



SOUTHERN  
AFRICAN  
DEVELOPMENT  
COMMUNITY

# TRAFFIC SIGNALS

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**CHAPTER**

**6**

## CHAPTER 6: TRAFFIC SIGNALS

### 6.1 INTRODUCTION

#### 6.1.1 Scope

- 1 Traffic signals are standard devices comprising prescribed arrangements of signals for the regulation of vehicular road traffic, pedestrians and pedal cyclists. Signals are used at locations such as:
  - (a) signalised road junctions;
  - (b) signalised pedestrian and pedal cyclist mid-block crossings;
  - (c) the intersection of roads with exclusive public transport rights of way;
  - (d) single traffic lanes that carry two-way traffic;
  - (e) freeway ramps and toll booths;
  - (f) roadworks;
  - (g) reversible lanes; and
  - (h) railway crossings.
- 2 This chapter covers the more important requirements that traffic signals must comply with. Additional details regarding traffic signals are given in Volume 3: *Traffic signal design*, which contains guidelines for the practical design of road and traffic signals.
- 3 The traffic signals covered in this chapter are those shown in Figures 6.1 and 6.2. The figures show all traffic signals in colour as if they are illuminated, which obviously does not occur under operational conditions.
- 4 Unless the context indicates otherwise, words and expressions used in this chapter shall have the meanings given in Chapter 10: Glossary of Terms.

#### 6.1.2 Recommended and alternative systems

- 1 The preparation and contents of the Manual have been motivated by a requirement to harmonise the road traffic sign systems of the SADC member states into one common system. In the case of electrically operated traffic signals there are two basic systems in use in the region. Given the very high investment in existing traffic signal installations it is considered financially and operationally impractical to achieve total harmonisation of these traffic signal systems in the short term.
- 2 The two basic traffic signal systems are the Recommended System, which is recommended because it is considered to represent the system used in the majority of traffic signal installations in the region and is used in at least half of the member states, and the Alternative System. The most significant differences between the two systems are as follows:

- (a) In the Recommended System the traffic signal switching cycle is GREEN - YELLOW - RED, whereas in the Alternative System the switching cycle is RED plus YELLOW - GREEN - YELLOW - RED.
  - (b) The Recommended System utilises a FLASHING GREEN ARROW LIGHT SIGNAL instead of a STEADY GREEN ARROW SIGNAL when giving right of way to turning movements.
  - (c) The Recommended System uses FLASHING RED LIGHT SIGNALS on all approaches to indicate an out of order signal. The Alternative System utilises FLASHING YELLOW LIGHT SIGNALS for this purpose.
  - (d) In the Recommended System the pedestrian/cyclist "do not start to cross" message is given by a FLASHING RED light signal, whereas in the Alternative System this same message is given by a FLASHING GREEN light signal.
  - (e) In the Recommended System the required principal traffic signal faces are required to be mounted on the far and near side of the intersection, whereas the Alternative System requires these signal faces to be mounted only on the near side of the intersection.
  - (f) In the Recommended System the FLASHING RED disc light signal used at railway crossings is displayed with a STOP sign R1; in the Alternative System a no STOP sign is used and a FLASHING WHITE disc light signal may be used when no train is approaching.
- 3 Both systems are described in this chapter, but differences between the two systems are clearly identified. The user, however, must be aware of the differences in the two systems and must take care in differentiating between the two systems.
  - 4 In South Africa, the Recommended system is prescribed and shall be complied to.

#### 6.1.3 South African Bureau of Standard specifications

- 1 Traffic signals should be manufactured and installed in a disciplined and standardised manner. The use of the following South African Bureau of Standards specifications is therefore recommended for both the Recommended and Alternative systems:
  - (a) SANS 1459: *Traffic lights*
  - (b) SANS 1547: *Traffic signal controllers*
- 2 In South Africa, these specifications are prescribed and shall be complied to.

### 6.1.4 Approval of traffic signals

- 1 Due to the complexity of traffic signal systems, decisions concerning the design, installation, and operation of traffic signals, should only be undertaken by professionals with a high level of skill and knowledge of the subject.
- 2 **A responsible registered PROFESSIONAL ENGINEER or registered professional TECHNOLOGIST (engineering) of the road authority concerned SHALL approve every traffic signal installation at a signalised junction or pedestrian or pedal cyclist crossing, and sign a declaration containing the following:**
  - (a) scaled drawing of the layout of the junction or crossing, indicating lane markings and road layout;
  - (b) number, type and location of traffic signal faces;
  - (c) pedestrian and pedal cyclist facilities, including pedestrian push buttons;
  - (d) phasing, time plans and offset settings;
  - (e) date of implementation; and
  - (f) name, signature and registration number of the engineer or technologist (engineering) who approved the signal, and date of signature.
- 3 The declaration shall be kept by the road authority in control of the traffic signal concerned.

### 6.1.5 Transitional arrangements

- 1 All traffic signals installed after 30 June 2002 shall be displayed substantially in accordance with the requirements of this chapter.
- 2 All traffic signals installed on or before this date, and which could validly be displayed in terms of the National Road Traffic Act, may notwithstanding the requirements of this chapter, be displayed until the 31 December 2010.

