1. Shall be displayed following a CIRCULAR GREEN or straight-through GREEN ARROW signal indication in the same signal face.
2. Shall not be displayed in conjunction with the change from the CIRCULAR RED signal indication to the CIRCULAR GREEN signal indication.
3. Shall be followed by a CIRCULAR RED signal indication except that, when entering preemption operation, the return to the previous CIRCULAR GREEN signal indication shall be permitted following a steady CIRCULAR YELLOW signal indication (see Section 4F.19).
4. Shall not be displayed to an approach from which drivers are turning left permissively using a shared signal face or making a U-turn to the left permissively using a shared signal face unless one of the following conditions exists:
  - (a) A steady CIRCULAR YELLOW signal indication is also simultaneously being displayed to the opposing approach;
  - (b) ~~An engineering study has determined that, because of unique intersection conditions, the condition described in Item (a) cannot reasonably be implemented without causing significant operational or safety problems and that the volume of impacted left-turning or U-turning traffic is relatively low, and those left-turning or U-turning drivers are advised that a steady CIRCULAR YELLOW signal indication is not simultaneously being displayed to the opposing traffic if this operation occurs continuously by the installation of a W25-1 sign (see Section 2C.44) with the legend ONCOMING TRAFFIC HAS EXTENDED GREEN; or W25-1 sign shall not be used in California~~
  - (c) ~~Drivers are advised of the operation if it occurs only occasionally, such as during a preemption sequence, by the installation of a W25-2 sign (see Section 2C.44) with the legend ONCOMING TRAFFIC MAY HAVE EXTENDED GREEN. W25-2 sign shall not be used in California~~

- C. A steady CIRCULAR GREEN signal indication shall be displayed only when it is intended to permit traffic to proceed in any direction that is lawful and practical.
- D. A steady RED ARROW signal indication shall be displayed when it is intended to prohibit traffic, except pedestrians directed by a pedestrian signal head, from entering the intersection or other controlled area to make the indicated turn. ~~Except as described in Item C.2 in Paragraph 1 of Section 4A.03, turning on a steady RED ARROW signal indication shall not be permitted.~~
- E. A flashing RED ARROW signal indication shall be displayed as part of a steady (stop-and-go) mode of operation only when it is intended to permit traffic, after coming to a full stop, to cautiously enter the

intersection to make a turn in the direction indicated by the arrow after yielding to pedestrians, if any, and/or to opposing traffic, if any.

F. A steady YELLOW ARROW signal indication:

1. Shall be displayed in the same direction as a GREEN ARROW signal indication following a GREEN ARROW signal indication in the same signal face, unless:
  - (a) The GREEN ARROW signal indication and a CIRCULAR GREEN (or straight- through GREEN ARROW) signal indication terminate simultaneously in the same signal face, or
  - (b) The green arrow is a straight-through GREEN ARROW (see Item B.1 in this Paragraph).
2. Shall be displayed in the same direction as a flashing YELLOW ARROW signal indication or flashing RED ARROW signal indication following a flashing YELLOW ARROW signal indication or flashing RED ARROW signal indication in the same signal face, when the flashing arrow indication is displayed as part of a steady mode operation, if the signal face will subsequently display a steady red signal indication.
3. Shall not be displayed in conjunction with the change from a steady RED ARROW, flashing RED ARROW, or flashing YELLOW ARROW signal indication to a GREEN ARROW signal indication, except when entering preemption operation as provided in Item F.5(a) of this Paragraph.
4. Shall not be displayed when any conflicting vehicular movement has a green or yellow signal indication (except for the situation regarding U-turns to the left provided in Paragraph 4 of this Section) or any conflicting pedestrian movement has a WALKING PERSON (symbolizing WALK) or flashing UPRAISED HAND (symbolizing DONT WALK) signal indication, except that a steady left-turn (or U-turn to the left) YELLOW ARROW signal indication used to terminate a flashing left-turn (or U-turn to the left) YELLOW ARROW or a flashing left-turn (or U-turn to the left) RED ARROW signal indication in a signal face controlling a permissive left-turn (or U-turn to the left) movement as described in Sections 4F.04 and 4F.08 shall be permitted to be displayed when a CIRCULAR YELLOW signal indication is displayed for the opposing through movement. Vehicles departing in the same direction shall not be considered in conflict if, for each turn lane with moving traffic, there is a separate departure lane, and pavement markings or raised channelization clearly indicate which departure lane to use.
5. Shall not be displayed to terminate a flashing arrow signal indication on an approach from which drivers are turning left permissively or making a U-turn to the left permissively unless one of the following conditions exists:
  - (a) A steady CIRCULAR YELLOW or CIRCULAR RED signal indication is also simultaneously being displayed to the opposing approach;
  - (b) ~~An engineering study has determined that, because of unique intersection conditions, the condition described in Item (a) cannot reasonably be implemented without causing significant operational or safety problems and that the volume of impacted left-turning or U-turning traffic is relatively low, and those left-turning or U-turning drivers are advised that a steady CIRCULAR YELLOW signal indication is not simultaneously being displayed to the opposing traffic if this operation occurs continuously by the installation of a W25-1 sign (see Section 2C.44) with the legend ONCOMING TRAFFIC HAS EXTENDED GREEN; or W25-1 sign shall not be used in California~~
  - (c) ~~Drivers are advised of the operation if it occurs only occasionally, such as during a preemption sequence, by the installation of a W25-2 sign (see Section 2C.44) with the legend ONCOMING TRAFFIC MAY HAVE EXTENDED GREEN. W25-2 sign shall not be used in California.~~
6. Shall be terminated by a RED ARROW signal indication for the same direction or a CIRCULAR RED signal indication except:
  - (a) When entering preemption operation, the display of a GREEN ARROW signal indication or a flashing arrow signal indication shall be permitted following a steady YELLOW ARROW signal indication.
  - (b) When the movement controlled by the arrow is to continue on a permissive mode basis during an immediately following signal phase, the display of a CIRCULAR GREEN signal indication or a flashing YELLOW ARROW signal indication shall be permitted following a steady YELLOW

**ARROW signal indication.** To provide a red clearance interval, it shall be permitted to display a steady left-turn RED ARROW signal indication immediately following the steady left-turn YELLOW ARROW signal indication.

- G. A flashing YELLOW ARROW signal indication shall be displayed as part of a steady (stop- and-go) mode of operation only when it is intended to permit traffic to cautiously enter the intersection to make a turn in the direction indicated by the arrow after yielding to pedestrians, if any, and/or to opposing traffic, if any.
- H. A steady GREEN ARROW signal indication:
  1. Shall be displayed only to allow vehicular movements, in the direction indicated, that are not in conflict with other vehicles moving on a green or yellow signal indication (except for the situation regarding U-turns provided in Paragraph 4 of this Section and straight- through GREEN ARROWS provided in Paragraph 5 of this Section), even if the other vehicles are required to yield the right-of-way to the traffic moving on the GREEN ARROW signal indication, and are not in conflict with pedestrians crossing in compliance with a WALKING PERSON (symbolizing WALK) or flashing UPRAISED HAND (symbolizing DONT WALK) signal indication. Vehicles departing in the same direction shall not be considered in conflict if, for each turn lane with moving traffic, there is a separate departure lane, and pavement markings or raised channelization clearly indicate which departure lane to use.
  2. Shall be displayed on a signal face that controls a left-turn movement when said movement is not in conflict with other vehicles moving on a green or yellow signal indication (except for the situation regarding U-turns provided in Paragraph-4 **4a** of this Section) and is not in conflict with pedestrians crossing in compliance with a WALKING PERSON (symbolizing WALK) or flashing UPRAISED HAND (symbolizing DONT WALK) signal indication. Vehicles departing in the same direction shall not be considered in conflict if, for each turn lane with moving traffic, there is a separate departure lane, and pavement markings or raised channelization clearly indicate which departure lane to use.
  3. Shall not be required on the stem of a T-intersection or for turns from a one-way street.

**Option:**

04 If U turns are permitted from the approach and a right turn GREEN ARROW signal indication is simultaneously being displayed to road users making a right turn from the conflicting approach to the left, road users making a U turn may be advised of the operation by the installation of a U TURN YIELD TO RIGHT TURN (R10-16) sign (see Section 2B.59).

**Standard:**

04a When a RIGHT TURN ARROW controls the Right Turn movement, a conflicting U-turn approach shall be prohibited.

**Option:**

05 A steady straight-through GREEN ARROW signal indication may be used instead of a CIRCULAR GREEN signal indication in a signal face to discourage wrong-way turns under the following conditions, even if opposed by a simultaneous permissive left-turn movement:

- A. On an approach intersecting a one-way street;
- B. On an approach intersecting an interchange exit ramp;
- C. On an approach with unique geometric design that prohibits turns; or
- D. On an approach with pre-signals and the adjacent lanes are controlled separately (see Sections 8D.11 and 8D.12).

06 If not otherwise prohibited, steady red, yellow, and green turn arrow signal indications may be used instead of steady circular red, yellow, and green signal indications in a signal face on an approach where all traffic is required to turn or where the straight-through movement is not physically possible.

**Support:**

07 Section 4F.16 contains information regarding the signalization of approaches that have a combined left-turn/right-turn lane and no through movement.

08 Section 4D.07 contains information regarding limitations on left-turn arrows, right-turn arrows, and U-turn arrows in supplemental signal faces.

**Standard:**

09 A straight-through RED ARROW signal indication or a straight-through YELLOW ARROW signal indication shall not be displayed on any signal face, either alone or in combination with any other signal

**indication.**

10 The following combinations of signal indications shall not be simultaneously displayed on any one signal face:

- CIRCULAR YELLOW with CIRCULAR RED,
- CIRCULAR GREEN with CIRCULAR RED, or
- Straight-through GREEN ARROW with CIRCULAR RED.

11 Except as provided in Paragraph 13 of this Section, the above combinations shall not be simultaneously displayed on an approach as a result of the combination of displays from multiple signal faces unless the display is created by a signal face(s) devoted exclusively to the control of a right-turn movement and:

- The signal face(s) controlling the right-turn movement is visibility limited from the adjacent through movement or positioned to minimize potential confusion to approaching road users, or
- A RIGHT TURN SIGNAL (R10-10) sign (see Sections 4F.09, 4F.11, 4F.13, and 4F.15) is mounted adjacent to the signal face(s) controlling the right-turn movement.

12 Except as provided in Paragraph 13 of this Section, the following combinations of signal indications shall not be simultaneously displayed on any one signal face or as a result of the combination of displays from multiple signal faces on an approach:

- CIRCULAR GREEN with CIRCULAR YELLOW,
- Straight-through GREEN ARROW with CIRCULAR YELLOW,
- GREEN ARROW with YELLOW ARROW pointing in the same direction,
- YELLOW ARROW with RED ARROW pointing in the same direction, or
- GREEN ARROW with RED ARROW pointing in the same direction.

13 If a separate signal face is provided at a pre-signal (see Section 8D.11) or at a queue cutter signal (see Section 8D.12) for a left-turn and/or right-turn lane that extends from the downstream signalized intersection back to and across a grade crossing, the following combinations of signal indications shall be permitted to be simultaneously displayed as a result of the combination of displays from multiple signal faces at the pre-signal or queue cutter signal:

- Straight-through GREEN ARROW with CIRCULAR RED,
- Straight-through GREEN ARROW with CIRCULAR YELLOW, and
- CIRCULAR YELLOW with CIRCULAR RED.

14 Except as otherwise provided in Sections 4F.08, 4F.15, 4J.03, and 4N.03, the same signal section shall not be used to display both a flashing yellow and a steady yellow indication during steady mode operation. Except as otherwise provided in Sections 4F.04, 4F.08, 4F.11, and 4F.13, the same signal section shall not be used to display both a flashing red and a steady red indication during steady mode operation.

*Guidance:*

15 No movement that creates an unexpected crossing of pathways of moving vehicles or pedestrians should be allowed during any green or yellow interval, except when all three of the following conditions are met:

- The movement involves only slight conflict, and
- Serious traffic delays are substantially reduced by permitting the conflicting movement, and
- Drivers and pedestrians subjected to the unexpected conflict are effectively warned thereof by a sign.

## **Section 4F.02 Signal Indications for Left-Turn Movements – General**

**Support:**

01 In Sections 4F.03 through 4F.08, provisions applicable to left-turn movements and left-turn lanes are also applicable to signal indications for U-turns to the left that are provided at locations where left turns are prohibited or not geometrically possible.

02 Left-turning traffic is controlled by one of four modes as follows:

- Permissive Only Mode—turns made on a CIRCULAR GREEN signal indication, a flashing left-turn YELLOW ARROW signal indication, or a flashing left-turn RED ARROW signal indication after yielding to pedestrians, if any, and/or opposing traffic, if any.
- Protected Only Mode—turns made only when a left-turn GREEN ARROW signal indication is displayed.
- Protected/Permissive Mode—both modes can occur on an approach during the same cycle.
- Variable Left-Turn Mode—the operating mode changes among the protected only mode and/or the protected/permissive mode and/or the permissive only mode during different periods of the day or as traffic

conditions change.

Option:

03 In areas having a high percentage of older drivers, special consideration may be given to the use of protected only mode left-turn phasing, when appropriate.

Standard:

04 During a permissive left-turn movement, the signal faces for through traffic on the opposing approach shall simultaneously display green or steady yellow signal indications. If pedestrians crossing the lane or lanes used by the permissive left-turn movement to depart the intersection are controlled by pedestrian signal heads, the signal indications displayed by those pedestrian signal heads shall not be limited to any particular display during the permissive left-turn movement.

05 During a protected left-turn movement, the signal faces for through traffic on the opposing approach shall simultaneously display steady CIRCULAR RED signal indications. During a protected left-turn movement, a GREEN ARROW or a YELLOW ARROW signal indication shall not simultaneously be displayed to right-turning traffic on the opposing approach, except where a separate departure lane is available for each left-turn and right-turn lane with moving traffic and pavement markings or raised channelization clearly indicate which departure lane to use (see Item H.1 in Paragraph 3 in Section 4F.01). If pedestrians crossing the lane or lanes used by the protected left-turn movement to depart the intersection are controlled by pedestrian signal heads, the pedestrian signal heads shall display a steady UPRAISED HAND (symbolizing DONT WALK) signal indication during the protected left-turn movement.

06 If a combined left-turn/through lane exists on an approach, a left-turn GREEN ARROW or left- turn YELLOW ARROW signal indication or a flashing left-turn RED ARROW signal indication shall not be displayed to the approach simultaneously with a CIRCULAR RED signal indication for the through movement, and a left-turn RED ARROW signal indication shall not be displayed to the approach simultaneously with a CIRCULAR GREEN or CIRCULAR YELLOW signal indication for the through movement.

07 A yellow change interval for the left-turn movement shall not be displayed when the status of the left-turn operation is changing from permissive to protected within any given signal sequence.

08 If the operating mode changes among the protected only mode and/or the protected/permissive mode and/or the permissive only mode during different periods of the day or as traffic conditions change, the requirements in Sections 4F.03 through 4F.08 that are appropriate to that mode of operation shall be met, subject to the following:

- A. The CIRCULAR GREEN and CIRCULAR YELLOW signal indications shall not be displayed when operating in the protected only mode.
- B. The left-turn GREEN ARROW and left-turn YELLOW ARROW signal indications shall not be displayed when operating in the permissive only mode.

Option:

09 When variable left-turn mode phasing is used for an approach that has a combined left-turn/straight- through lane and a flashing yellow arrow is used as the permissive turn display, a five-section shared left-turn signal face containing both circular and arrow indications may be used in combination with one or more separate left-turn signal faces for the mandatory left-turn lane(s), if any are present, on the same approach.

The steady left-turn YELLOW ARROW signal indication and the flashing left-turn YELLOW ARROW signal indication may be displayed in the same section of the five-section shared left-turn signal face.