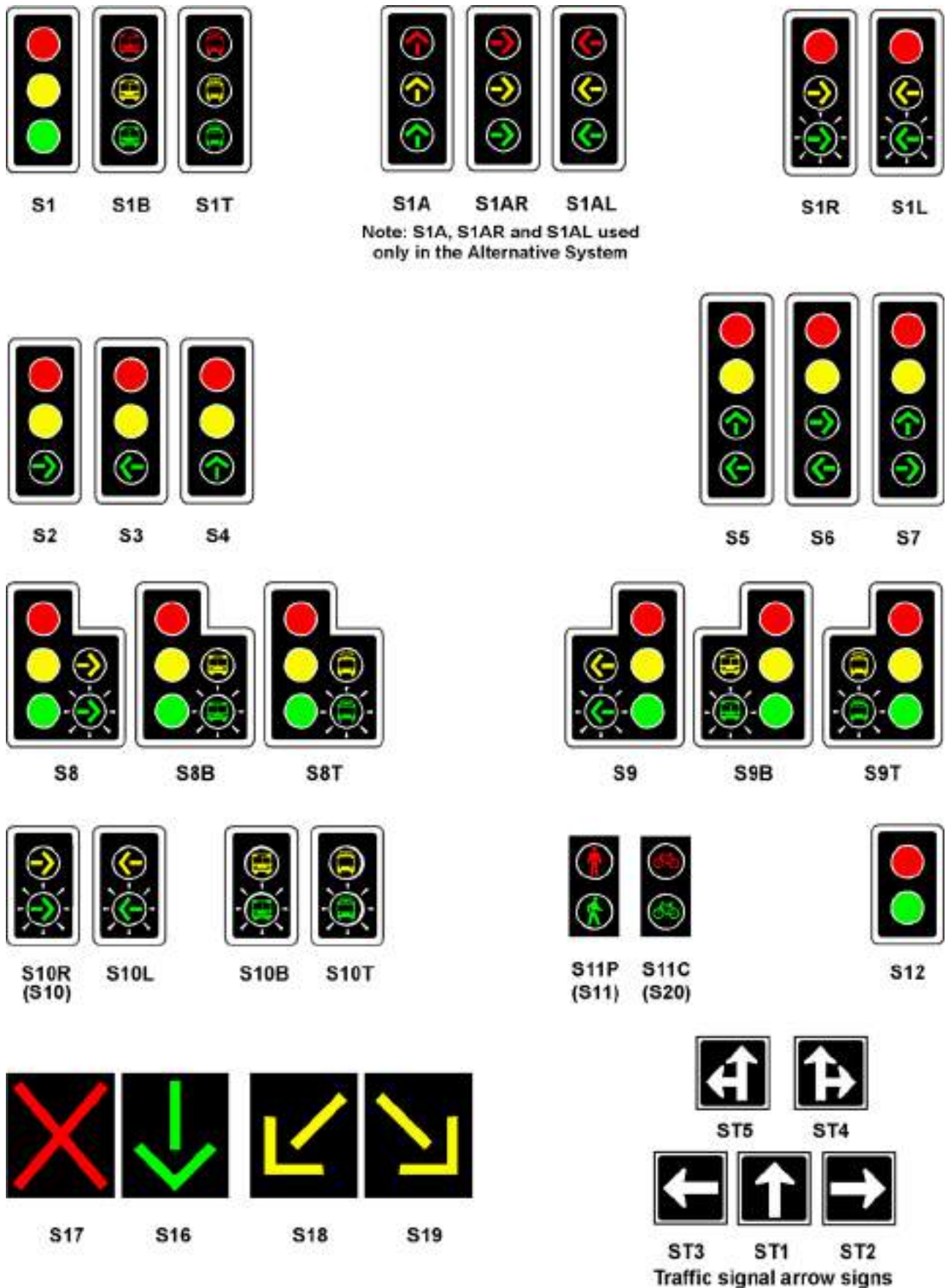
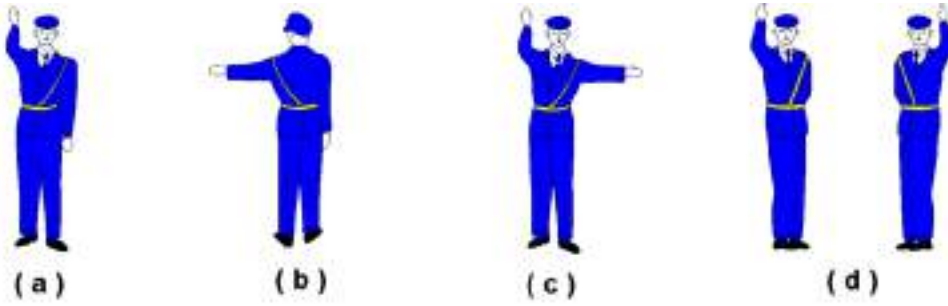
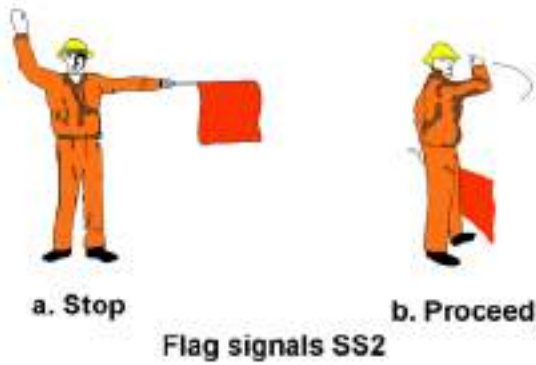


Figure 6.1: Traffic signal faces and Traffic signal arrow signs



Control hand signals for use by traffic officers SS1



Flashing yellow warning signal SS3



Flashing Red Disc (FRD) signal at railway crossings

Figure 6.2: Other road signals

## 6.2 VEHICULAR TRAFFIC SIGNALS AT JUNCTIONS AND CROSSINGS

### 6.2.1 Introduction

- 1 The traffic signals and signal faces described in this section are specifically for the control of vehicular traffic at signalised road junctions and signalised pedestrian and pedal cyclist crossings.
- 2 The function of a vehicular traffic signal is to successively give right of way to, and stop, vehicular traffic with respect to other conflicting movements of traffic, subject to normal priority rules in regard to turning movements and pedestrians or pedal cyclist.
- 3 Warrants for the installation and removal of traffic signals at road junctions and pedestrian crossings are given in Volume 3, *Traffic signal design*. Traffic signals should not be installed unless they are not warranted.

### 6.2.2 Area of Control

- 1 Traffic signals, as defined by the National Road Traffic Regulations, shall control traffic only at a junction or a pedestrian or pedal cyclist crossing. The signals shall control ALL approaches to the junction or crossing.
- 2 Slipways can be controlled independently of the main junction. However, **a slipway for traffic turning left or right at a junction which is traffic signal controlled, shall be separated from the lane to the right or left of such slipway by a constructed island.**
- 3 A slipway that is signal controlled would normally only have signals controlling the slipway, and any potential conflicts must be prevented at the main junction. All conflicting movements at the main junction, including the right-turn movement from the opposite direction, must face a RED LIGHT SIGNAL while the slipway receives a GREEN SIGNAL.

### 6.2.3 Control Precedence

- 1 **The traffic control at a junction or pedestrian or pedal cyclist crossing may include the use of road signs, road markings and road signals and the control precedence SHALL be as follows:**
  - (a) **A road sign which prohibits or prescribes directional movement of traffic at a junction or pedestrian or pedal cyclist crossing which is controlled by a traffic signal, shall have precedence over any light signal which permits right of way.**
  - (b) **A light signal that permits right of way shall have precedence over the stop line RTM1;**
  - (c) **A light signal that has the significance that traffic shall stop, has precedence over any other road traffic sign or another light signal that permits right of way, EXCEPT when such other light signal (permitting right of way) has a higher precedence level. The precedence levels for light signals are as follows, given from the highest to lowest precedence level:**
    - (i) **steady or flashing pedestrian and pedal cyclist light signals;**
    - (ii) **steady or flashing bus or tram light signals;**
    - (iii) **steady or flashing arrow signals, or steady disc signals with traffic signal arrow signs ST1 to ST5; and**
    - (iv) **steady disc light signals.**

### 6.2.4 Road signs

- 1 **NO road sign except –**
  - (a) **a street name sign;**
  - (b) **a direction route marker sign;**
  - (c) **information signs IN14, IN15 and pedestrian and pedal cyclist signs relating to the function of the traffic signal;**
  - (d) **a one-way roadway sign;**
  - (e) **a no-entry sign;**
  - (f) **a left-turn prohibited, right-turn prohibited or a U-turn prohibited sign;**
  - (g) **a proceed straight through only, proceed left only, or proceed right only sign;**
  - (h) **a pedestrian prohibited sign R218; or**
  - (i) **a traffic signal arrow sign ST1 to ST5; SHALL be used in conjunction with a traffic signal, and such signs may be mounted on the same post or overhead cantilever or gantry as that of the traffic signal.**
- 2 The following signs, in particular, may NOT be used in conjunction with a traffic signal, even if the signal is out of order (however, the signs may be used when the traffic signal has been masked out):
  - (a) STOP sign R1 or any of its derivatives.
  - (b) YIELD sign R2.
  - (c) RIGHT-OF-WAY sign IN7.
  - (d) Any sign that conflicts with or gives right of way over the traffic signal.