10 Additional static signs or changeable message signs may be used to meet the requirements for the variable left-turn mode or to inform drivers that left-turn green arrows will not be available during certain times of the day.

Support:

11 Sections 4F.03 through 4F.08 describe the use of the following two types of signal faces for controlling left-turn movements:

- A. Shared signal face – This type of signal face controls both the left-turn movement and the adjacent movement (usually the through movement) and can serve as one of the two required primary signal faces for the adjacent movement. A shared signal face always displays the same color of circular indication that is displayed by the signal face or faces for the adjacent movement. If a shared signal face that provides protected/permissive mode left turns is mounted overhead for an approach that includes a mandatory left-turn lane, it is usually positioned over or slightly to the right of the extension of the lane line separating the left-turn lane from the adjacent lane.

If a shared signal face that provides protected/permissive mode left turns is mounted overhead for an approach that does not include a mandatory left-turn lane, it is usually positioned over the center of the combined left-turn/straight-through lane.

B. Separate left-turn signal face – This type of signal face controls only the left-turn movement and cannot serve as one of the two required primary signal faces for the adjacent movement (usually the through movement) because it displays signal indications that are applicable only to the left-turn movement. This type of signal face is used only for an approach that has a mandatory left-turn lane(s). If a separate left-turn signal face is mounted overhead at the intersection, it is positioned over the extension of the mandatory left-turn lane. In a separate left-turn signal face, a flashing left-turn YELLOW ARROW signal indication or a flashing left-turn RED ARROW signal indication is used to control permissive left-turn movements.

12 Section 4D.07 contains provisions regarding the lateral positioning of signal faces that control left- turn movements.

13 It is not necessary that the same mode of left-turn operation or same type of left-turn signal face be used on every approach to a signalized location. Selecting different modes and types of left-turn signal faces for the various approaches to the same signalized location is acceptable.

Option:

14 A signal face that is shared by left-turning and right-turning traffic may be provided for a combined left-turn/right-turn lane on an approach that has no through traffic (see Section 4F.16).

### **Section 4F.03 Signal Indications for Permissive Only Mode Left-Turn Movements in a Shared Signal Face**

#### **Standard:**

01 If a shared signal face is provided for a permissive only mode left turn, it shall meet the following requirements (see Figure 4F-1):

- A. It shall be capable of displaying the following signal indications: steady CIRCULAR RED, steady CIRCULAR YELLOW, and CIRCULAR GREEN. Only one of the three indications shall be displayed at any given time.
- B. During the permissive left-turn movement, a CIRCULAR GREEN signal indication shall be displayed.
- C. A permissive only shared signal face, regardless of where it is positioned and regardless of how many adjacent through signal faces are provided, shall always simultaneously display the same color of circular indication that the adjacent through signal face or faces display.
- D. If the permissive only mode is not the only left-turn mode used for the approach, the signal face shall be the same shared signal face that is used for the protected/permissive mode (see Section 4F.07) except that the left-turn GREEN ARROW and left-turn YELLOW ARROW signal indications shall not be displayed when operating in the permissive only mode.

### **Section 4F.04 Signal Indications for Permissive Only Mode Left-Turn Movements in a Separate Signal Face**

#### **Standard:**

01 A separate left-turn signal face shall not be used for an approach that does not include a mandatory left-turn lane.

02 If a separate left-turn signal face is being operated in a permissive only left-turn mode, a CIRCULAR GREEN signal indication shall not be used in that face.

03 If a separate left-turn signal face is being operated in a permissive only left-turn mode and a flashing left-turn YELLOW ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-2):

- A. It shall be capable of displaying the following signal indications: steady left-turn RED ARROW, steady left-turn YELLOW ARROW, and flashing left-turn YELLOW ARROW. Only one of the three indications shall be displayed at any given time.
- B. During the permissive left-turn movement, a flashing left-turn YELLOW ARROW signal indication shall be displayed.
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the flashing left-turn YELLOW ARROW signal indication.
- D. It shall be permitted to display a flashing left-turn YELLOW ARROW signal indication for a permissive

**left-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement.**

- E. During steady mode (stop-and-go) operation, the signal section that displays the steady left-turn YELLOW ARROW signal indication during change intervals shall not be used to display the flashing left-turn YELLOW ARROW signal indication for permissive left turns unless a bimodal signal section capable of alternating between the display of a steady YELLOW ARROW and a flashing YELLOW ARROW signal indication is used to operate variable left- turn mode phasing.**
- F. During flashing mode operation (see Section 4G.01), the display of a flashing left-turn YELLOW ARROW signal indication shall be only from the signal section that displays a steady left-turn YELLOW ARROW signal indication during steady mode (stop-and-go) operation.**
- G. If the permissive only mode is not the only left-turn mode used for the approach, the signal face shall be the same separate left-turn signal face with a flashing YELLOW ARROW signal indication that is used for the protected/permissive mode (see Section 4F.08) except that the left- turn GREEN ARROW signal indication shall not be displayed when operating in the permissive only mode.**

**Option:**

04 A separate left-turn signal face with a flashing left-turn RED ARROW signal indication during the permissive left-turn movement may be used for unusual geometric conditions, such as wide medians with offset left-turn lanes, but only when an engineering study determines that each and every vehicle must successively come to a full stop before making a permissive left turn.

**Standard:**

05 If a separate left-turn signal face is being operated in a permissive only left-turn mode and a flashing left-turn RED ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-3):

- A. It shall be capable of displaying the following signal indications: steady or flashing left-turn RED ARROW, steady left-turn YELLOW ARROW, and left-turn GREEN ARROW. Only one of the three indications shall be displayed at any given time. The GREEN ARROW indication is required in order to provide a three-section signal face, but shall not be displayed during the permissive only mode.**
- B. During the permissive left-turn movement, a flashing left-turn RED ARROW signal indication shall be displayed, thus indicating that each and every vehicle must successively come to a full stop before making a permissive left turn.**
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the flashing left-turn RED ARROW signal indication.**
- D. It shall be permitted to display a flashing left-turn RED ARROW signal indication for a permissive left-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement.**
- E. A supplementary sign shall not be required. ~~If used, it shall be a LEFT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27) sign (see Section 2B.59).~~**

**Option:**

06 The requirements of Item A in Paragraph 5 of this Section may be met by a vertically-arranged signal face with a horizontal cluster of two left-turn RED ARROW signal indications, the left-most of which displays a steady indication and the right-most of which displays a flashing indication (see Figure 4F-3).

## **Section 4F.05 Signal Indications for Protected Only Mode Left-Turn Movements in a Shared Signal Face**

**Standard:**

01 A shared signal face shall not be used for protected only mode left turns unless the CIRCULAR GREEN and left-turn GREEN ARROW signal indications always begin and terminate together. If a shared signal face is provided for a protected only mode left turn, it shall meet the following requirements (see Figure 4F-4):

- A. It shall be capable of displaying the following signal indications: steady CIRCULAR RED, steady CIRCULAR YELLOW, CIRCULAR GREEN, and left-turn GREEN ARROW. Only one of the three colors shall be displayed at any given time.**
- B. During the protected left-turn movement, the shared signal face shall simultaneously display both a**

**CIRCULAR GREEN signal indication and a left-turn GREEN ARROW signal indication.**

- C. The shared signal face shall always simultaneously display the same color of circular indication that the adjacent through signal face or faces display.
- D. If the protected only mode is not the only left-turn mode used for the approach, the signal face shall be the same shared signal face that is used for the protected/permissive mode (see Section 4F.07).

Option:

02 A straight-through GREEN ARROW signal indication may be used instead of the CIRCULAR GREEN signal indication in Items A and B in Paragraph 1 of this Section on an approach where a straight- through GREEN ARROW signal indication is also used instead of a CIRCULAR GREEN signal indication in the other signal face(s) for through traffic.

**Section 4F.06 Signal Indications for Protected Only Mode Left-Turn Movements in a Separate Signal Face**

Standard:

01 A separate left-turn signal face shall not be used for an approach that does not include a mandatory left-turn lane.

02 If a separate left-turn signal face is provided for a protected only mode left turn, it shall meet the following requirements (see Figure 4F-5):

- A. It shall be capable of displaying, the following signal indications: steady left-turn RED ARROW, steady left-turn YELLOW ARROW, and left-turn GREEN ARROW. Only one of the three indications shall be displayed at any given time.
- B. During the protected left-turn movement, a left-turn GREEN ARROW signal indication shall be displayed.
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the left- turn GREEN ARROW signal indication.
- D. If the protected only mode is not the only left-turn mode used for the approach, the signal face shall be the same separate left-turn signal face that is used for the protected/permissive mode (see Section 4F.08 and Figures 4F-3 and 4F-7) except that the flashing left-turn YELLOW ARROW or flashing left-turn RED ARROW signal indication shall not be displayed when operating in the protected only mode.

Guidance:

03 Since separate signal phases for protected left turns will reduce the green time available for other phases, alternate means of handling left turn conflicts should be considered first.

Support:

04 The most likely possibilities are:

1. Prohibition of left turns. This can be done only if there are convenient alternate means of making the movement. Typical alternate means are:
  - a. A series of right and/or left turns around a block to permit getting to the desired destination; or
  - b. Making the left turn at an adjacent unsignalized intersection during gaps in the opposing through traffic.
2. Geometric changes to eliminate the left turn. An effective change would be a complete separation or a complete or partial "clover leaf" at grade. Any of these, while eliminating left turns, requires additional cost and right of way.
3. Provide protected-permissive or permissive-protected left turn operation. The protected left turn interval may be prohibited during certain periods of the day to allow only permissive intervals for left turn movement in order to increase the green time available for other phases. Refer to Section 4F.07 for the requirements of protected-permissive or permissive-protected left turn operation.

Guidance:

05 Protected left turn phases should be considered where such alternatives couldn't be utilized, and one or more of the following conditions exist:

1. Collisions - Five or more left turn collisions for a particular left turn movement during a recent 12-month period.
2. Delay - Left-turn delay of one or more vehicles, which were waiting at the beginning of the green interval and are still remaining in the left turn lane after at least 80% of the total number of cycles for one hour.
3. Volume - At new intersections where only estimated volumes are available, the following criteria may be used. For pre-timed signal or a background-cycle-controlled actuated signal, a left turn volume of more than two vehicles per

*approach per cycle for a peak hour; or for a traffic-actuated signal, 50 or more left turning vehicles per hour in one direction with the product of the turning and conflicting through traffic during the peak hour of 100,000 or more.*

4. *Miscellaneous. Other factors that might be considered include but are not limited to: impaired sight distance due to horizontal or vertical curvature, or where there are a large percentage of buses and trucks.*

## **Section 4F.07 Signal Indications for Protected/Permissive Mode Left-Turn Movements in a Shared Signal Face**

### **Standard:**

01 If a shared signal face is provided for a protected/permissive mode left turn, it shall meet the following requirements (see Figure 4F-6):

- A. It shall be capable of displaying the following signal indications: steady CIRCULAR RED, steady CIRCULAR YELLOW, CIRCULAR GREEN, steady left-turn YELLOW ARROW, and left-turn GREEN ARROW. Only one of the three circular indications shall be displayed at any given time. Only one of the two arrow indications shall be displayed at any given time. If the left-turn GREEN ARROW signal indication and the CIRCULAR GREEN signal indication(s) for the adjacent through movement are always terminated together, the steady left-turn YELLOW ARROW signal indication shall not be required.
- B. During the protected left-turn movement, the shared signal face shall simultaneously display a left-turn GREEN ARROW signal indication and a circular signal indication that is the same color as the signal indication for the adjacent through lane on the same approach as the protected left turn.
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the left- turn GREEN ARROW signal indication, unless the left-turn GREEN ARROW signal indication and the CIRCULAR GREEN signal indication(s) for the adjacent through movement are being terminated together. When the left-turn GREEN ARROW and CIRCULAR GREEN signal indications are being terminated together, the required display following the left-turn GREEN ARROW signal indication shall be either the display of a CIRCULAR YELLOW signal indication alone or the simultaneous display of the CIRCULAR YELLOW and left-turn YELLOW ARROW signal indications.
- D. During the permissive left-turn movement, the shared signal face shall display only a CIRCULAR GREEN signal indication.
- E. A protected/permissive shared signal face, regardless of where it is positioned and regardless of how many adjacent through signal faces are provided, shall always simultaneously display the same color of circular indication that the adjacent through signal face or faces display.
- F. A supplementary sign shall not be required. If used, it shall be a LEFT TURN YIELD ON GREEN (symbolic circular green) (R10-12) sign (see Section 2B.59).

## **Section 4F.08 Signal Indications for Protected/Permissive Mode Left-Turn Movements in a Separate Signal Face**

### **Standard:**

01 A separate left-turn signal face shall not be used for an approach that does not include a mandatory left-turn lane.

02 If a separate left-turn signal face is being operated in a protected/permissive left-turn mode, a CIRCULAR GREEN signal indication shall not be used in that face.

03 If a separate left-turn signal face is being operated in a protected/permissive left-turn mode and a flashing left-turn YELLOW ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-7):

- A. It shall be capable of displaying the following signal indications: steady left-turn RED ARROW, steady left-turn YELLOW ARROW, flashing left-turn YELLOW ARROW, and left-turn GREEN ARROW. Only one of the four indications shall be displayed at any given time.
- B. During the protected left-turn movement, a left-turn GREEN ARROW signal indication shall be displayed.
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the left- turn GREEN ARROW signal indication. It shall be permitted to display a steady left-turn RED ARROW

**signal indication immediately following the steady left-turn YELLOW ARROW signal indication to provide a red clearance interval.**

- D. During the permissive left-turn movement, a flashing left-turn YELLOW ARROW signal indication shall be displayed.**
- E. A steady left-turn YELLOW ARROW signal indication shall be displayed following the flashing left-turn YELLOW ARROW signal indication if the permissive left-turn movement is being terminated and the separate left-turn signal face will subsequently display a steady left-turn RED ARROW indication.**
- F. It shall be permitted to display a flashing left-turn YELLOW ARROW signal indication for a permissive left-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement.**
- G. When a permissive left-turn movement is changing to a protected left-turn movement, a left- turn GREEN ARROW signal indication shall be displayed immediately upon the termination of the flashing left-turn YELLOW ARROW signal indication. A steady left-turn YELLOW ARROW signal indication shall not be displayed between the display of the flashing left-turn YELLOW ARROW signal indication and the display of the steady left-turn GREEN ARROW signal indication.**
- H. The display shall be either:**
  - 1. A four-section signal face with the steady left-turn YELLOW ARROW signal indication being displayed in a different section than the flashing left-turn YELLOW ARROW signal indication, or**
  - 2. A three-section signal face with the steady left-turn YELLOW ARROW signal indication and the flashing left-turn YELLOW ARROW signal indication being displayed in the same bimodal signal section.**
- I. During steady mode (stop-and-go) operation where a four-section signal face is used, the signal section that displays the steady left-turn YELLOW ARROW signal indication during change intervals shall not be used to display the flashing left-turn YELLOW ARROW signal indication for permissive left turns.**
- J. During flashing mode operation (see Chapter 4G) where a four-section signal face is used, the display of a flashing left-turn YELLOW ARROW signal indication shall be only from the signal section that displays a steady left-turn YELLOW ARROW signal indication during steady mode (stop-and-go) operation.**

Option:

- 04 A bimodal signal section (capable of displaying a GREEN ARROW for the protected left-turn movement and a flashing YELLOW ARROW for the permissive left-turn movement) along with a steady left- turn YELLOW ARROW signal indication and a steady left-turn RED ARROW signal indication may be used for a separate left-turn signal face and may be considered to be a four-section signal face that is compliant with Item H.1 of Paragraph 3 of this Section.
- 05 A separate left-turn signal face with a flashing left-turn RED ARROW signal indication during the permissive left-turn movement may be used for unusual geometric conditions, such as wide medians with offset left-turn lanes, but only when an engineering study determines that each and every vehicle must successively come to a full stop before making a permissive left turn.