A slipway, however, can be STOP or YIELD controlled as it is regarded as a separate junction.
- 3 The PEDESTRIAN PROHIBITED SIGN R218 is used to prohibit pedestrians from proceeding beyond the sign. The sign must be posted on the near side of the junction, in the direction to which it is applicable (and in both directions of the crossing).
- 4 TRAFFIC SIGNAL ARROW SIGNS ST1 to ST5 may be used in conjunction with traffic signals. The signs **indicate to the driver of a vehicle, when displayed vertically above a traffic signal face, that any light signal installed in such face only applies to the direction of movement indicated by the arrow.**
- 5 The following information signs related to the operation of traffic signals, may be used at signals:
  - (a) Where signal timings are co-ordinated for a fixed speed, information sign IN14 may be displayed on the relevant exit from a junction.
  - (b) Where a traffic signal has three or more vehicular signal phases, information sign IN15 may be located directly below a signal face.
  - (c) Pedestrian and pedal cyclist information signs.

- 6 The TRAFFIC SIGNAL AHEAD SIGN W301 may be used to warn a road user of the presence of a traffic signal. This sign should be displayed in advance of:
  - (a) Any new traffic signal installation. The sign may be removed after a period of three months.
  - (b) Any approach where the approach speed is 70 km/h or more, or where the signal is not visible within 180 m of the junction.
  - (c) A remotely located junction or mid-block pedestrian crossing.
- 7 A TEMPORARY TRAFFIC SIGNAL AHEAD SIGN TW301 may be used in advance of any traffic signal that is used temporary at roadworks.
- 8 The TRAFFIC SIGNAL OUT OF ORDER SIGN TW412 may be used to warn a road user that the traffic signals ahead are out of order. If a TRAFFIC SIGNAL AHEAD SIGN W301 is located in advance of the traffic signal, the temporary warning sign TW412 may be placed over the W301 sign for the period the signal is out of order.

### 6.2.5 Road markings

- 1 The minimum road markings required at a signalised junction or crossing includes the stop line (RTM1), pedestrian crossing lines (RTM3) and the no-overtaking line (RM1). Additional road markings will be required at more complex junctions.
- 2 Pedestrian crossing lines (RTM2) are used to indicate the position where pedestrians (or pedal cyclists) may cross at a junction or a mid-block crossing. Block pedestrian crossing markings (RTM4) may also be used instead of the crossing lines at both junctions and mid-block crossings, particularly in locations where pedestrian volumes are high.
- 3 Pedestrian crossing lines (or block pedestrian crossing markings):
  - (a) SHOULD as a general rule be provided at all traffic signal controlled junctions, even if the junction is used by no pedestrians (except where pedestrians are specifically prohibited);
  - (b) MAY be provided without pedestrian or pedal cyclist signals being installed at a junction;
  - (c) SHALL be provided where pedestrian signals are installed at junctions or crossings; and
  - (d) SHALL NOT be provided when PEDESTRIAN PROHIBITED R218 signs have been posted.
- 4 Pedestrian crossing lines not only mark crossing positions for pedestrians, but also serve to improve the visibility of the junction and to assist drivers in recognising and identifying a junction as being signal controlled.

### 6.2.6 Vehicular light signals

- 1 Vehicular light signals are described in the following sections. Vehicular traffic light signals shall have the meanings assigned to them in the National Road Traffic Regulations.
- 2 The following basic sequence of vehicular light signals shall be used on each approach road to a signalised junction or pedestrian or pedal cyclist crossing, and on each traffic signal face:
  - (a) In the **Recommended System** (see Figure 6.3a):
    - (i) a FLASHING or STEADY GREEN LIGHT SIGNAL, followed by:
    - (ii) a STEADY YELLOW LIGHT SIGNAL followed by:
    - (iii) a STEADY RED LIGHT SIGNAL, where it is provided on a signal face (not provided on S10L, S10R, S10B and S10T signal faces); provided that on the S9 and S10L signal faces, the STEADY YELLOW ARROW LIGHT SIGNAL may be omitted from the sequence subject to the conditions that:
    - (iv) the FLASHING GREEN ARROW LIGHT SIGNAL must immediately be followed by a STEADY GREEN LIGHT SIGNAL which allows the left-turn movement to turn; and
    - (v) when pedestrian or pedal cyclist signals are provided, no GREEN PEDESTRIAN or PEDAL CYCLIST LIGHT SIGNAL may be displayed following the flashing green arrow light signal. The yellow arrow light signal shall NOT be omitted when such green pedestrian or pedal cyclist light signal is displayed.
  - (b) In the **Alternative System** (see Figure 6.3b):
    - (i) a STEADY YELLOW AND RED LIGHT SIGNAL (together), followed by:
    - (ii) a FLASHING or STEADY GREEN LIGHT SIGNAL, followed by:
    - (iii) a STEADY YELLOW LIGHT SIGNAL followed by:
    - (iv) a STEADY RED LIGHT SIGNAL, where it is provided on a signal face;
- 3 Light signals of different colours shall NOT be displayed at the same time to the same turning movement. A driver may, for example, not receive a red signal at the same time as a yellow or green signal (even at a staggered or very wide junction).
- 4 Under no circumstances SHALL a GREEN LIGHT SIGNAL be used at some times in a STEADY mode and other times in a FLASHING mode.
- 5 When traffic signals are not in operation, such as during installation, all traffic signal faces SHALL be suitably masked so as to obscure them from the sight of drivers, pedestrians or pedal cyclists. Advance information signs relating to the signal shall also be masked. While the traffic signal is not operational, each non-priority side road approach to the junction shall be controlled by a STOP sign R1, or a YIELD sign R2, or all approaches shall be controlled by all-way STOP signs R1.3 or R1.4. These signs shall be removed immediately once the traffic signal has come into operation.

6.2.7 Red vehicular light signals

- 1 A STEADY RED DISC LIGHT SIGNAL (without a traffic signal arrow sign ST1 to ST5) indicates to the driver of a vehicle that he or she shall stop his or her vehicle behind the stop line RTM1 and that he or she shall remain stationary until a green light signal is displayed, and it is safe to proceed, and in the event that a pedestrian light signal is not provided, indicates to a pedestrian that he or she shall not cross the roadway until a green light signal is displayed and it is safe to do so.
- 2 A STEADY RED BUS LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive bus lane that he or she shall stop his or her vehicle behind the stop line RTM1 and that he or she shall remain stationary until a green bus light signal is displayed, and it is safe to proceed.
- 3 A STEADY RED TRAM LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive tram lane that he or she shall stop his or her vehicle behind the stop line RTM1 and that he or she shall remain stationary until a green tram light signal is displayed, and it is safe to proceed.
- 4 A STEADY RED ARROW LIGHT SIGNAL or A STEADY RED DISC LIGHT SIGNAL WITH A TRAFFIC SIGNAL ARROW SIGN ST1 to ST5 INSTALLED ABOVE THE SIGNAL indicates to the driver of a vehicle that he or she shall stop his or her vehicle behind the stop line RTM1 if he or she intends turning in the direction indicated by the steady red arrow light signal or the traffic signal arrow sign and that he or she shall remain stationary until a green light signal is displayed that allows movement in the direction of the arrow and it is safe to proceed. The steady red arrow light signal is used only in the Alternative System and may NOT be used in the Recommended System.