Standard:

- 06 If a separate left-turn signal face is being operated in a protected/permissive left-turn mode and a flashing left- turn RED ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-3):

- A. It shall be capable of displaying the following signal indications: steady or flashing left-turn RED ARROW, steady left-turn YELLOW ARROW, and left-turn GREEN ARROW. Only one of the three indications shall be displayed at any given time.**
- B. During the protected left-turn movement, a left-turn GREEN ARROW signal indication shall be displayed.**
- C. A steady left-turn YELLOW ARROW signal indication shall be displayed following the left- turn GREEN ARROW signal indication.**
- D. During the permissive left-turn movement, a flashing left-turn RED ARROW signal indication shall be displayed.**
- E. A steady left-turn YELLOW ARROW signal indication shall be displayed following the flashing left- turn RED ARROW signal indication if the permissive left-turn movement is being terminated and the separate left-turn signal face will subsequently display a steady left-turn RED ARROW indication.**

- F. When a permissive left-turn movement is changing to a protected left-turn movement, a left- turn GREEN ARROW signal indication shall be displayed immediately upon the termination of the flashing left-turn RED ARROW signal indication. A steady left-turn YELLOW ARROW signal indication shall not be displayed between the display of the flashing left-turn RED ARROW signal indication and the display of the steady left-turn GREEN ARROW signal indication.
- G. It shall be permitted to display a flashing left-turn RED ARROW signal indication for a permissive left- turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement.
- H. A supplementary sign shall not be required. ~~If used, it shall be a LEFT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27) sign (see Section 2B.59).~~

Option:

07 The requirements of Item A in Paragraph 6 of this Section may be met by a vertically-arranged signal face with a horizontal cluster of two left-turn RED ARROW signal indications, the left-most of which displays a steady indication and the right-most of which displays a flashing indication (see Figure 4F-3).

## Section 4F.09 Signal Indications for Right-Turn Movements – General

Support:

01 In Sections 4F.10 through 4F.15, provisions applicable to right-turn movements and right-turn lanes are also applicable to signal indications for U-turns to the right that are provided at locations where right turns are prohibited or not geometrically possible.

02 Right-turning traffic is controlled by one of four modes as follows:

- A. Permissive Only Mode—turns made on a CIRCULAR GREEN signal indication, a flashing right-turn YELLOW ARROW signal indication, or a flashing right-turn RED ARROW signal indication after yielding to pedestrians, if any.
- B. Protected Only Mode—turns made only when a right-turn GREEN ARROW signal indication is displayed.
- C. Protected/Permissive Mode—both modes occur on an approach during the same cycle.
- D. Variable Right-Turn Mode—the operating mode changes among the protected only mode and/or the protected/permisive mode and/or the permissive only mode during different periods of the day or as traffic conditions change.

Standard:

03 During a permissive right-turn movement, the signal faces, if any, that exclusively control U- turn traffic that conflicts with the permissive right-turn movement (see Item H.1 in Paragraph 3 in Section 4F.01) shall simultaneously display steady U-turn RED ARROW signal indications. If pedestrians crossing the lane or lanes used by the permissive right-turn movement to depart the intersection are controlled by pedestrian signal heads, the signal indications displayed by those pedestrian signal heads shall not be limited to any particular display during the permissive right-turn movement.

04 During a protected right-turn movement, a GREEN ARROW or a YELLOW ARROW signal indication shall not simultaneously be displayed to left-turning traffic on the opposing approach, except where a separate departure lane is available for each left-turn and right-turn lane with moving traffic and pavement markings or raised channelization clearly indicate which departure lane to use (see Item H.1 in Paragraph 3 in Section 4F.01). Signal faces, if any, that exclusively control U-turn traffic that conflicts with the protected right-turn movement shall simultaneously display steady RED ARROW signal indications. If pedestrians crossing the lane or lanes used by the protected right-turn movement to depart the intersection are controlled by pedestrian signal heads, the pedestrian signal heads shall display a steady UPRAISED HAND (symbolizing DONT WALK) signal indication during the protected right-turn movement.

05 If a combined right-turn/through lane exists on an approach, a right-turn GREEN ARROW or right-turn YELLOW ARROW signal indication or a flashing right-turn RED ARROW signal indication shall not be displayed to the approach simultaneously with a CIRCULAR RED signal indication for the through movement, and a right-turn RED ARROW signal indication shall not be displayed to the approach simultaneously with a CIRCULAR GREEN or CIRCULAR YELLOW signal indication for the through movement.

06 If the operating mode changes among the protected only mode and/or the protected/permisive mode and/or

**the permissive only mode during different periods of the day or as traffic conditions change, the requirements in Sections 4F.10 through 4F.15 that are appropriate to that mode of operation shall be met, subject to the following:**

- A. The CIRCULAR GREEN and CIRCULAR YELLOW signal indications shall not be displayed when operating in the protected only mode.
- B. The right-turn GREEN ARROW and right-turn YELLOW ARROW signal indications shall not be displayed when operating in the permissive only mode.

Option:

07 When variable right-turn mode phasing is used for an approach that has a combined right- turn/straight-through lane and a flashing yellow arrow is used as the permissive turn display, a five-section shared right-turn signal face containing both circular and arrow indications may be used in combination with one or more separate right-turn signal faces for the mandatory right-turn lane(s), if any are present, on the same approach. The steady right-turn YELLOW ARROW signal indication and the flashing right-turn YELLOW ARROW signal indication may be displayed in the same section of the five-section shared right- turn signal face.

08 Additional static signs or changeable message signs may be used to meet the requirements for the variable right-turn mode or to inform drivers that right-turn green arrows will not be available during certain times of the day.

Support:

09 Sections 4F.10 through 4F.15 describe the use of the following two types of signal faces for controlling right-turn movements:

- A. Shared signal face – This type of signal face controls both the right-turn movement and the adjacent movement (usually the through movement) and can serve as one of the two required primary signal faces for the adjacent movement. A shared signal face always displays the same color of circular indication that is displayed by the signal face or faces for the adjacent movement.
- B. Separate right-turn signal face – This type of signal face controls only the right-turn movement and cannot serve as one of the two required primary signal faces for the adjacent movement (usually the through movement) because it displays signal indications that are applicable only to the right-turn movement. If a separate right-turn signal face is mounted overhead at the intersection, it is positioned over the extension of the mandatory right-turn lane. In a separate right-turn signal face, a flashing right-turn YELLOW ARROW signal indication or a flashing right-turn RED ARROW signal indication is used to control permissive right-turn movements.

10 Section 4D.07 contains provisions regarding the lateral positioning of signal faces that control right- turn movements.

11 It is not necessary that the same mode of right-turn operation or same type of right-turn signal face be used on every approach to a signalized location. Selecting different modes and types of right-turn signal faces for the various approaches to the same signalized location is acceptable.

Option:

12 A signal face that is shared by left-turning and right-turning traffic may be provided for a combined left-turn/right-turn lane on an approach that has no through traffic (see Section 4F.16).

Guidance:

13 *A right-turn green arrow should be considered for use only when there is an exclusive right-turn lane or it is the only movement that traffic is permitted to make or when the right-turn volume exceeds 200 vehicles per hour.*

## **Section 4F.10 Signal Indications for Permissive Only Mode Right-Turn Movements in a Shared Signal Face**

Standard:

01 If a shared signal face is provided for a permissive only mode right turn, it shall meet the following requirements (see Figure 4F-8):

- A. It shall be capable of displaying the following signal indications: steady CIRCULAR RED, steady CIRCULAR YELLOW, and CIRCULAR GREEN. Only one of the three indications shall be displayed at any given time.
- B. During the permissive right-turn movement, a CIRCULAR GREEN signal indication shall be displayed.
- C. A permissive only shared signal face, regardless of where it is positioned and regardless of how many adjacent through signal faces are provided, shall always simultaneously display the same color of circular indication that the adjacent through signal face or faces display.

D. If the permissive only mode is not the only right-turn mode used for the approach, the signal face shall be the same shared signal face that is used for the protected/permisive mode (see Section 4F.14) except that the right-turn GREEN ARROW and right-turn YELLOW ARROW signal indications shall not be displayed when operating in the permissive only mode.

## Section 4F.11 Signal Indications for Permissive Only Mode Right-Turn Movements in a Separate Signal Face

### Standard:

01 A separate right-turn signal face shall not be used for an approach that does not include a mandatory right-turn lane.

02 If a separate right-turn signal face is being operated in a permissive only right-turn mode, a CIRCULAR GREEN signal indication shall not be used in that face.

03 If a separate right-turn signal face is being operated in a permissive only right-turn mode and a flashing right-turn YELLOW ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-9):

- A. It shall be capable of displaying one of the following sets of signal indications:
  1. Steady right-turn RED ARROW, steady right-turn YELLOW ARROW, and flashing right- turn YELLOW ARROW. Only one of the three indications shall be displayed at any given time.
  2. Steady CIRCULAR RED, steady right-turn YELLOW ARROW, and flashing right-turn YELLOW ARROW. Only one of the three indications shall be displayed at any given time. If the CIRCULAR RED signal indication is sometimes displayed when the signal faces for the adjacent through lane(s) are not displaying a CIRCULAR RED signal indication, a RIGHT TURN SIGNAL (R10-10R) sign (see Section 2B.59) shall be used unless the CIRCULAR RED signal indication in the separate right-turn signal face is shielded, hooded, louvered, positioned, or designed such that it is not readily visible to drivers in the through lane(s).
- B. During the permissive right-turn movement, a flashing right-turn YELLOW ARROW signal indication shall be displayed.
- C. A steady right-turn YELLOW ARROW signal indication shall be displayed following the flashing right-turn YELLOW ARROW signal indication.
- D. When the separate right-turn signal face is ~~provided providing a message to stop and remain stopped~~, a steady right-turn RED ARROW signal indication shall be displayed if it is intended that right turns on red not be permitted (except when a traffic control device is in place permitting a turn on a steady RED ARROW signal indication) or a steady CIRCULAR RED signal indication shall be displayed if it is intended that right turns on red be permitted. [Refer to CVC 21453](#).
- E. It shall be permitted to display a flashing right-turn YELLOW ARROW signal indication for a permissive right-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications.
- F. During steady mode (stop-and-go) operation, the signal section that displays the steady right- turn YELLOW ARROW signal indication during change intervals shall not be used to display the flashing right-turn YELLOW ARROW signal indication for permissive right turns unless a bimodal signal section capable of alternating between the display of a steady YELLOW ARROW and a flashing YELLOW ARROW signal indication is used during variable right-turn mode operation.
- G. During flashing mode operation (see Chapter 4G), the display of a flashing right-turn YELLOW ARROW signal indication shall be only from the signal section that displays a steady right-turn YELLOW ARROW signal indication during steady mode (stop-and-go) operation.
- H. If the permissive only mode is not the only right-turn mode used for the approach, the signal face shall be the same separate right-turn signal face with a flashing YELLOW ARROW signal indication that is used for the protected/permisive mode (see Section 4F.15) except that the right-turn GREEN ARROW signal indication shall not be displayed when operating in the permissive only mode.

### Option:

04 When an engineering study determines that each and every vehicle must successively come to a full stop before making a permissive right turn, a separate right-turn signal face with a flashing right-turn RED ARROW signal

indication during the permissive right-turn movement may be used.

**Standard:**

05 If a separate right-turn signal face is being operated in a permissive only right-turn mode and a flashing right-turn RED ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-10):

- A. It shall be capable of displaying one of the following sets of signal indications:
  1. Steady or flashing right-turn RED ARROW, steady right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of the three indications shall be displayed at any given time. The GREEN ARROW indication is required in order to provide a three-section signal face, but shall not be displayed during the permissive only mode.
  2. Steady CIRCULAR RED on the left and steady right-turn RED ARROW on the right of the top position, steady right-turn YELLOW ARROW in the middle position, and right-turn GREEN ARROW in the bottom position. Only one of the four indications shall be displayed at any given time. The GREEN ARROW indication is required in order to provide three vertical positions, but shall not be displayed during the permissive only mode. If the CIRCULAR RED signal indication is sometimes displayed when the signal faces for the adjacent through lane(s) are not displaying a CIRCULAR RED signal indication, a RIGHT TURN SIGNAL (R10-10R) sign (see Section 2B.59) shall be used unless the CIRCULAR RED signal indication in the separate right-turn signal face is shielded, hooded, louvered, positioned, or designed such that it is not readily visible to drivers in the through lane(s).
- B. During the permissive right-turn movement, a flashing right-turn RED ARROW signal indication shall be displayed, thus indicating that each and every vehicle must successively come to a full stop before making a permissive right turn.
- C. A steady right-turn YELLOW ARROW signal indication shall be displayed following the flashing right-turn RED ARROW signal indication.
- D. When the separate right-turn signal face is ~~provided providing a message to stop and remain stopped~~, a steady right-turn RED ARROW signal indication shall be displayed if it is intended that right turns on red not be permitted (~~except when a traffic control device is in place permitting a turn on a steady RED ARROW signal indication~~) or a steady CIRCULAR RED signal indication shall be displayed if it is intended that right turns on red be permitted. [Refer to CVC 21453](#).
- E. The display of a flashing right-turn RED ARROW signal indication for a permissive right-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement shall be permitted.
- F. A supplementary sign shall not be required. ~~If used, it shall be a RIGHT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27) sign (see Section 2B.59).~~

Option:

06 The requirements of Item A.1 in Paragraph 5 of this Section may be met by a vertically-arranged signal face with a horizontal cluster of two right-turn RED ARROW signal indications, the left-most of which displays a steady indication and the right-most of which displays a flashing indication (see Figure 4F-10).

## Section 4F.12 Signal Indications for Protected Only Mode Right-Turn Movements in a Shared Signal Face

**Standard:**

01 A shared signal face shall not be used for protected only mode right turns unless the CIRCULAR GREEN and right-turn GREEN ARROW signal indications always begin and terminate together. If a shared signal face is provided for a protected only right turn, it shall meet the following requirements (see Figure 4F-11):

- A. It shall be capable of displaying the following signal indications: steady CIRCULAR RED, steady CIRCULAR YELLOW, CIRCULAR GREEN, and right-turn GREEN ARROW. Only one of the three colors shall be displayed at any given time.
- B. During the protected right-turn movement, the shared signal face shall simultaneously display both a CIRCULAR GREEN signal indication and a right-turn GREEN ARROW signal indication.
- C. The shared signal face shall always simultaneously display the same color of circular indication that the

adjacent through signal face or faces display.

D. If the protected only mode is not the only right-turn mode used for the approach, the signal face shall be the same shared signal face that is used for the protected/permissive mode (see Section 4F.15).

Option:

02 A straight-through GREEN ARROW signal indication may be used instead of the CIRCULAR GREEN signal indication in Items A and B in Paragraph 1 of this Section on an approach where a straight- through GREEN ARROW signal indication is also used instead of a CIRCULAR GREEN signal indication in the other signal face(s) for through traffic.

### Section 4F.13 Signal Indications for Protected Only Mode Right-Turn Movements in a Separate Signal Face

Standard:

01 A separate right-turn signal face shall not be used for an approach that does not include a mandatory right-turn lane.