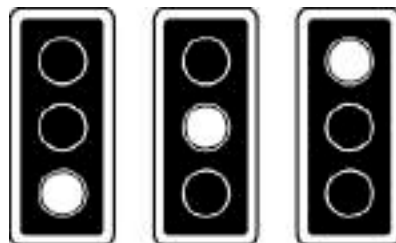


Figure 6.3a: Recommended system – Vehicular light signal operating sequence

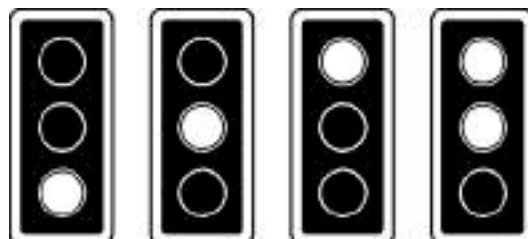


Figure 6.3b: Alternative system - Vehicular light signal operating sequence



### 6.2.8 Yellow vehicular light signals

- 1 A STEADY YELLOW DISC LIGHT SIGNAL indicates to the driver of a vehicle that he or she shall stop his or her vehicle behind the stop line RTM1 and that he or she shall remain stationary until a green light signal is displayed, and it is safe to proceed; provided that if he or she is so close to a stop line RTM1 when the steady yellow disc light signal is displayed that he or she cannot stop safely, he or she may proceed with caution against such yellow light signal, and in the event that a pedestrian light signal is not provided, indicates to a pedestrian that he or she shall not cross a roadway until a green light signal is displayed and it is safe to do so. The use of this signal shall be SUBJECT TO THE FOLLOWING CONDITIONS:
  - (a) *It shall NOT be displayed to right-turning traffic at the same time as a GREEN LIGHT SIGNAL is displayed to traffic on the conflicting opposing approach. This means that a phase allowing traffic to turn right may not be terminated while a green light signal is still being displayed on the conflicting opposing approach (Right-turning traffic receiving yellow may not know that the opposing traffic is still receiving green and may turn right into the face of oncoming traffic).*
  - (b) It should be followed by a clearance or all-red interval to allow vehicles to clear the junction before green light signals are displayed to conflicting traffic movements.
  - (c) The duration of the yellow and clearance or all-red intervals is calculated using procedures given in Volume 3: *Traffic signal design*.
  - (d) *An enforcement tolerance should be provided during the all-red interval to accommodate drivers who are unable to stop during the yellow interval. Law enforcement should only commence during the last one second of the all-red interval.*
- 2 A STEADY YELLOW BUS LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive bus lane that he or she shall stop his or her vehicle behind the stop line RTM1 and that he or she shall remain stationary until a green light signal is displayed, and it is safe to proceed; provided that if he or she is so close to a stop line RTM1 when the steady yellow bus light signal is displayed that he or she cannot stop safely, he or she may proceed with caution against such yellow light signal. The use of this light signal is SUBJECT TO THE CONDITIONS given for the STEADY YELLOW DISC LIGHT SIGNAL.

- 3 A STEADY YELLOW TRAM LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive tram lane that he or she shall stop his or her vehicle behind the stop line RTM1 and that he or she shall remain stationary until a green light signal is displayed, and it is safe to proceed; provided that if he or she is so close to a stop line RTM1 when the steady yellow tram light signal is displayed that he or she cannot stop safely, he or she may proceed with caution against such yellow light signal. The use of this light signal is SUBJECT TO THE CONDITIONS given for the STEADY YELLOW DISC LIGHT SIGNAL, except that the duration of the yellow and clearance intervals must be adjusted to accommodate the operational characteristics of the tram.
- 4 A STEADY YELLOW ARROW LIGHT SIGNAL indicates to the driver of a vehicle that he or she shall stop his or her vehicle behind the stop line RTM1 if he or she intends turning in the direction indicated by the yellow arrow light signal and that he or she shall remain stationary until a green light signal allowing the movement is displayed, and it is safe to proceed; Provided that if he or she is so close to stop line RTM1 when a steady yellow arrow light signal is displayed that he or she cannot stop safely then he or she may proceed with caution against such yellow arrow light signal. The use of this light signal is SUBJECT TO THE CONDITIONS given for the STEADY YELLOW DISC LIGHT SIGNAL.

### 6.2.9 Green vehicular light signals

- 1 A STEADY GREEN DISC LIGHT SIGNAL indicates to the driver of a vehicle that he or she may proceed through a junction or crossing, or turn to the left or right, subject to any restricting road traffic sign or light signal, but shall yield right of way to other vehicular traffic and to pedestrians lawfully within the junction or crossing, at the time a steady green disc light signal is displayed, and in the event that a pedestrian light signal is not provided, to indicate to a pedestrian that he or she may cross the junction within the pedestrian crossing markings RTM3 or RTM4 as appropriate, provided that a conflicting flashing green arrow, bus or tram light signal is not displayed at the same time. The use of this signal is SUBJECT TO THE FOLLOWING CONDITIONS:
  - (a) It shall NOT be displayed at the same time on the same approach as a STEADY GREEN ARROW LIGHT SIGNAL.
  - (b) With the exception of the S12 traffic signal face, it shall NOT be displayed for a duration less than 7 seconds (preferably not less than 11 seconds).

- 2 A STEADY GREEN BUS LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive bus lane that he or she may proceed through a junction or crossing, or turn to the left or right, subject to any restricting road traffic sign or light signal, but shall yield right of way to other vehicular traffic and to pedestrians lawfully within the junction or crossing, at the time such steady green bus light signal is displayed. The use of this signal is SUBJECT TO THE CONDITION that it shall NOT be used to indicate a FLASHING GREEN BUS LIGHT SIGNAL at another time.
- 3 A STEADY GREEN TRAM LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive tram lane that he or she may proceed through a junction or crossing, or turn to the left or right, subject to any restricting road traffic sign or light signal, but shall yield right of way to other vehicular traffic and to pedestrians lawfully within the junction or crossing, at the time such steady green tram light signal is displayed. The use of this signal is SUBJECT TO THE CONDITION that it shall NOT be used to indicate a FLASHING GREEN TRAM LIGHT SIGNAL at another time.

### 6.2.10 Steady green arrow light signals

- 1 The Recommended System utilises the steady green arrow light signal mainly to indicate the direction of one-way streets. In the Alternative System it is used to signal directional movements that are unopposed.
- 2 In the Recommended System, A STEADY GREEN ARROW LIGHT SIGNAL indicates to the driver of a vehicle that he or she may proceed in the direction indicated by the steady green arrow light signal, subject to any restricting road traffic sign or light signal, but shall yield right of way to other vehicular traffic and to pedestrians lawfully within the junction or crossing, at the time such green light signal is displayed and in the event that a pedestrian light signal is not provided, indicates to a pedestrian that he or she may cross the junction within the pedestrian crossing markings RTM3 or RTM4 as appropriate, provided that a conflicting flashing green arrow, bus or tram light signal is not displayed at the same time. The use of this signal is SUBJECT TO THE FOLLOWING CONDITIONS:
  - (a) It should preferably only be used to indicate the direction of ONE-WAY roads or streets.
  - (b) It shall NOT be used when there is a conflicting traffic movement from the opposite direction (the movement is opposed). The STEADY GREEN RIGHT ARROW LIGHT SIGNAL, in particular, may NOT be used when there is an opposing traffic movement (e.g. on two-way roads).
  - (c) It shall NOT be displayed at the same time on the same approach as a STEADY GREEN DISC LIGHT SIGNAL.
  - (d) A maximum of two STEADY GREEN ARROW LIGHT SIGNALS, showing in different directions, may be located in one signal face.
  - (e) It shall NOT be used to indicate a FLASHING GREEN ARROW LIGHT SIGNAL at another time.
  - (f) It shall NOT be displayed for a duration less than 7 seconds (preferably not less than 11 seconds).
- 3 In the Alternative System, A STEADY GREEN ARROW LIGHT SIGNAL indicates to the driver of a vehicle that he or she may proceed in the direction indicated by the arrow and that such movement is unopposed by other traffic. The use of this signal is SUBJECT TO THE FOLLOWING CONDITIONS:
  - (a) It shall NOT be used to indicate a FLASHING GREEN ARROW SIGNAL at another time.
  - (b) It shall be displayed only when the indicated movement is protected and no opposing or conflicting vehicular, pedestrian or pedal cyclist movement has explicit or priority right of way. Conflicting movements through the junction shall face RED LIGHT SIGNALS.
  - (c) When no pedestrian signal is provided, pedestrians do not have right of way when the signal is displayed. However, separate pedestrian signals are recommended at junctions where such signals are displayed. Alternatively, pedestrian movements may be prohibited by means of PEDESTRIAN PROHIBITED SIGNS R218.
  - (d) It shall NOT be displayed for a duration less than 4 seconds (preferably not less than 7 seconds).

### 6.2.11 Flashing green vehicular light signals

- 1 The Recommended System utilises the flashing green vehicular light signals to signal directional movements that are unopposed. In the Alternative System, steady green light signals are used for this purpose.
- 2 A FLASHING GREEN BUS LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive bus lane that he or she may proceed and that his or her movements are unopposed by other traffic. The use of this light signal is SUBJECT TO THE CONDITIONS given for the FLASHING GREEN ARROW LIGHT SIGNAL except that it shall NOT be used to indicate a STEADY GREEN BUS LIGHT SIGNAL at another time.
- 3 A FLASHING GREEN TRAM LIGHT SIGNAL indicates to the driver of a vehicle allowed in an exclusive tram lane that he or she may proceed and that his or her movements are unopposed by other traffic. The use of this light signal is SUBJECT TO THE CONDITIONS given for the FLASHING GREEN ARROW LIGHT SIGNAL except that it shall NOT be used to indicate a STEADY GREEN TRAM LIGHT SIGNAL at another time.

- 4 A FLASHING GREEN ARROW LIGHT SIGNAL indicates **to the driver of a vehicle that he or she may proceed in the direction indicated by the flashing green arrow light signal and that his or her movement is unopposed by other traffic.** The use of this signal is SUBJECT TO THE FOLLOWING CONDITIONS:
- It shall NOT be used to indicate a STEADY GREEN ARROW LIGHT SIGNAL at another time.
  - It SHALL be displayed only when the indicated movement is protected and no opposing or conflicting vehicular, pedestrian or pedal cyclist movement has explicit or priority right of way. Conflicting movements through the junction shall face RED LIGHT SIGNALS.
  - When no pedestrian signal is provided, pedestrians do not have right of way when the FLASHING GREEN ARROW LIGHT SIGNAL is displayed. However, separate pedestrian signals for the control of pedestrians are recommended at junctions where such signals are displayed. Alternatively, pedestrian movements may be prohibited by means of PEDESTRIAN PROHIBITED SIGNS R218.
  - It shall NOT be displayed for a duration less than 4 seconds (preferably not less than 7 seconds).

#### 6.2.12 Yellow and red light signals displayed together in the Alternative System

- The Alternative System displays a yellow and red light signal together immediately before a green light signal. This signal is NOT used in the Recommended System.
- A STEADY YELLOW LIGHT SIGNAL shall be shown together with a STEADY RED LIGHT SIGNAL immediately prior to the commencement of a GREEN LIGHT SIGNAL to **indicate to drivers that such a green phase is about to commence.**
- The yellow and red light signals shown together may form part of the clearance time provided at a traffic signal, and may be treated as an all-red interval.

#### 6.2.13 Flashing and other modes of operation

- Flashing and other modes of operations include:
  - FLASHING LIGHT SIGNALS on ALL approaches.
  - No light signal illuminated (all signal aspects switched off).
  - Manual signal advance, whereby the timings of green light signals can be changed manually;
- In the Recommended System A FLASHING RED DISC, BUS OR TRAM LIGHT SIGNAL indicates **to the driver of a vehicle that he or she shall act as for a 3-way stop sign R1.3 or 4-way stop sign R1.4 and shall yield right of way to all pedestrians crossing his or her path, and the signal indicates to a pedestrian that he or she may cross the roadway if it is safe to do so.** This use of this signal shall be SUBJECT TO THE FOLLOWING CONDITIONS:
  - It shall NOT be displayed at the same time as ANY other light signal on any approach road, and the pedestrian and pedal cyclist signals shall be switched off (except when a pelican phase is provided).
  - At a pedestrian crossing it may be used during a "Pelican" phase to indicate to drivers of vehicles that pedestrians may be clearing the road and have right of way. During this phase, the FLASHING RED LIGHT SIGNAL may be displayed only at the same time as the FLASHING RED MAN or PEDAL CYCLIST RED LIGHT SIGNAL. Pedestrians or pedal cyclists may not enter the crossing on the flashing red signal, and the duration of this interval should therefore NOT exceed the time required to clear the crossing.
- In the Alternative System a FLASHING YELLOW DISC, BUS OR TRAM LIGHT SIGNAL indicates **to the driver of a vehicle that he or she shall act as for a 3-way stop sign R1.3 or 4-way stop sign R1.4 and shall yield right of way to all pedestrians crossing his or her path. The signal indicates to a pedestrian that he or she may cross the roadway if it is safe to do so.** The use of this signal shall be SUBJECT TO THE FOLLOWING CONDITIONS:
  - It shall NOT be displayed at the same time as ANY other light signal on any approach road, and the pedestrian and pedal cyclist signals shall be switched off (except when a pelican phase is provided).
  - At a pedestrian crossing it may be used during a "Pelican" phase to indicate to drivers of vehicles that pedestrians may be clearing the road and have right of way. During this phase, the FLASHING YELLOW LIGHT SIGNAL may be displayed only at the same time as the FLASHING GREEN MAN or PEDAL CYCLIST GREEN LIGHT SIGNAL. Pedestrians or pedal cyclists may not enter the crossing on the flashing green signal, and the duration of this interval should therefore NOT exceed the time required to clear the crossing.
- The operations at the signal when light signals are in flashing mode or when signal aspects are not illuminated, are similar to that of a 3- or 4-way STOP controlled junction.
- When a traffic signal is out of order, it may be placed in the flashing mode of operation, or all the light signals shall be switched off.
- At no time SHALL an operational traffic signal be intentionally switched off, other than for maintenance or repairs or when controlled by a traffic officer or an authorised pointsman (part-time operation of traffic signals is NOT allowed).
- A traffic officer or an authorised pointsman may intervene with the operation of a traffic signal. The traffic signal may then be placed in any one of the flashing modes of operation.

- 8 The planned operation of traffic signals in flashing mode for part of the day or night, in place of normal traffic signal operations, is not recommended. Under conditions of low traffic flow, the following alternatives should first be considered:
- Reduce cycle length, but with pedestrian phases still available on demand (in which case the cycle length may have to be increased to accommodate pedestrian crossing times).
  - Vehicle-actuated control.
- 9 It is recommended that, where and when possible, a traffic signal should be placed in a flashing mode of operation or switched off by first introducing STEADY RED LIGHT SIGNALS on all traffic signal faces for a duration of at least 3 to 5 seconds.
- 10 The traffic signal should again be returned to the normal mode of operations, or switched on, by using one of the following methods:
- The flashing mode of operation should be followed by a STEADY RED LIGHT SIGNAL for a duration of between 3 and 5 seconds. This steady red light signal in turn, should, be followed by a GREEN LIGHT SIGNAL on the main road (where possible).
  - A switched-off traffic signal should be switched on again by first placing the signal in the flashing mode of operation for a duration of not less than 5 seconds, followed by STEADY RED LIGHT SIGNALS for a duration of between 3 and 5 seconds, followed by a GREEN LIGHT SIGNAL on the main road (where possible).