02 If a separate right-turn signal face is provided for a protected only mode right turn, it shall meet the following requirements (see Figure 4F-12):

- A. It shall be capable of displaying one of the following sets of signal indications:
  1. Steady right-turn RED ARROW, steady right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of the three indications shall be displayed at any given time.
  2. Steady CIRCULAR RED, steady right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of three indications shall be displayed at any given time. If the CIRCULAR RED signal indication is sometimes displayed when the signal faces for the adjacent through lane(s) are not displaying a CIRCULAR RED signal indication, a RIGHT TURN SIGNAL (R10-10R) sign (see Section 2B.59) shall be used unless the CIRCULAR RED signal indication is shielded, hooded, louvered, positioned, or designed such that it is not readily visible to drivers in the through lane(s).
- B. During the protected right-turn movement, a right-turn GREEN ARROW signal indication shall be displayed.
- C. A steady right-turn YELLOW ARROW signal indication shall be displayed following the right- turn GREEN ARROW signal indication.
- D. When the separate signal face is ~~provided providing a message to stop and remain stopped~~, a steady right-turn RED ARROW signal indication shall be displayed if it is intended that right turns on red not be permitted (~~except when a traffic control device is in place permitting a turn on a steady RED ARROW signal indication~~) or a steady CIRCULAR RED signal indication shall be displayed if it is intended that right turns on red be permitted. Refer to CVC 21453.
- E. If the protected only mode is not the only right-turn mode used for the approach, the signal face shall be the same separate right-turn signal face that is used for the protected/permissive mode (see Section 4F.15) except that a flashing right-turn YELLOW ARROW or flashing right-turn RED ARROW signal indication shall not be displayed when operating in the protected only mode.

### Section 4F.14 Signal Indications for Protected/Permissive Mode Right-Turn Movements in a Shared Signal Face

Standard:

01 If a shared signal face is provided for a protected/permissive mode right turn, it shall meet the following requirements (see Figure 4F-13):

- A. It shall be capable of displaying the following signal indications: steady CIRCULAR RED, steady CIRCULAR YELLOW, CIRCULAR GREEN, steady right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of the three circular indications shall be displayed at any given time. Only one of the two arrow indications shall be displayed at any given time. If the right-turn GREEN ARROW signal indication and the CIRCULAR GREEN signal indication(s) for the adjacent through movement are always terminated together, the steady right-turn YELLOW ARROW signal indication shall not be required.
- B. During the protected right-turn movement, the shared signal face shall simultaneously display a right-

turn GREEN ARROW signal indication and a circular signal indication that is the same color as the signal indication for the adjacent through lane on the same approach as the protected right turn.

- C. A steady right-turn YELLOW ARROW signal indication shall be displayed following the right- turn GREEN ARROW signal indication, unless the right-turn GREEN ARROW signal indication and the CIRCULAR GREEN signal indication(s) for the adjacent through movement are being terminated together. When the right-turn GREEN ARROW and CIRCULAR GREEN signal indications are being terminated together, the required display following the right-turn GREEN ARROW signal indication shall be either the display of a CIRCULAR YELLOW signal indication alone or the simultaneous display of the CIRCULAR YELLOW and right-turn YELLOW ARROW signal indications.
- D. During the permissive right-turn movement, the shared signal face shall display only a CIRCULAR GREEN signal indication.
- E. A protected/permissive shared signal face, regardless of where it is positioned and regardless of how many adjacent through signal faces are provided, shall always simultaneously display the same color of circular indication that the adjacent through signal face or faces display.

#### Section 4F.15 Signal Indications for Protected/Permissive Mode Right-Turn Movements in a Separate Signal Face

##### Standard:

- 01 A separate right-turn signal face shall not be used for an approach that does not include a mandatory right-turn lane.
- 02 If a separate right-turn signal face is being operated in a protected/permissive right-turn mode, a CIRCULAR GREEN signal indication shall not be used in that face.
- 03 If a separate right-turn signal face is being operated in a protected/permissive right-turn mode and a flashing right-turn YELLOW ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-14):

- A. It shall be capable of displaying one of the following sets of signal indications:
  1. Steady right-turn RED ARROW, steady right-turn YELLOW ARROW, flashing right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of the four indications shall be displayed at any given time.
  2. Steady CIRCULAR RED, steady right-turn YELLOW ARROW, flashing right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of the four indications shall be displayed at any given time. If the CIRCULAR RED signal indication is sometimes displayed when the signal faces for the adjacent through lane(s) are not displaying a CIRCULAR RED signal indication, a RIGHT TURN SIGNAL (R10-10R) sign (see Section 2B.59) shall be used unless the CIRCULAR RED signal indication in the separate right-turn signal face is shielded, hooded, louvered, positioned, or designed such that it is not readily visible to drivers in the through lane(s).
- B. During the protected right-turn movement, a right-turn GREEN ARROW signal indication shall be displayed.
- C. A steady right-turn YELLOW ARROW signal indication shall be displayed following the right- turn GREEN ARROW signal indication. It shall be permitted to display a steady right-turn RED ARROW signal indication immediately following the steady right-turn YELLOW ARROW signal indication to provide a red clearance interval.
- D. During the permissive right-turn movement, a flashing right-turn YELLOW ARROW signal indication shall be displayed.
- E. A steady right-turn YELLOW ARROW signal indication shall be displayed following the flashing right- turn YELLOW ARROW signal indication if the permissive right-turn movement is being terminated and the separate right-turn signal face will subsequently display a steady red indication.
- F. When a permissive right-turn movement is changing to a protected right-turn movement:
  1. If a permissive left-turn movement from the opposing approach is being terminated simultaneously with the termination of the permissive right-turn movement, a steady right- turn YELLOW ARROW signal indication shall be displayed following the flashing right- turn YELLOW ARROW signal indication. To provide a red clearance interval, it shall be permitted to display a steady right-turn

**RED ARROW signal indication immediately following the steady right-turn YELLOW ARROW signal indication.**

2. If a permissive left-turn movement from the opposing approach that is being terminated simultaneously with the termination of the permissive right-turn movement is not present, a right-turn GREEN ARROW signal indication shall be displayed immediately upon the termination of the flashing right-turn YELLOW ARROW signal indication. In this situation, a steady right-turn YELLOW ARROW signal indication shall not be displayed between the display of the flashing right-turn YELLOW ARROW signal indication and the display of the steady right-turn GREEN ARROW signal indication.
- G. When the separate right-turn signal face is **provided** ~~providing a message to stop and remain stopped~~, a steady right-turn RED ARROW signal indication shall be displayed if it is intended that right turns on red not be permitted ~~(except when a traffic control device is in place permitting a turn on a steady RED ARROW signal indication)~~ or a steady CIRCULAR RED signal indication shall be displayed if it is intended that right turns on red be permitted. **Refer to CVC 21453.**
- H. It shall be permitted to display a flashing right-turn YELLOW ARROW signal indication for a permissive right-turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications.
- I. The display shall be either:
  1. A four-section signal face with the steady right-turn YELLOW ARROW signal indication being displayed in a different section than the flashing right-turn YELLOW ARROW signal indication, or
  2. A three-section signal face with the steady right-turn YELLOW ARROW signal indication and the flashing right-turn YELLOW ARROW signal indication being displayed in the same bimodal signal section.
- J. During steady mode (stop-and-go) operation where a four-section signal face is used, the signal section that displays the steady right-turn YELLOW ARROW signal indication during change intervals shall not be used to display the flashing right-turn YELLOW ARROW signal indication for permissive right turns.
- K. During flashing mode operation (see Chapter 4G) where a four-section signal face is used, the display of a flashing right-turn YELLOW ARROW signal indication shall be only from the signal section that displays a steady right-turn YELLOW ARROW signal indication during steady mode (stop-and-go) operation.

Option:

04 A bimodal signal section (capable of displaying a GREEN ARROW for the protected right-turn movement and a flashing YELLOW ARROW for the permissive right-turn movement) along with a steady right-turn YELLOW ARROW signal indication and a steady right-turn RED ARROW signal indication may be used for a separate right-turn signal face and may be considered to be a four-section signal face that is compliant with Item I.1 of Paragraph 3 of this Section.

05 When an engineering study determines that each and every vehicle must successively come to a full stop before making a permissive right turn, a separate signal face that has a flashing right-turn RED ARROW signal indication during the permissive right-turn movement may be used.

Standard:

06 If a separate right-turn signal face is being operated in a protected/permissive right-turn mode and a flashing right-turn RED ARROW signal indication is provided, it shall meet the following requirements (see Figure 4F-10):

- A. It shall be capable of displaying one of the following sets of signal indications:
  1. Steady or flashing right-turn RED ARROW, steady right-turn YELLOW ARROW, and right-turn GREEN ARROW. Only one of the three indications shall be displayed at any given time.
  2. Steady CIRCULAR RED on the left and steady or flashing right-turn RED ARROW on the right of the top position, steady right-turn YELLOW ARROW in the middle position, and right-turn GREEN ARROW in the bottom position. Only one of the four indications shall be displayed at any given time. If the CIRCULAR RED signal indication is sometimes displayed when the signal faces for the adjacent through lane(s) are not displaying a CIRCULAR RED signal indication, a RIGHT

**TURN SIGNAL (R10-10R) sign (see Section 2B.59) shall be used unless the CIRCULAR RED signal indication in the separate right-turn signal face is shielded, hooded, louvered, positioned, or designed such that it is not readily visible to drivers in the through lane(s).**

- B. During the protected right-turn movement, a right-turn GREEN ARROW signal indication shall be displayed.**
- C. A steady right-turn YELLOW ARROW signal indication shall be displayed following the right- turn GREEN ARROW signal indication.**
- D. During the permissive right-turn movement, the separate right-turn signal face shall display a flashing right-turn RED ARROW signal indication.**
- E. A steady right-turn YELLOW ARROW signal indication shall be displayed following the flashing right- turn RED ARROW signal indication if the permissive right-turn movement is being terminated and the separate right-turn signal face will subsequently display a steady red indication.**
- F. When a permissive right-turn movement is changing to a protected right-turn movement, a right-turn GREEN ARROW signal indication shall be displayed immediately upon the termination of the flashing right-turn RED ARROW signal indication. A steady right-turn YELLOW ARROW signal indication shall not be displayed between the display of the flashing right-turn RED ARROW signal indication and the display of the steady right-turn GREEN ARROW signal indication.**
- G. When the separate right-turn signal face is ~~provided providing a message to stop and remain stopped~~, a steady right-turn RED ARROW signal indication shall be displayed if it is intended that right turns on red not be permitted (except when a traffic control device is in place permitting a turn on a steady RED ARROW signal indication) or a steady CIRCULAR RED signal indication shall be displayed if it is intended that right turns on red be permitted. Refer to CVC 21453.**
- H. It shall be permitted to display a flashing right-turn RED ARROW signal indication for a permissive right- turn movement while the signal faces for the adjacent through movement display steady CIRCULAR RED signal indications and the opposing left-turn signal faces display left-turn GREEN ARROW signal indications for a protected left-turn movement.**
- I. A supplementary sign shall not be required. ~~If used, it shall be a RIGHT TURN YIELD ON FLASHING RED ARROW AFTER STOP (R10-27) sign (see Section 2B.59).~~**

Option:

07 The requirements of Item A.1 in Paragraph 6 of this Section may be met by a vertically-arranged signal face with a horizontal cluster of two right-turn RED ARROW signal indications, the left-most of which displays a steady indication and the right-most of which displays a flashing indication (see Figure 4F-10).

## **Section 4F.16 Signal Indications for Approaches with No Through Movement**

Support:

01 The provisions of this section apply only to approaches where no through movement exists, such as the stem of a T-intersection or where the opposite approach is a one-way roadway in the opposing direction.

Standard:

02 **Except for single-lane approaches, a minimum of two primary signal faces shall be provided for the signalized turning movement that is considered to be the major movement from the approach (see Section 4D.05).**

Option:

03 The required two primary signal faces and any supplemental primary signal faces may continuously display a steady CIRCULAR RED signal indication while steady or flashing YELLOW and steady GREEN ARROW signal indications are displayed during times when the traffic control signal is being operated in the steady (stop-and-go) mode. The continuous display of steady CIRCULAR RED is intended to reinforce that there is no through movement for safety-critical locations.

Standard:

04 **CIRCULAR GREEN and CIRCULAR YELLOW signal indications shall not be displayed to an approach with no through movement if:**

- A. The posted or statutory speed limit on the approach is 35 mph or higher,**
- B. The one-way roadway that opposes the approach is an exit ramp from a freeway or expressway, or**
- C. The one-way roadway that opposes the approach has a posted or statutory speed limit of 35 mph or**

**higher.**

Support:

05 A lane from which left-turn and right-turn movements can both be made is sometimes provided on an approach that has no through movement, either as the only approach lane or as one of several approach lanes.

Option:

06 If all of the lanes on the approach are designated as mandatory turn lanes and no lane is designated as a combined left-turn/right-turn lane, the left-turn and right-turn movements may start and terminate independently, and the left-turn and right-turn movements each may be operated in one or more of the modes of operation as described in Sections 4F.02 through 4F.15.

Standard:

07 **When a combined left-turn/right-turn lane exists on an approach, the left-turn and right-turn movements shall start and terminate simultaneously and the red signal indication used in each of the signal faces on the approach shall be a CIRCULAR RED.**

Support:

08 This requirement for the use of CIRCULAR RED signal indications in signal faces for approaches having a combined lane for left-turn and right-turn movements is a specific exception to other provisions in this Chapter that would otherwise require the use of RED ARROW signal indications.

Standard:

09 **The signal faces provided for an approach with a combined left-turn/right-turn lane and no through movement shall be one of the following:**

- A. **Except as provided in Paragraph 6 of Section 4F.01 and Paragraph 4 of this Section, two or more signal faces, each capable of displaying CIRCULAR RED, CIRCULAR YELLOW, and CIRCULAR GREEN signal indications, shall be provided for the approach. This display shall be permissible regardless of the number of mandatory left-turn and/or right-turn lanes that exist on the approach in addition to the combined left-turn/right-turn lane and regardless of whether or not there are pedestrian or opposing vehicular movements that conflict with the left- turn or right-turn movements. However, if there is an opposing approach and the signal phasing protects the left-turn movement on the approach with the combined left-turn/right-turn lane from conflicts with the opposing vehicular movements and any signalized pedestrian movements, a left-turn GREEN ARROW signal indication shall also be included in the left-most signal face and shall be displayed simultaneously with the CIRCULAR GREEN signal indication.**
- B. **If the approach has one or more mandatory turn lanes in addition to the combined left- turn/right-turn lane and there is no conflict with a signalized vehicular or pedestrian movement, and GREEN ARROW signal indications are used in place of CIRCULAR GREEN signal indications on the approach, the signal faces for the approach shall be:**
  1. **A signal face(s) capable of displaying CIRCULAR RED, YELLOW ARROW, and GREEN ARROW signal indications for the mandatory turn lane(s), with the arrows pointing in the direction of the turn, and**
  2. **A shared left-turn/right-turn signal face capable of displaying CIRCULAR RED, left-turn YELLOW ARROW, left-turn GREEN ARROW, right-turn YELLOW ARROW, and right- turn GREEN ARROW signal indications, in an arrangement of signal sections that complies with the provisions of Section 4E.04 or 4E.05.**
- C. **If the approach has one or more mandatory turn lanes in addition to the combined left- turn/right-turn lane and there is a conflict with a signalized vehicular or pedestrian movement, and flashing YELLOW ARROW signal indications are used in place of CIRCULAR GREEN signal indications on the approach, the signal faces for the approach shall be as described in Items B.1 and B.2 of this Paragraph, except that flashing YELLOW ARROW signal indications shall be used in place of the GREEN ARROW signal indications for the turning movement(s) that conflicts with the signalized vehicular or pedestrian movement.**

Support:

10 Figure 4F-15 illustrates application of these Standards on approaches that have only a combined left- turn/right-turn lane, and on approaches that have one or more mandatory turn lanes in addition to the combined left-turn/right-turn

lane.