#### 6.2.14 Arrangement of light signals on a traffic signal face

- The number and positioning of light signals on a traffic signal face SHALL conform to one of the standard traffic signal face arrangements. The relative position of each light signal relative to the others on a particular traffic signal face is of significance in the interpretation of the meaning of light signals.
- The RED, YELLOW and GREEN LIGHT SIGNALS on a traffic signal face that contains three or more light signals, shall be positioned in line vertically with the RED LIGHT SIGNAL at the top, the YELLOW LIGHT SIGNAL immediately below the red and the GREEN LIGHT SIGNAL immediately below the yellow signal. If there is a second GREEN ARROW LIGHT SIGNAL it shall be located in line vertically below the first green arrow signal. A straight-ahead arrow shall be located above a right or left arrow and a right arrow shall be located above a left.
- The YELLOW and GREEN LIGHT SIGNALS on a traffic signal face that contains two light signals, shall be positioned in line vertically with the YELLOW LIGHT SIGNAL at the top and the GREEN LIGHT SIGNAL immediately below the yellow signal.
- When vehicular signal faces are mounted adjacent to each other in a horizontal group, all light signals of the same colour must be located on the same horizontal level, except that for S5, S6, S7 traffic signal faces, the second green arrow light signal may be located immediately below the level of the green light signals.
- No light signal shall be located at the same level as a light signal of a different colour (except for pedestrian or pedal cyclist light signals).

- 6 *DUPLICATE light signals shall NOT be provided in a traffic signal face.* Providing such light signals would mean that the signal face no longer conform to one of the standard traffic signal faces. Where increased conspicuity is required, additional standard traffic signal faces may be provided.

#### 6.2.15 Standard traffic signal faces

- Standard traffic signal faces are prescribed by the National Road Traffic Regulations. The standard faces are shown in Figure 6.1. All traffic signal faces SHALL conform to one of the standards.
- The standard traffic signal faces have been developed to ensure uniformity and adequate comprehension by all road users. They will meet all practical signal requirements and applications. The use of any other signal face arrangements is not necessary and is NOT allowed.
- Dimensions for the standard traffic signal faces are given in Volume 4 of the Road Traffic Signs Manual (and in the Standard specifications SANS 1459: *Traffic lights*).
- TRAFFIC SIGNAL ARROW SIGNS ST1 to ST5 may be used in the **Recommended System** to indicate the directions in which light signals are applicable. The use of the signs is subject to the following conditions:
  - The signs shall ONLY be used when it is necessary to assign to traffic signal faces S1L and S1R a higher precedence level (using signs ST3 and ST2 respectively).
  - When the arrow signs are used with the S1L and S1R signal faces, arrow signs may optionally also be used with signal faces S1, S2, S3, S4, S5, S6 and S7. However, when these signal faces are erected immediately adjacent to the S1L and S1R signal faces (typically on the same post), the use of arrow signs with the signal faces is recommended as shown in Figures 6.4a and 6.4b.

#### 6.2.16 Standard Signal Faces for the **Recommended System**

- The following signal faces may be used in the **Recommended System**.
- The standard TRAFFIC SIGNAL FACE S1 is used when traffic is permitted to proceed in any direction that is allowed at the junction. The signal face is also used at signalised pedestrian and pedal cyclist crossings, as well as for the control of two-way traffic on a single lane. The signal face may NOT be used on the same approach as signal faces S2, S3, S4, S5, S6 and S7 (because of the conflicting meanings of the green light signals).
- Standard TRAFFIC SIGNAL FACES S1B and S1T are only applicable to vehicles allowed in exclusive bus and tram lanes respectively. The faces may NOT be used to control buses or trams travelling in non-exclusive lanes.

- 4 Standard TRAFFIC SIGNAL FACES S1R and S1L are used to signal protected-only turning phases. The flashing green signals indicate that the turning movement is unopposed by any conflicting movements during the turning phase. During other phases, turning is prohibited by the red light signal. The use of the signal faces is subject to the following conditions:
- The signal faces may be used without TRAFFIC SIGNAL ARROW SIGNS ST2 and ST3 on approaches to junctions serving only one turning movement or on signalised slipways that are separated from other turning movements by a constructed island.
  - The signal faces must be used in combination with TRAFFIC SIGNAL ARROW SIGNS ST2 and ST3 on approaches to junctions from which more than one direction of movement is allowed. Examples of the combined use of the traffic signal faces and arrow signs are shown in Figures 6.4a and 6.4b.
  - The signal faces may only be used when the conditions for the use of red, yellow and green light signals given in this chapter are met.
- 5 Standard TRAFFIC SIGNAL FACES S2, S3, S4, S5, S6 and S7 may be used where traffic is permitted to proceed only in particular directions. The use of the signal faces is subject to the following conditions:
- The signal faces should preferably only be used to indicate the direction of ONE-WAY roads or streets.
  - Traffic signal faces S2, S6 and S7 may ONLY be used if there are no vehicular movements from the opposite direction conflicting with the right-turn movement.
  - The signal faces shall NOT be used on the same approach as signal face S1 (because of the conflicting meanings of the green light signals).
  - The green arrow light signals on signal faces S5, S6 and S7 shall be indicated concurrently.
- 6 Standard TRAFFIC SIGNAL FACES S8, S8B, S8T, S9, S9B and S9T may be applied in a similar way than traffic signal faces S1, S1B and S1T, except that provision is made for signalling of a protected/permitted turning phase. During the turning phase, the movement is protected and unopposed by any conflicting traffic movement. During other phases of the signal, the turning movement is permitted (e.g. by means of gap acceptance). The use of the signal faces is subject to the following conditions:
- The signal faces may only be used when the conditions for the use of red, yellow and green light signals given in this chapter are met.
  - The traffic signal faces can also be provided as two separate but adjacent traffic signal faces (e.g. faces S1 and S10R instead of face S8).
- 7 Standard TRAFFIC SIGNAL FACES S10R, S10L, S10B and S10T may be used to signal protected/permitted right-turn or left-turn phases. The use of the signal faces is subject to the following conditions:
- The light signals shall only be displayed during the protected turning phase and shall NOT be displayed at any other time.
  - The signal faces may only be used when the conditions for the use of yellow and green signal faces given in this chapter are met.
  - The signal faces can be used as stand-alone signal faces or in combination with other signal faces. The stand-alone configuration, however, is not recommended (since no red light signal is available in these faces).

### 6.2.17 Standard Signal Faces for the Alternative System

- The following signal faces may be used in the Alternative System.
- The standard TRAFFIC SIGNAL FACE S1 is used when traffic is permitted to proceed in any direction that is allowed at the junction. The signal face is also used at signalised pedestrian and pedal cyclist crossings, as well as for the control of two-way traffic on a single lane. The signal face may NOT be used on the same approach as signal faces S2, S3, S4, S5, S6 and S7 (because of the conflicting meanings of the green light signals).
- Standard TRAFFIC SIGNAL FACES S1B and S1T are only applicable to vehicles allowed in exclusive bus and tram lanes respectively. The faces may NOT be used to control buses or trams travelling in non-exclusive lanes carrying other types of vehicles.
- Standard TRAFFIC SIGNAL FACES S1A, S1AR and S1AL may be used to signal protected turning phases, and may be used only if the turning movements are unopposed by any conflicting movements.
- Standard TRAFFIC SIGNAL FACES S2, S3, S4, S5, S6 and S7 may be used where traffic is permitted to proceed only in particular directions. The use of the signal faces is subject to the following conditions:
  - The signal faces should preferably only be used to indicate the direction of ONE-WAY roads or streets.
  - Traffic signal faces S2, S6 and S7 may ONLY be used if there are no vehicular movements from the opposite direction conflicting with the right-turn movement.
  - The signal faces shall NOT be used on the same approach as signal face S1 (because of the conflicting meanings of the green light signals).
  - The green arrow light signals on signal faces S5, S6 and S7 shall be indicated concurrently.