Option:

11 If the lane-use regulations on an approach are variable such that at certain times all of the lanes on the approach are designated as mandatory turn lanes and no lane is designated as a combined left-turn/right-turn lane:

- A. During the times that no lane is designated as a combined left-turn/right-turn lane, the left-turn and right-turn movements may start and terminate independently, and the left-turn and right-turn movements may be operated in one or more of the modes of operation as described in Sections 4F.02 through 4F.15; and
- B. If a protected/permissive mode is used, the operation of the shared left-turn/right-turn signal face provided in Paragraph 9 may be modified to display the steady left-turn (right-turn) YELLOW ARROW signal indication and the flashing left-turn (right-turn) YELLOW ARROW signal indication in the same section in order to not exceed the maximum of five sections per signal face provided in Section 4E.03.

## **Section 4F.17 Yellow Change and Red Clearance Intervals**

Support:

01 The exclusive function of the yellow change interval is to warn traffic approaching a signalized location that their permission to proceed is being terminated after which they will be directed to stop, or in the case of a protected/permissive turning movement that their protected movement is being terminated after which they will need to perform their turn in a permissive manner.

Standard:

02 A steady yellow signal indication shall be displayed following every CIRCULAR GREEN or GREEN ARROW signal indication and following every flashing YELLOW ARROW or flashing RED ARROW signal indication displayed as a part of a steady mode operation. This requirement shall not apply when a CIRCULAR GREEN, a flashing YELLOW ARROW, or a flashing RED ARROW signal indication is followed immediately by a GREEN ARROW signal indication.

03 The duration of the yellow change interval shall be determined using engineering practices.

Support:

04 Section 4F.01 contains provisions regarding the display of steady CIRCULAR YELLOW signal indications to approaches from which drivers are allowed to make permissive left turns.

Guidance:

05 When indicated by the application of engineering practices, the yellow change interval should be followed by a red clearance interval to provide additional time before conflicting traffic movements, including pedestrians, are released.

Standard:

06 When used, the duration of the red clearance interval shall be determined using engineering practices.

07 The durations of yellow change intervals and red clearance intervals shall be consistent with the determined values within the technical capabilities of the controller unit.

08 The duration of a yellow change interval shall not vary on a cycle-by-cycle basis within the same signal timing plan.

09 Except as provided in Paragraph 10 of this Section, the duration of a red clearance interval shall not be decreased or omitted on a cycle-by-cycle basis within the same signal timing plan.

Option:

10 The duration of a red clearance interval may be extended from its predetermined value for a given cycle based upon the detection of a vehicle that is predicted to violate the red signal indication.

11 When an actuated signal sequence includes a signal phase for permissive/protected (lagging) left-turn movements in both directions, the red clearance interval may be shown during those cycles when the lagging left-turn signal phase is skipped and may be omitted during those cycles when the lagging left-turn signal phase is shown.

12 The duration of a yellow change interval or a red clearance interval may be different in different signal timing plans for the same controller unit.

Support:

12a When used, red clearance intervals normally range from 0.1 to 2.0 seconds.

Guidance:

13 A yellow change interval should have a minimum duration of 3 seconds, and a maximum duration of 6 seconds. The longer intervals should be reserved for use on approaches with higher speeds. Except when clearing a one-lane, two-

*way facility (see Section 40.02) or when clearing an exceptionally wide intersection, a red clearance interval should have a duration not exceeding 6 seconds.*

13a *Practitioners should exercise engineering judgment for determination of the minimum yellow change interval. Judgment should be based on numerous factors including, but not limited to, field observation of traffic behavior, intersection geometrics, downhill grade, perception-reaction time of drivers in the area, and actually driving the protected left-turn or protected right-turn movements to assess the need for longer yellow change intervals. Particular attention should be paid where setting minimum yellow change interval timing when exclusive turn lane exceeds 150 feet in length excluding the transition. Refer to Table 4D-101(CA).*

Support:

13b The purpose of the yellow signal indication is to warn traffic approaching a traffic signal that the related green movement is ending or that a steady red indication will be exhibited immediately thereafter and traffic will be required to stop when the red signal is exhibited.

Standard:

13c **The minimum yellow change interval for through traffic movement shall be determined by using the 85th percentile speed of free-flow traffic rounded up to the next 5 mph increment. Where the posted or prima facie speed limit is higher than the rounded value, use the posted or prima facie speed limit for determination of the minimum yellow change interval for the through traffic movement. See Table 4D-101(CA) sub-heading "a".**

13d **If the 85th percentile speed data is not available, the minimum yellow change interval for through traffic movements shall be determined by adding 7 miles per hour to the posted or prima facie speed limits of 30 mph or higher, and by adding 10 miles per hour to the posted or prima facie speed limits of 25 mph or less. See Table 4D-101(CA) sub-heading "b".**

Option:

13e The minimum yellow change interval for the through movement and the protected left-turn or protected right-turn may be increased based on appropriate engineering judgment.

Standard:

14 **Except for Warning Beacons mounted on advance warning signs on the approach to a signalized location (see Section 2C.35), signal displays that are intended to provide a "pre-yellow warning" interval, such as flashing green signal indications, vehicular countdown displays, or other similar displays, shall not be used at a signalized location.**

Support:

15 The use of signal displays (other than Warning Beacons mounted on advance warning signs) that convey a "pre-yellow warning" have been found by research to increase the frequency of crashes.

## **Section 4F.18 Preemption and Priority Control of Traffic Control Signals – General**

Option:

01 Traffic control signals may be designed and operated to respond to certain classes of approaching vehicles by altering the normal signal timing and phasing plan(s) during the approach and passage of those vehicles. The alternative plan(s) may be as simple as extending a currently displayed green interval or as complex as replacing the entire set of signal phases and timing.

Support:

02 Some types or classes of vehicles supersede others when a traffic control signal responds to more than one type or class. In general, a vehicle that is more difficult to control supersedes a vehicle that is easier to control.

Option:

03 Preemption or priority control of traffic control signals may also be a means of indicating to specified classes of vehicles at certain non-intersection locations, such as on approaches to one-lane bridges and tunnels, movable bridges, highway maintenance and construction activities, metered freeway entrance ramps, and transit operations, that they are permitted to proceed.

Guidance:

04 *When a traffic control signal that is returning to a steady mode from a dark mode (typically upon restoration from a power failure) receives a preemption or priority request, care should be exercised to minimize the possibility of vehicles or pedestrians being misdirected into a conflict with the vehicle making the request.*

**Option:**

05 During the change from a dark mode to a steady mode under a preemption or priority request, the display of signal indications that could misdirect road users may be prevented by one or more of the following methods:

- A. Having the traffic control signal remain in the dark mode,
- B. Having the traffic control signal remain in the flashing mode,
- C. Altering the flashing mode,
- D. Executing the normal start-up routine before responding, or
- E. Responding directly to initial or dwell period.

**Guidance:**

06 *Traffic control signals operating under preemption control or under priority control should be operated in a manner designed to keep traffic moving.*

07 *Traffic control signals that are designed to respond under preemption or priority control to more than one type or class of vehicle should be designed to respond in the relative order of importance or difficulty in stopping the type or class of vehicle. The order of priority should be: train, boat, heavy vehicle (fire vehicle, emergency medical service), light vehicle (law enforcement), light rail ~~transit~~ vehicles, rubber-tired ~~transit~~ vehicles.*

**Option:**

08 If engineering judgment indicates that light rail transit signal indications would reduce road user confusion that might otherwise occur if standard traffic signal indications were used to control these movements, light rail transit signal indications complying with Section 8D.15 and as illustrated in Figure 8D-3 may be used for preemption or priority control of the following exclusive movements at signalized intersections:

- A. Public transit buses in “queue jumper” lanes, and
- B. Public transit buses in semi-exclusive or mixed-use alignments.

## **Section 4F.19 Preemption Control of Traffic Control Signals**

**Support:**

01 Preemption control (see definition in Section 1C.02) is typically given to trains, boats, emergency vehicles, and light rail transit.

02 Examples of preemption control include the following:

- A. The prompt displaying of green signal indications at signalized locations ahead of fire vehicles, law enforcement vehicles, ambulances, and other official emergency vehicles;
- B. A special sequence of signal phases and timing to expedite and/or provide additional clearance time for vehicles to clear the tracks prior to the arrival of rail traffic; and
- C. A special sequence of signal phases to display a steady red indication to prohibit ~~turning~~ all movements toward the tracks during the approach or passage of rail traffic.

**Standard:**

03 **During the transition into preemption control, the yellow change interval, and any red clearance interval that follows, shall not be shortened or omitted.**

**Option:**

04 During the transition into preemption control:

- A. Any pedestrian walk interval and/or pedestrian change interval may be shortened or omitted.
- B. The red clearance interval, if any, may be omitted so that the return to the previous green signal indication follows a steady yellow signal indication in the same signal face.

**Support:**

04a Section 8D.09 contains additional information regarding the pedestrian change interval for railroad preemption.

**Standard:**

05 **During preemption control and during the transition out of preemption control:**

- A. **Any yellow change interval, and any red clearance interval that follows, shall not be shortened or omitted.**
- B. **A signal indication sequence from a steady yellow signal indication to a green signal indication shall not be permitted.**

**Option:**

06 A distinctive indication may be provided at the intersection to inform law enforcement personnel who are escorting traffic (such as a parade or funeral procession) that the traffic control signal has changed to a red indication not because

of normal cycling, but because it has been preempted by rail traffic approaching an adjacent grade crossing or by boat traffic approaching an adjacent movable bridge.

07 A distinctive indication may be provided at the intersection to show that an emergency vehicle has been given control of the traffic control signal (see Section 11-106 of the “Uniform Vehicle Code”). In order to assist in the understanding of the control of the traffic control signal, a common distinctive indication may be used where drivers from different agencies travel through the same intersection when responding to emergencies.

*Guidance:*

08 *Except for traffic control signals interconnected with light rail transit systems, traffic control signals with railroad preemption or coordinated with flashing-light signal systems should be provided with a back-up power supply.*

09 *If a traffic control signal or hybrid beacon is installed near or within a grade crossing or if a grade crossing with active traffic control devices is within or near a signalized highway intersection, Chapter 8D should be consulted.*

*Support:*

10 Section 8D.09 contains additional information regarding preemption for grade crossings. Section 8D.10 contains information regarding prohibiting movements toward the grade crossing during preemption. Sections 8D.11 and 8D.12 contain additional information regarding pre-signals and queue cutter signals, respectively, for grade crossings.

### **Emergency Vehicle Preemption**

11 Authorized emergency vehicles may preempt traffic signals. The purpose of such preemption is to provide the right of way to the emergency vehicle as soon as practical. The preemption may be controlled by one of the following means:

1. By direct wire, modulated light or radio from a remote location such as a fire house; or
2. By modulated light or radio from an emergency vehicle, or
3. By network communication

*Guidance:*

12 *Emergency vehicle equipment should be capable of encoding IDs.*

13 *Emergency vehicle preemption should provide the following sequence of operation:*

1. *A yellow change interval and any required red clearance interval for any signal phase that is green or yellow when preemption is initiated and which will be red during the preemption interval.*

*Standard:*

14 **The length of the yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the preemption period shall remain green. Any pedestrian walk interval in effect when preemption is initiated shall be immediately terminated. The normal pedestrian clearance interval may be shortened or omitted.**

2. **An all-red intersection preemption display shall not be used.**
3. **The traffic signal shall return to normal operation upon termination of the demand for preemption or the termination of the assured green interval.**

15 **In the event of a demand for an emergency vehicle preemption during the time that the intersection is operating on railroad preemption, the railroad preemption sequence shall continue unaffected until completion. In the event of a demand for railroad preemption during emergency vehicle preemption operation, railroad preemption shall immediately assume control of the intersection.**

16 **When control of emergency vehicle preemption is by means of a radio or modulated light source, the following shall apply:**

1. **The transmitter shall be permanently mounted on the emergency vehicle or building and shall operate at a range sufficient to permit a normal yellow change interval and any required clearance intervals to take place prior to the arrival of the emergency vehicle. The normal pedestrian clearance interval may be abbreviated.**
2. **The preemption system may provide an indication (such as a special signal) to the driver of an emergency vehicle that preemption of the traffic signal has been effected. If a special signal light is used, the color shall not be red, yellow, or green.**
3. **The system shall be designed to prevent simultaneous preemption by two or more emergency vehicles on separate approaches to the intersection.**

17 **When performed by a local agency, the installation of emergency vehicle preemption equipment on state highways shall be covered by an Encroachment Permit issued by the Caltrans District Director.**

18 **The permit shall state the applicable requirements from those listed above and the following:**

1. **It should be understood that the permit for the installation might be revoked or changed as deemed advisable or necessary by Caltrans.**
2. **The programming of the preemption equipment shall be as approved in advance by Caltrans and shall not be changed without written permission. The Permittee shall make any changes in programming, requested by Caltrans.**
3. **The Permittee shall assume all liability for the claims, which arise due to or because of the permit.**

**Support:**

19 Normally emergency vehicle preemption equipment is installed, operated, and maintained at no cost to the State. An exception is where the equipment is installed for use by vehicles of another State agency.

**Standard:**

20 **The State shall maintain the preemption equipment at the traffic signal when the signal is maintained by the State. The costs of such maintenance shall be at 100% local agency expense.**

## **Section 4F.20 Priority Control of Traffic Control Signals**

**Support:**

01 Priority control (see definition in Section 1C.02) is typically given to certain non-emergency vehicles such as light-rail transit vehicles operating in a mixed-use alignment and buses.

02 Examples of priority control include the following:

- A. The displaying of early or extended green signal indications at an intersection to assist public transit vehicles improve operations, and
- B. Special phasing to assist public transit vehicles in entering the travel stream ahead of other waiting traffic.

**Standard:**

03 **During priority control and during the transition into or out of priority control:**

- A. **The shortening or omission of any yellow change interval, and of any red clearance interval that follows, shall not be permitted.**
- B. **The shortening of any pedestrian walk interval below that time described in Section 4I.06 shall not be permitted.**
- C. **The omission of a pedestrian walk interval and its associated change interval shall not be permitted unless the associated vehicular phase is also omitted or the pedestrian phase is exclusive.**
- D. **The shortening or omission of any pedestrian change interval shall not be permitted.**
- E. **A signal indication sequence from a steady yellow signal indication to a green signal indication shall not be permitted.**

### **Bus/Transit Vehicle Priority**

**Support:**

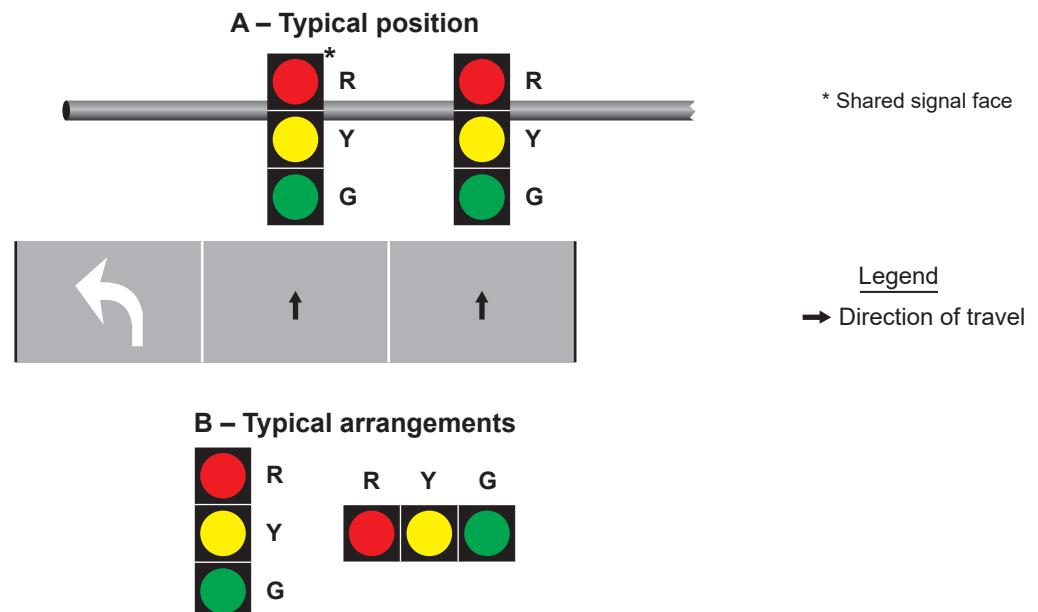
04 The requirements for bus/transit vehicle priority insofar as installation, encroachment permit, maintenance and funding are the same as stated above for emergency vehicle preemption on state highways.

**Guidance:**

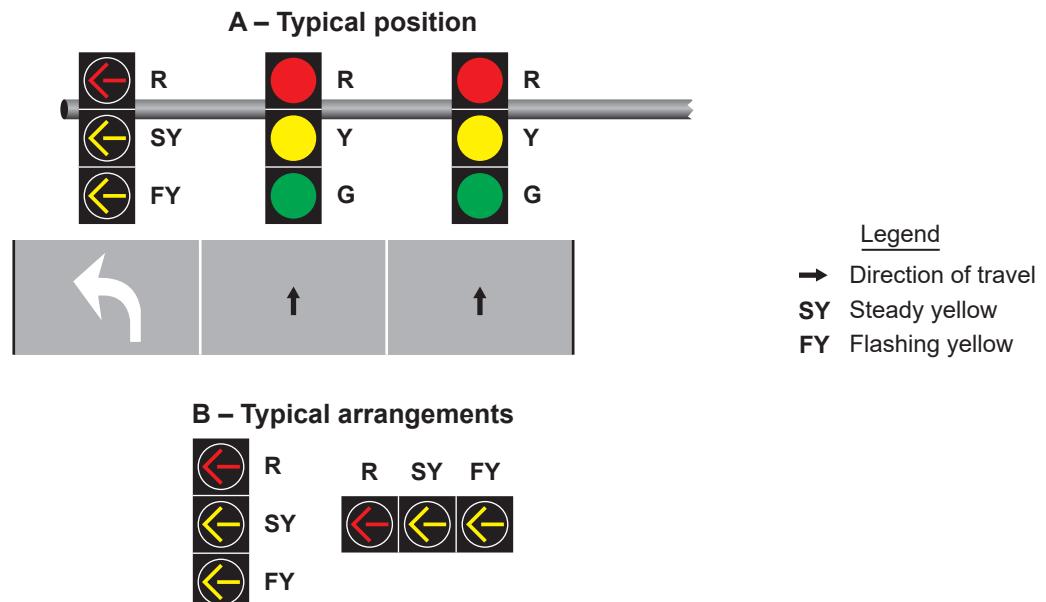
05 *The operational requirements for bus/transit vehicle priority should be similar to those above for emergency vehicle preemption. Refer to CVC Section 25352.*

06 *Normally, bus/transit priority should not occur more than once every other signal cycle..*

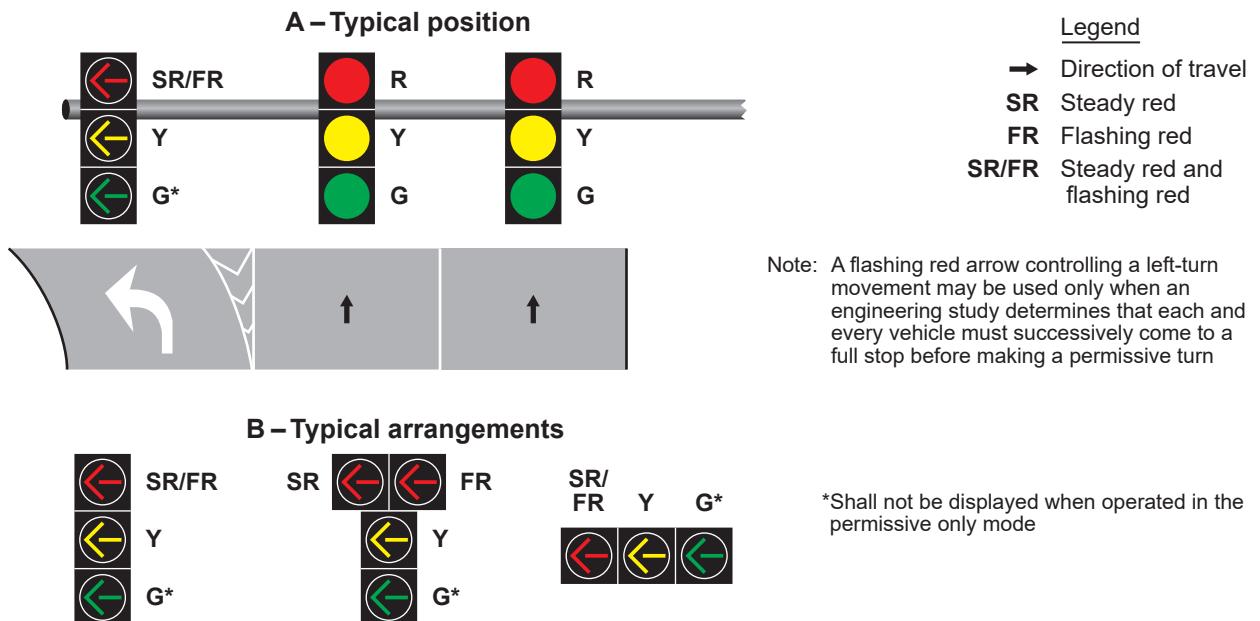
**Figure 4F-1. Typical Position and Arrangements of Shared Signal Faces for Permissive Only Mode Left Turns**



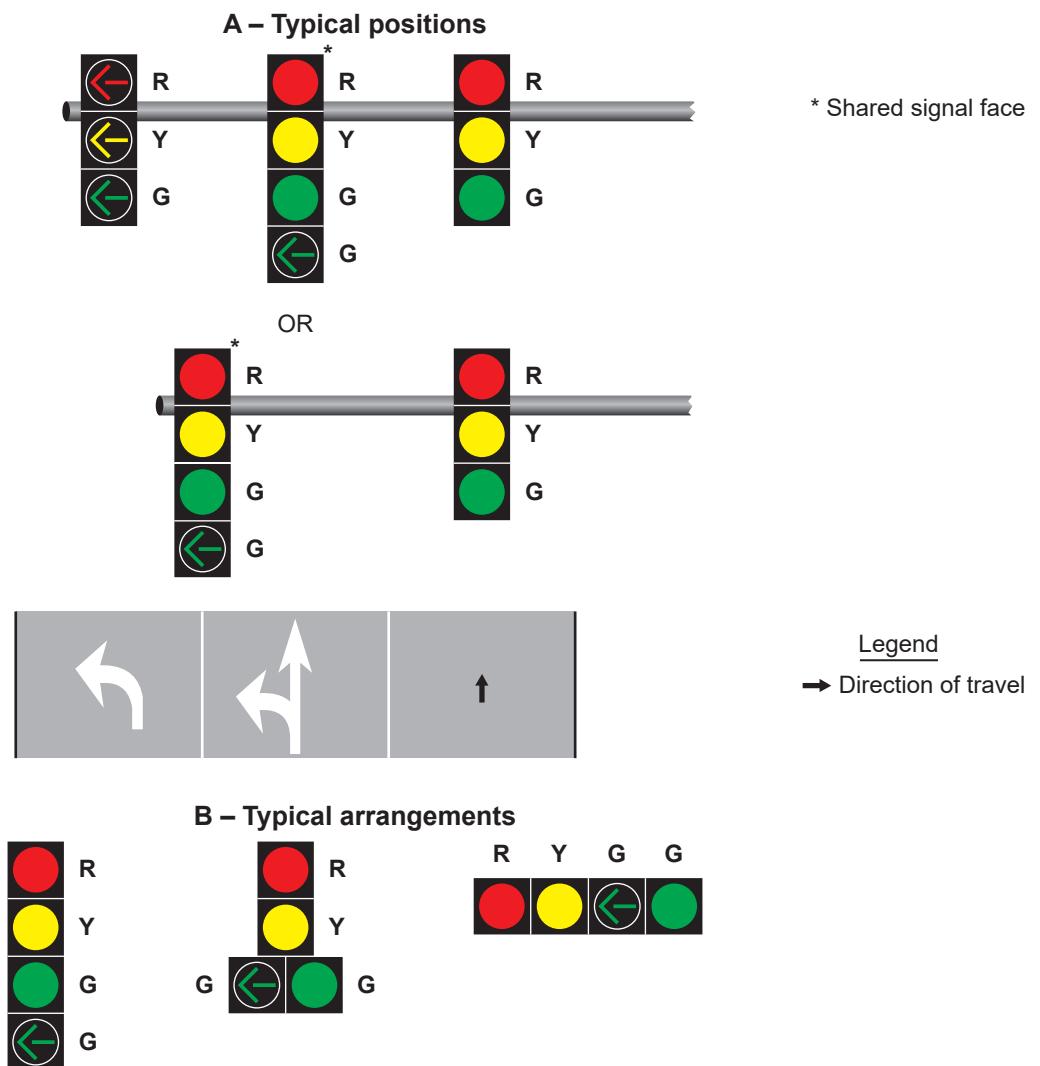
**Figure 4F-2. Typical Position and Arrangements of Separate Signal Faces with Flashing Yellow Arrow for Permissive Only Mode Left Turns**



## Figure 4F-3. Typical Position and Arrangements of Separate Signal Faces with Flashing Red Arrow for Permissive Only Mode and Protected/Permissive Mode Left Turns

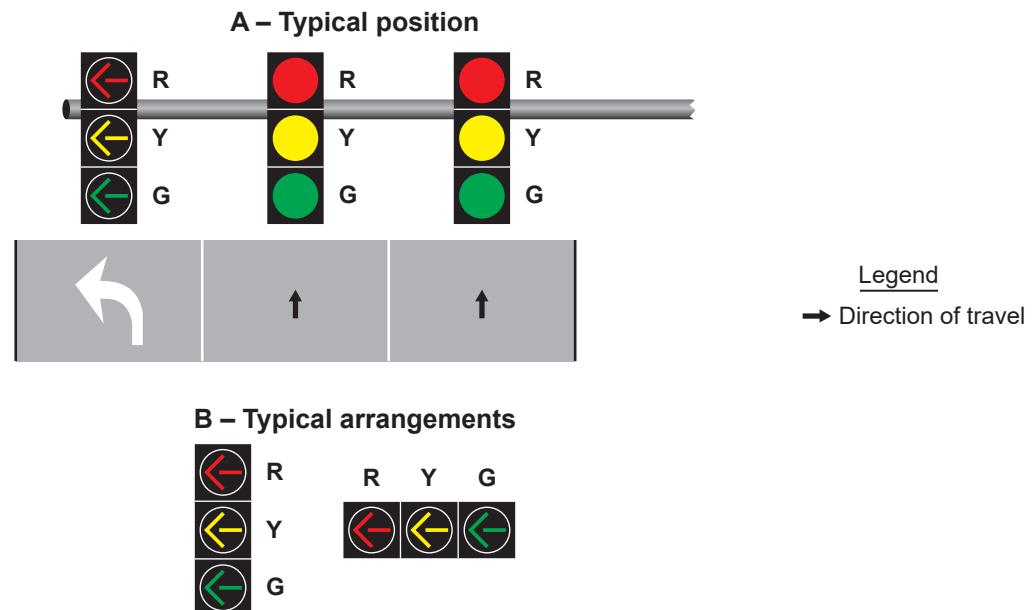


**Figure 4F-4. Typical Positions and Arrangements of Shared Signal Faces for Protected Only Mode Left Turns**



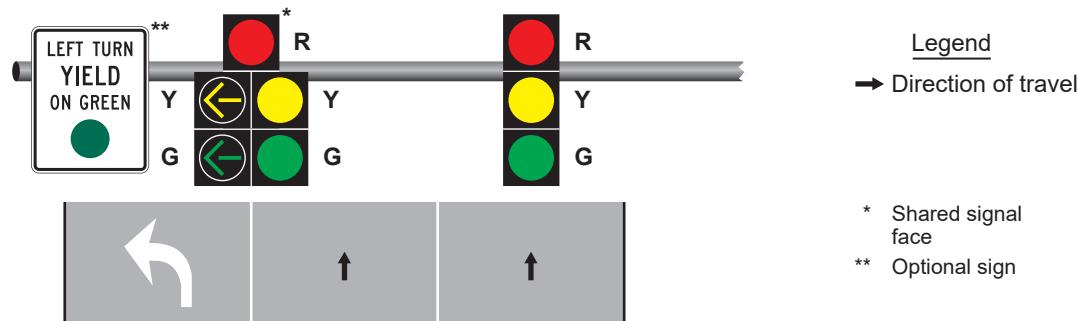
Note: Shared signal faces shall only be used for a protected-only mode left turn if the circular green and green left-turn arrow indications always begin and terminate together

**Figure 4F-5. Typical Position and Arrangements of Separate Signal Faces for Protected Only Mode Left Turns**

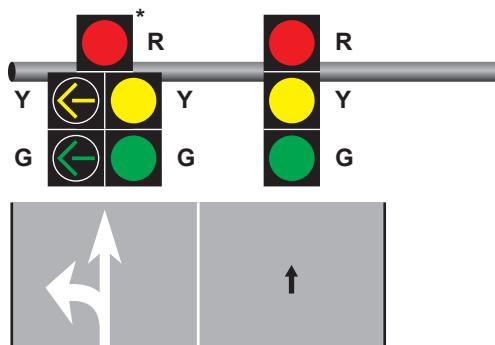


## Figure 4F-6. Typical Position and Arrangements of Shared Signal Faces for Protected/Permissive Mode Left Turns

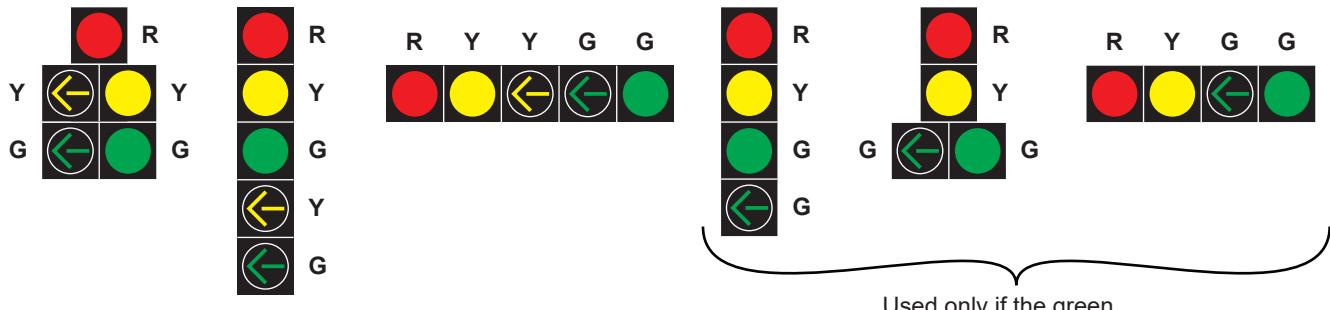
### A – Typical position with a mandatory left turn lane