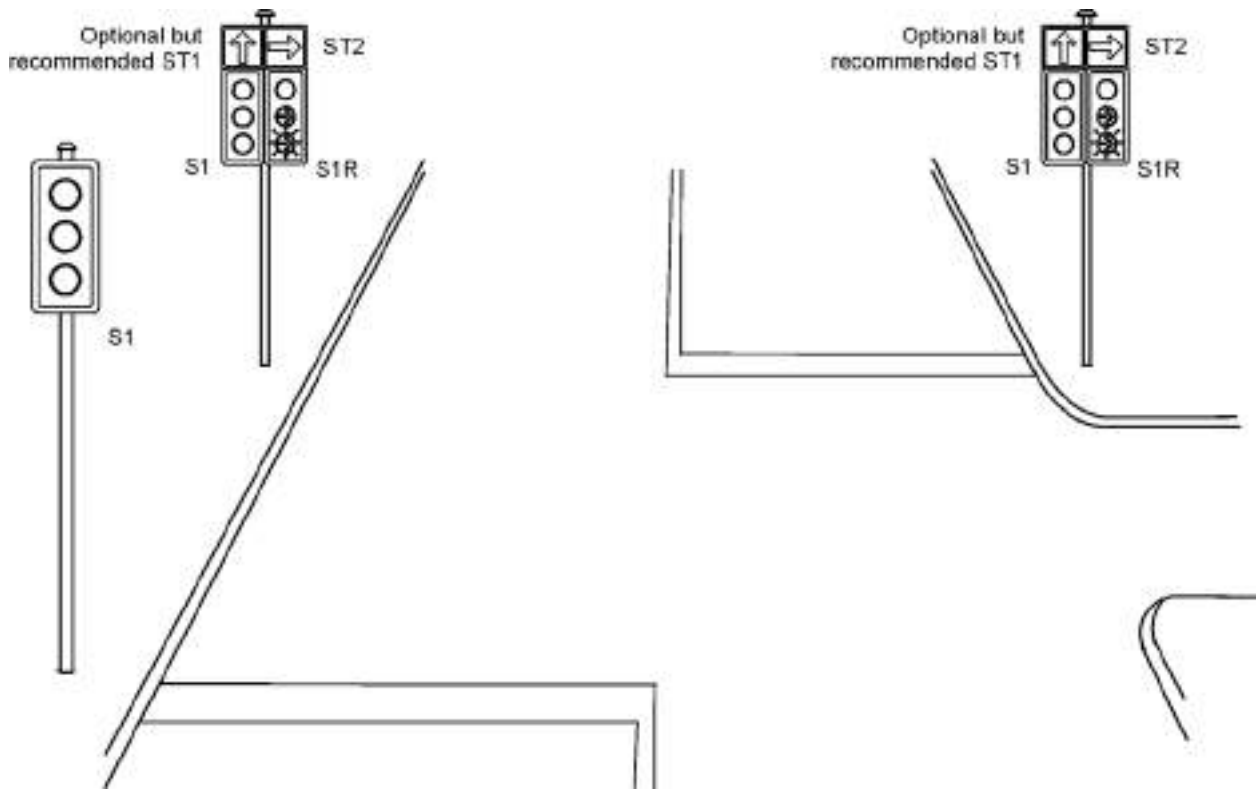


Figure 6.4a: Signalling for protected-only right turn at a T-junction

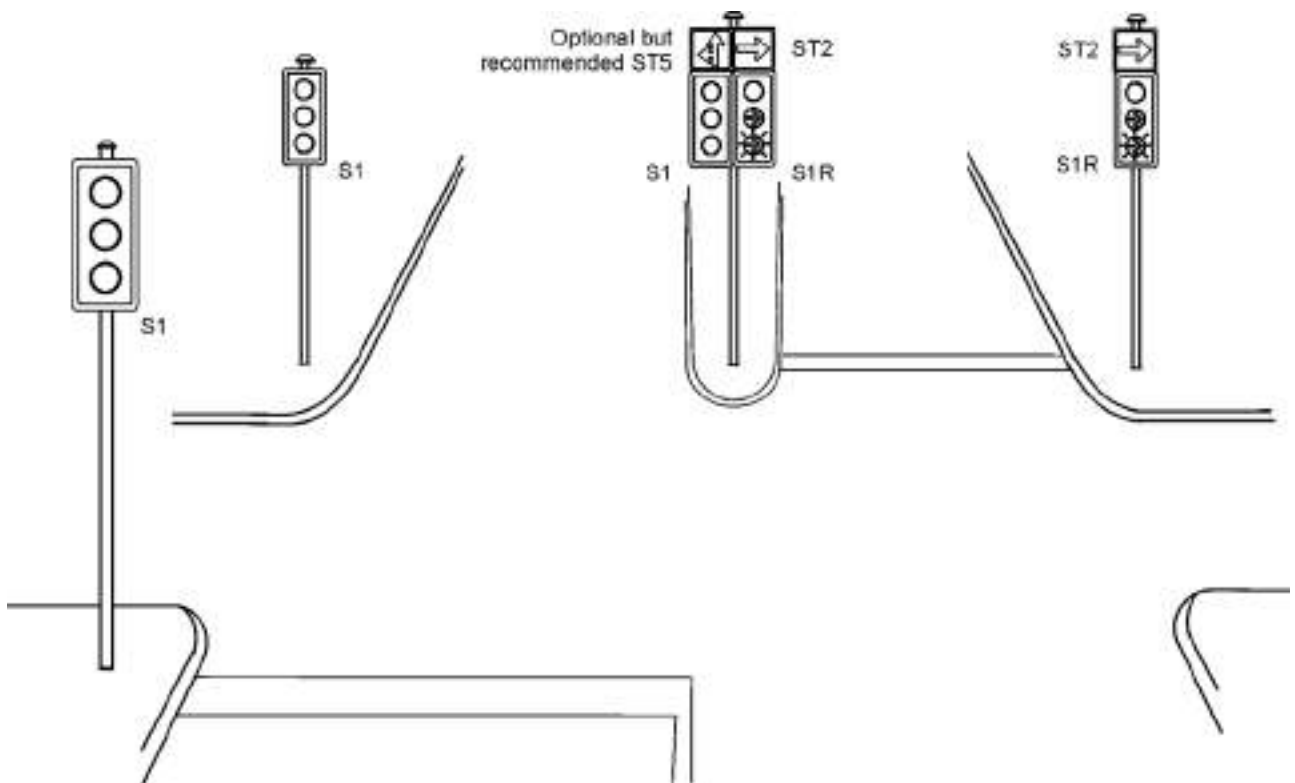


Figure 6.4b: Signalling for protected-only right turn at a 4-way junction (road divided by a median)