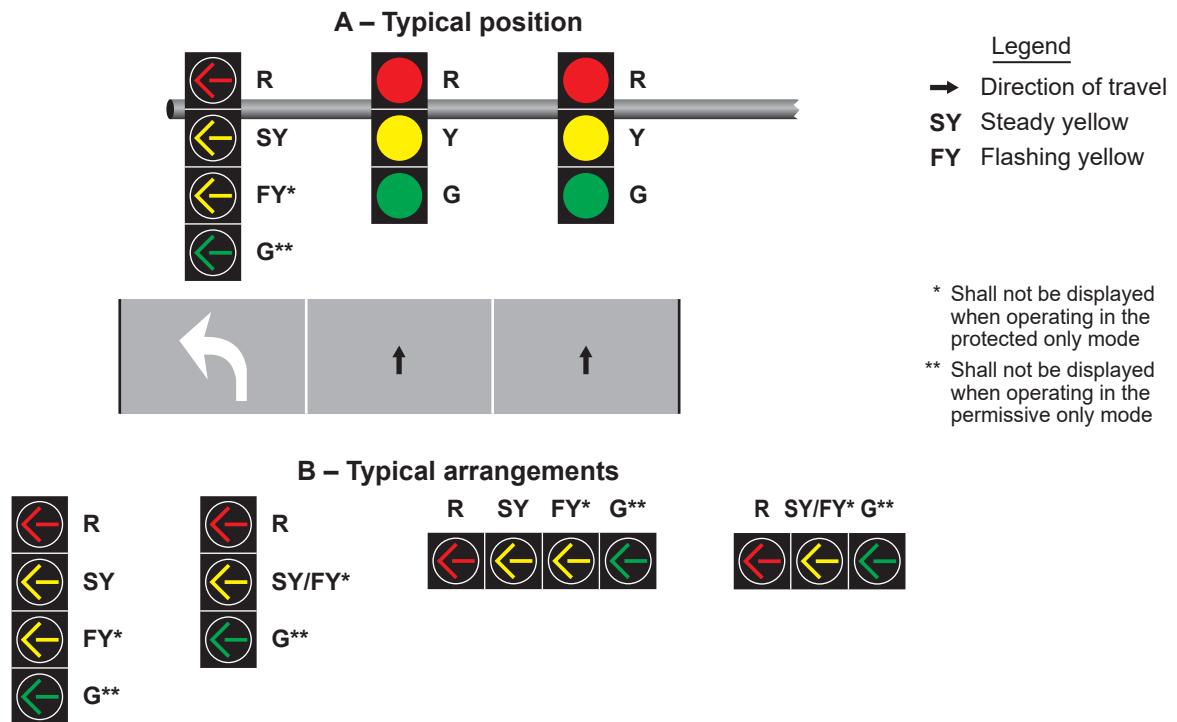
### B – Typical position without a mandatory left turn lane



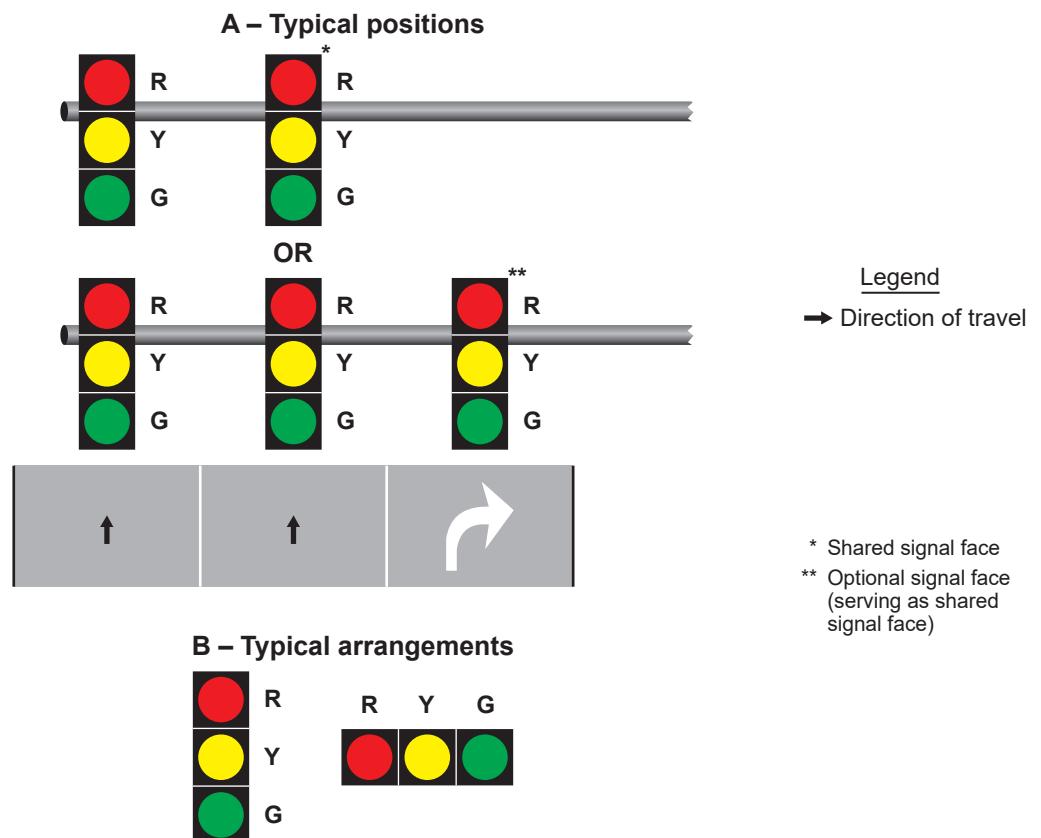
### C – Typical arrangements



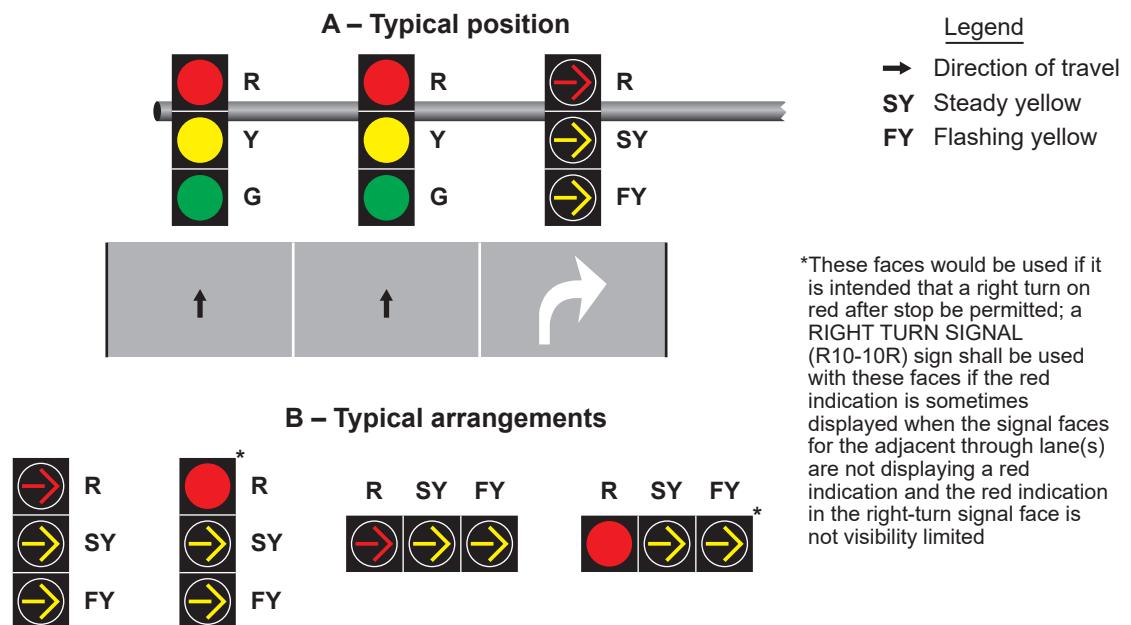
## Figure 4F-7. Typical Position and Arrangements of Separate Signal Faces with Flashing Yellow Arrow for Protected/Permissive Mode and Variable Mode Left Turns



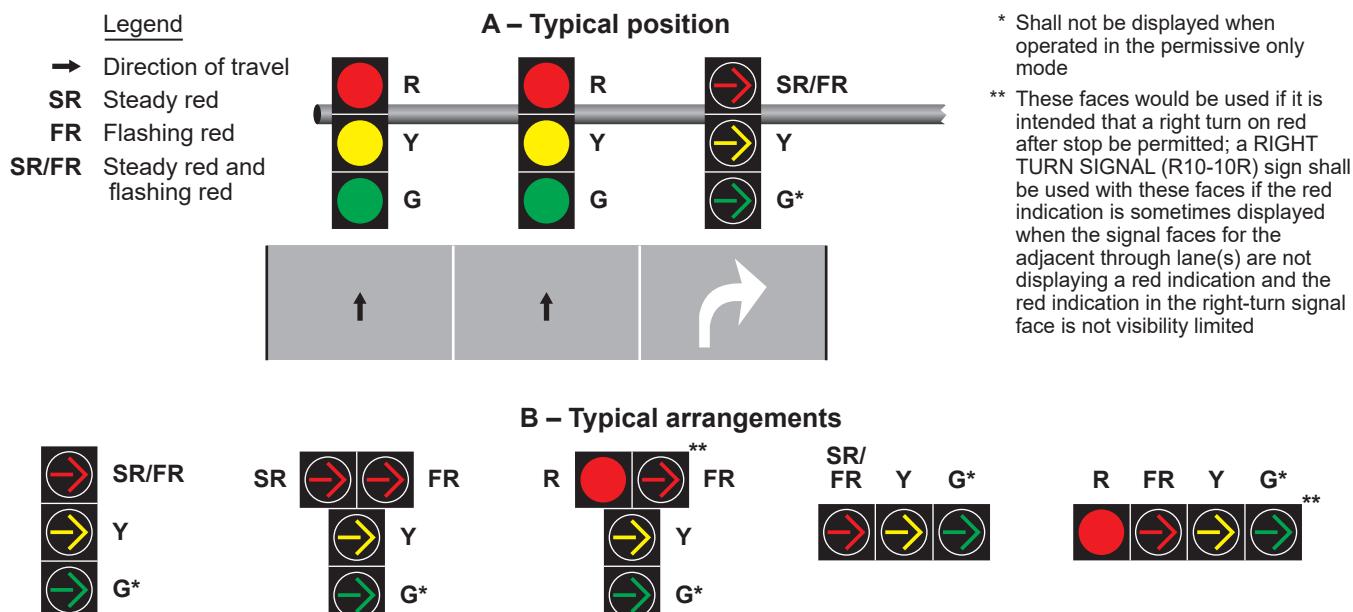
**Figure 4F-8. Typical Positions and Arrangements of Shared Signal Faces for Permissive Only Mode Right Turns**



**Figure 4F-9. Typical Position and Arrangements of Separate Signal Faces with Flashing Yellow Arrow for Permissive Only Mode Right Turns**

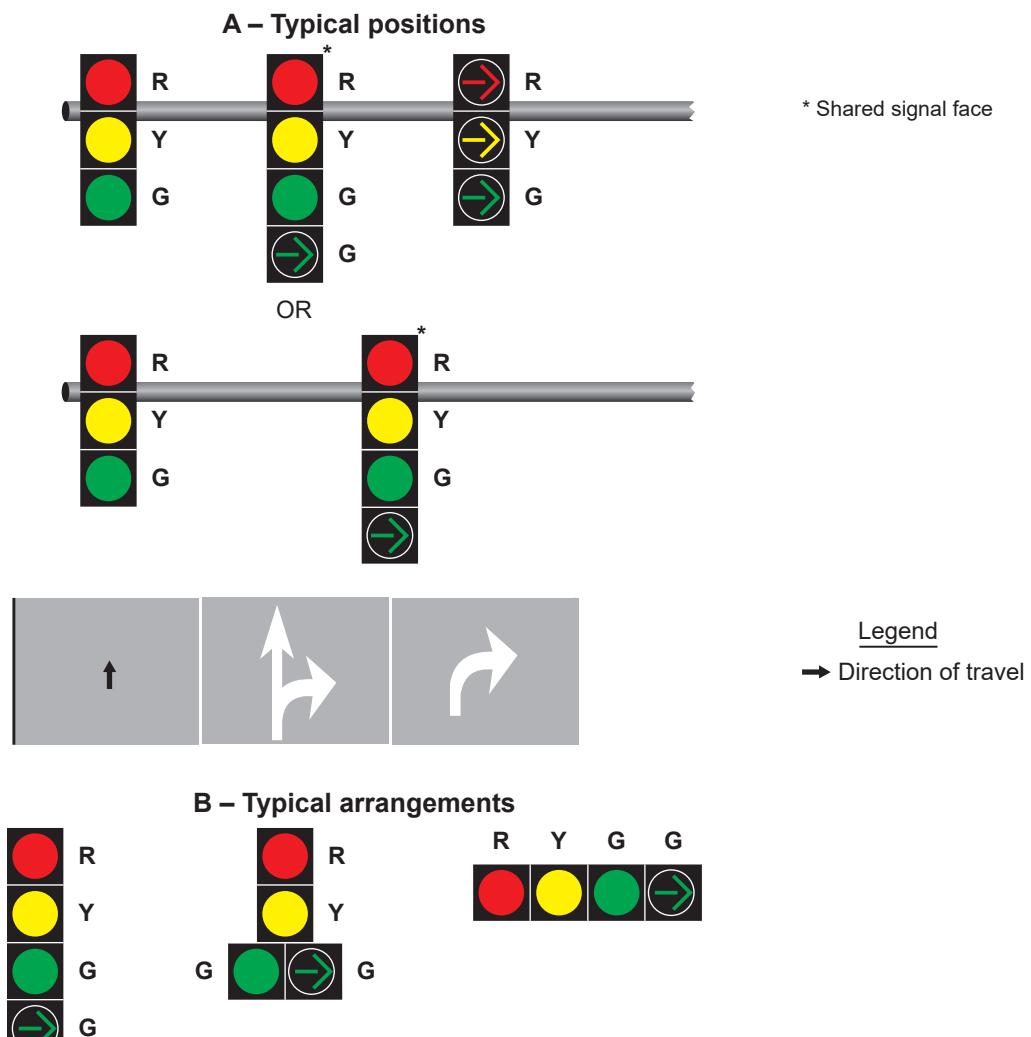


## Figure 4F-10. Typical Position and Arrangements of Separate Signal Faces with Flashing Red Arrow for Permissive Only Mode and Protected/Permissive Mode Right Turns



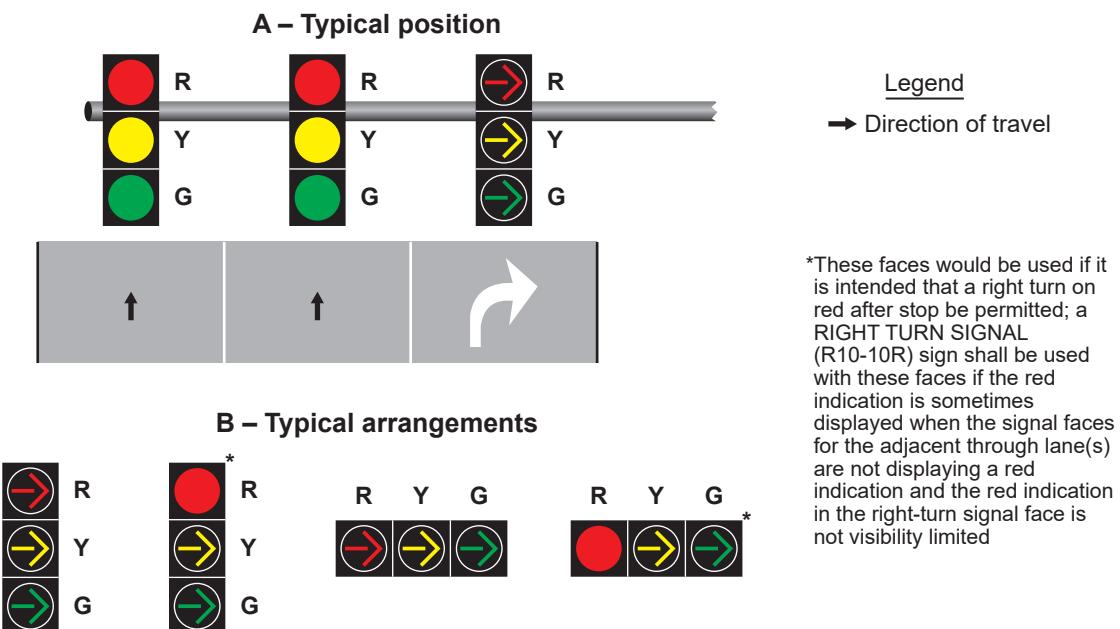
Note: A flashing red arrow controlling a right-turn movement may be used only when an engineering study determines that each and every vehicle must successively come to a full stop before making a permissive turn

**Figure 4F-11. Typical Positions and Arrangements of Shared Signal Faces for Protected Only Mode Right Turns**



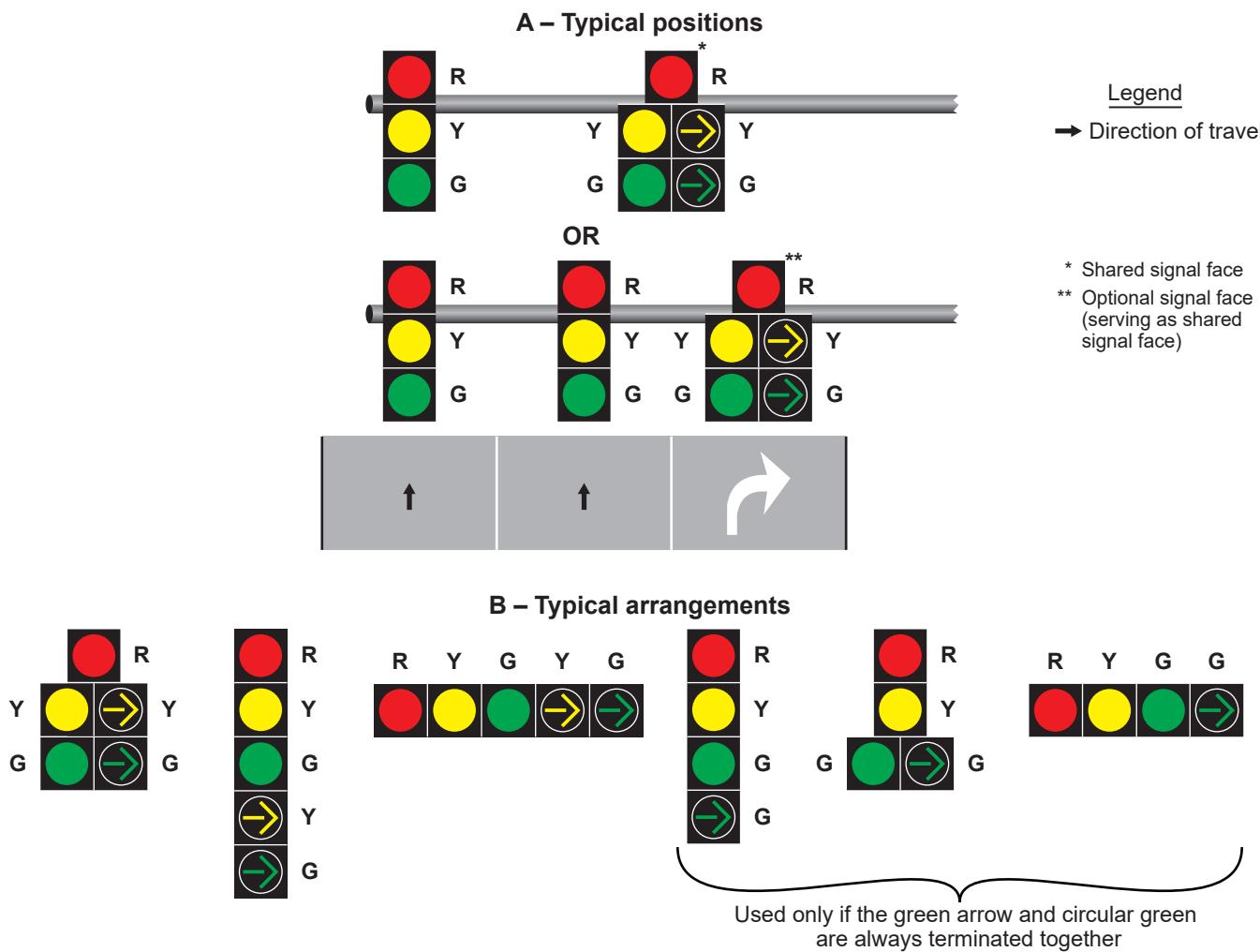
Note: Shared signal faces shall only be used for a protected-only mode right turn if the circular green and green right-turn arrow indications always begin and terminate together

### Figure 4F-12. Typical Position and Arrangements of Separate Signal Faces for Protected Only Mode Right Turns

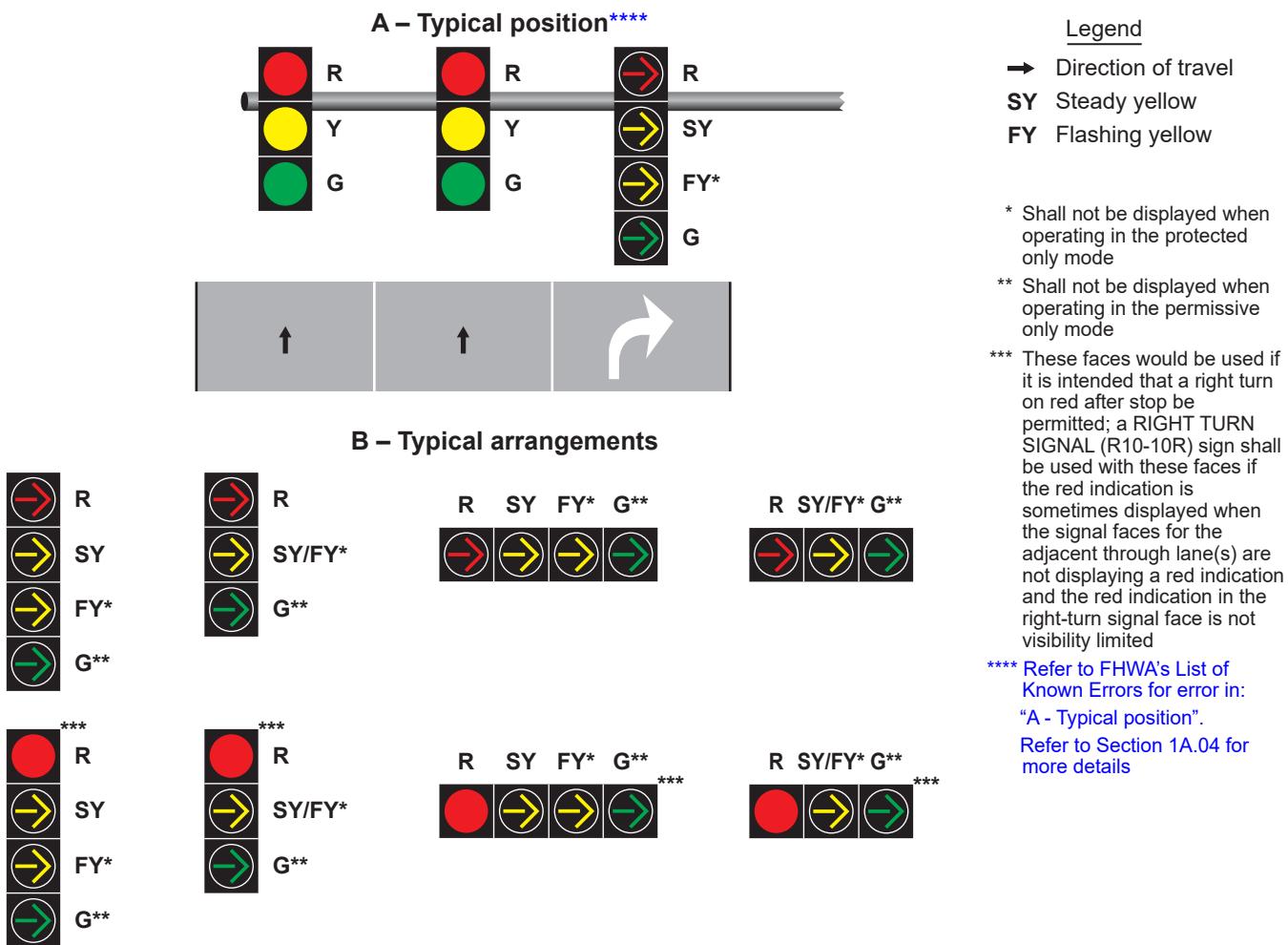


\*These faces would be used if it is intended that a right turn on red after stop be permitted; a RIGHT TURN SIGNAL (R10-10R) sign shall be used with these faces if the red indication is sometimes displayed when the signal faces for the adjacent through lane(s) are not displaying a red indication and the red indication in the right-turn signal face is not visibility limited

**Figure 4F-13. Typical Positions and Arrangements of Shared Signal Faces for Protected/Permissive Mode Right Turns**

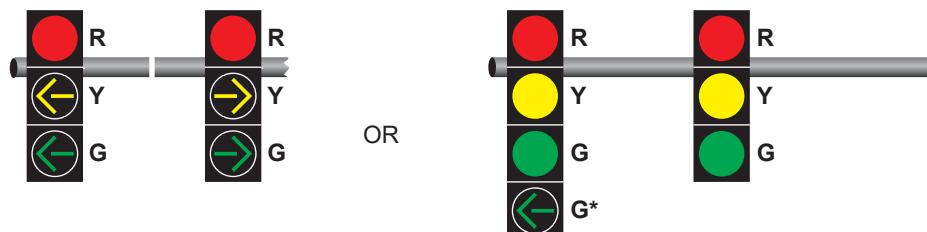


**Figure 4F-14. Typical Position and Arrangements of Separate Signal Faces with Flashing Yellow Arrow for Protected/Permissive Mode and Variable Mode Right Turns**



## Figure 4F-15. Signal Indications for Approaches with a Combined Left-Turn/Right-Turn Lane and No Through Movement (Sheet 1 of 3)

### A – No conflicting vehicular or pedestrian movements

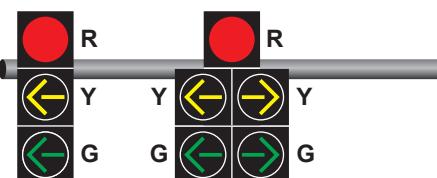


Single-lane approach

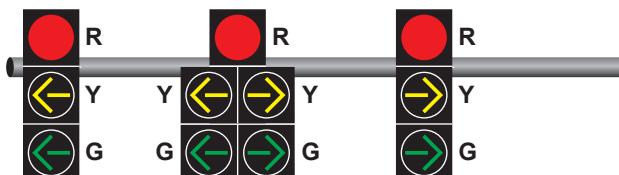
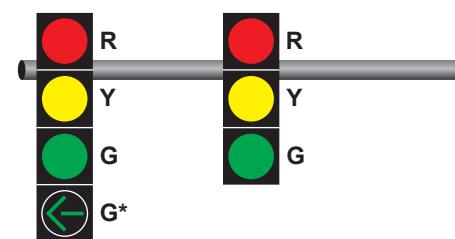


OR

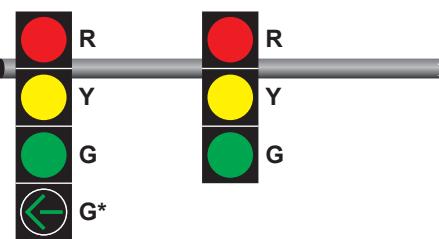
Single-lane approach



OR



OR



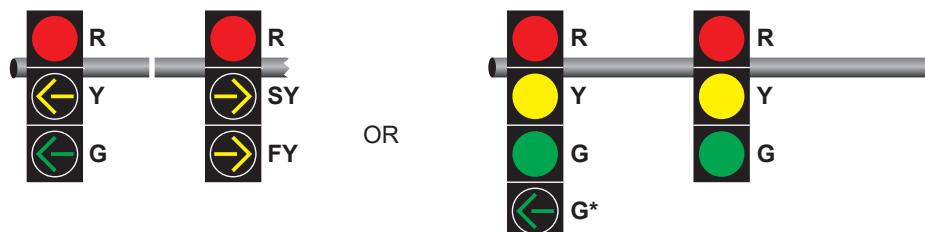
#### Notes:

1. Horizontally-aligned signal faces may also be used.
2. Shared signal faces may also be 5 sections in a vertical straight line instead of a cluster.

\*Left-turn GREEN ARROW section shall be included if there is an opposing one-way approach and the signal phasing eliminates conflicts.

## Figure 4F-15. Signal Indications for Approaches with a Combined Left-Turn/Right-Turn Lane and No Through Movement (Sheet 2 of 3)

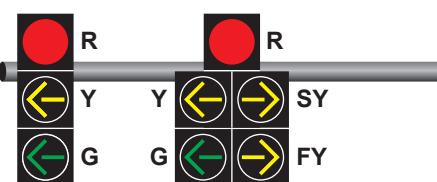
### B – Pedestrian or vehicular conflict with one turn movement



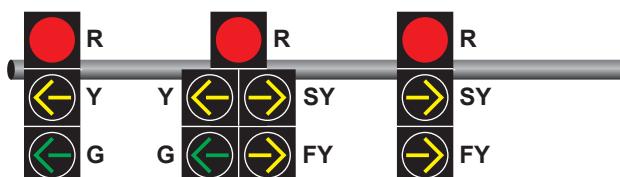
Single-lane approach



Single-lane approach



OR



OR



#### Notes:

1. A conflict with the right-turn movement is illustrated.
2. Horizontally-aligned signal faces may also be used.
3. Shared signal faces may also be 5 sections in a vertical straight line instead of a cluster.

\*Left-turn GREEN ARROW section shall be included if there is an opposing one-way approach and the signal phasing eliminates conflicts.

### Figure 4F-15. Signal Indications for Approaches with a Combined Left-Turn/Right-Turn Lane and No Through Movement (Sheet 3 of 3)

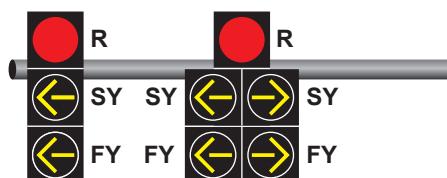
#### C – Pedestrian or vehicular conflicts with both turn movements



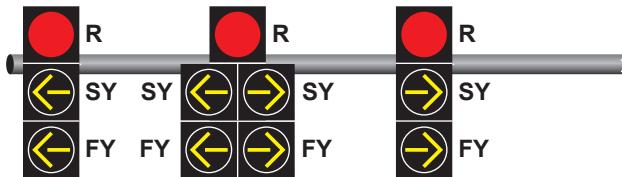
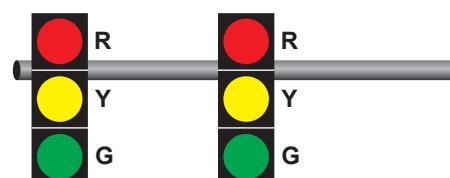
Single-lane approach



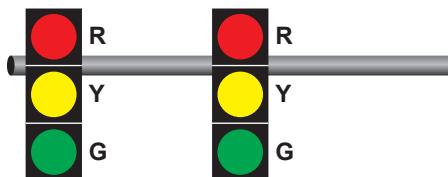
Single-lane approach



OR



OR



#### Notes:

1. Horizontally-aligned signal faces may also be used.
2. Shared signal faces may also be 5 sections in a vertical straight line instead of a cluster.