### 6.2.18 Numbers and locations of signal faces

- 1 Traffic signal faces for use at junctions and crossings are classified as follows:
  - (a) Principal traffic signal faces are faces provided to meet the minimum legal requirements of the National Road Traffic Regulations.
  - (b) Supplementary traffic signal faces are additional traffic signal faces, not being principal traffic signal faces, provided to meet requirements in respect of visibility and conspicuity or improved traffic operations.
- 2 In the Recommended System, the following PRINCIPAL traffic signal faces SHALL be provided at a signalised junction, signalised slipway or signalised pedestrian or pedal cyclist crossing for the control of vehicular traffic for each direction from which vehicles may approach the junction, slipway or crossing (these requirements shall not necessarily apply to traffic signals used at other locations):
  - (a) FAR-SIDE PRINCIPAL SIGNAL FACES. **At least two traffic signal faces that contain red light signals shall be provided on the far side of the stop line RTM1 at locations:**
    - (i) **that are NOT on the near side of a junction or slipway;**
    - (ii) **that are not less than 6 metres (but preferably not less than 10 metres) from the stop line RTM1;**
    - (iii) **such that the two traffic signal faces shall not be less than 3 metres and not more than 20 metres apart; Provided that where it is unavoidable that the traffic signals are more than 20 metres apart, additional principal traffic signals shall be provided in such a manner that no traffic signals are more than 20 metres apart (signals should preferably not be more than 16 metres apart);**
    - (iv) **at a signalised junction, but not a pedestrian or pedal cyclist crossing, where a straight-through movement is permitted from an approach to the junction, and where the roadway continues straight through the junction, a traffic signal face for the control of straight-through movements shall be provided subject to the requirements of subparagraphs a) (i) to (iii), on either side of the roadway on the far side of the junction; Provided that when the roadway is divided at the junction by a constructed median island of adequate width to accommodate a signal, the right-hand traffic signal face shall be situated on the median island;**
  - (b) NEAR-SIDE PRINCIPAL SIGNAL FACES. **At a signalised junction or slipway, but not a pedestrian or pedal cyclist crossing, at least one signal face containing a red light signal shall be provided on the near side of the junction or slipway, on the left- or right-hand side of the roadway at a position not further than 3 metres from the prolongation of the stop line RTM1.** Although not prescribed, the near-side signal face is also recommended at pedestrian and pedal cyclist crossings.
  - (c) PRINCIPAL SIGNAL FACES FOR TURNING PHASES. **When a separate left- or right-turn signal is required, at least two traffic signal faces that incorporate a flashing green arrow light signal, flashing green bus light signal or a flashing green tram light signal, shall be provided, one on the far side of the stop line RTM1 subject to subparagraphs a) (i) and (ii), and the other on the far or near side;**
- 3 In the Alternative System, the following PRINCIPAL traffic signal faces SHALL be provided at a signalised junction, signalised slipway or signalised pedestrian or pedal cyclist crossing for the control of vehicular traffic for each direction from which vehicular traffic may approach the junction or crossing (these requirements shall not apply to traffic signals used in other locations):
  - (a) At least two traffic signal faces shall be provided at a location on the near side of the junction or crossing (including a signalised slipway that is separated from other turning movements by a constructed island) at locations:
    - (i) approximately on the prolongation of the STOP LINE RTM1, one on the left side and one on the right side of the roadway, provided that when the roadway is divided at the junction by a constructed median island of adequate width, the right-hand traffic signal face shall be situated on the median;
    - (ii) where the two traffic signal faces shall not be less than 3 metres and not more than 20 metres apart (but preferably not more than 16 metres apart);
  - (b) When a separate right-turn signal is required, at least two signal faces S1AR that incorporate a right-turn green arrow light signal shall be provided, one on the near side of the junction and the other on either the far side or on the near side of the junction.
  - (c) When a separate left-turn signal is required, at least one signal face S1AL that incorporates a left-turn green arrow light signal shall be provided on the near side of the junction.
  - (d) When specifying the use of Type S1AR and/or S1AL signal faces, at least one such signal face shall be combined with a Type S1 signal face to cater for other traffic movements.

- 4 **Additional traffic signal faces may be provided at the junction or crossing at any suitable location**, even if the minimum requirements for principal traffic signal faces have been met. Supplementary signal faces must be provided where the minimum visibility requirements cannot be achieved by means of the principal faces alone.
- 5 The position of a signal face on an approach, including an overhead mounted signal face, in relation to any lane on the approach, is generally not significant in the interpretation of the light signal by the road user (although positions of traffic signals may be prescribed).

#### 6.2.19 Two-way traffic on a single lane

- 1 Traffic signals may be installed to successively give right of way to traffic from opposite directions on a single traffic lane, such as a narrow bridge and tunnel, or at roadworks when only one lane of the road is open.
- 2 At least two traffic signal faces of type S1 shall be provided on a two-way single lane road, one on each side of the road, at a position not less than 6 m (but preferably not less than 10 m) beyond the stop line RTM1. However, where the traffic signal is manually operated (such as at roadworks), only one such signal face may be provided.
- 3 An all-red interval of sufficient duration is necessary that would allow slow moving traffic to clear the single lane section before the onset of the opposing green. For fixed time operation, this may be established based on the 15th percentile free-flow speed on the lane (judgement may be required to establish whether this would be adequate).
- 4 When sufficient sight distance is provided, the signal may be placed in flashing mode to indicate that drivers can proceed if no vehicles are present in the opposite direction on the single lane section.

#### 6.2.20 Left- and right-turn signal phases

- 1 Turning movements at traffic signals can be permitted, prohibited or protected. The different modes of operation are as follows:
  - (a) Permitted-only mode in which a turning movement is permitted but no exclusive turning phase is provided.
  - (b) Protected/permitted mode in which an exclusive protected turning phase is provided, but the turning movement is also permitted during the main phase. This mode can NOT be accommodated in the **Alternative System** system.
  - (c) Protected-only mode in which vehicles are only allowed to turn during a protected phase.
  - (d) Prohibited mode in which no turning movement is allowed.

- 2 In the **Recommended System**, protected signal phases can be provided as follows:
  - (a) Protected/Permitted mode – traffic signal faces S10R, S10L, S10B or S10T used singly or in combination with another suitable signal face that contains a red light signal (preferably not singly). Signal faces S8, S8B, S8T, S9, S9B and S9T can also be used for this purpose.
  - (b) Protected-only mode on an approach other than a signalised slipway – traffic signal faces S1R and S1L with TRAFFIC SIGNAL ARROW SIGNS ST2 and ST3 respectively.
  - (c) Protected-only mode on a signalised slipway – traffic signal faces S1R and S1L without TRAFFIC SIGNAL ARROW SIGNS ST2 or ST3.

When one of the traffic signal faces S1R and S1L is used to control a turning movement, the straight through and other turning movement must be controlled using another suitable traffic signal face. When used on an approach other than a signalised slipway, separate lanes must be provided for the turning movements controlled by the S1R and S1L signal faces. Such lanes should be separated from other lanes by a WM2 CONTINUITY LINE, a RM5 PAINTED ISLAND or a constructed island.

- 3 In the **Alternative System**, protected-only signal phases can be provided by using signal faces S1AL and S1AR. Other straight through and turning movements must be controlled by using another suitable traffic signal face.

#### 6.2.21 Signals on high-speed roads

- 1 The speed limit on any approach to a signalised junction or pedestrian or pedal cyclist crossing shall NOT exceed 80 km/h.
- 2 At traffic signals where the speed limit is 70 km/h or higher, the following measures can be considered to improve the visibility of the signals:
  - (a) high intensity traffic light signals; or
  - (b) overhead mounted traffic signal faces;
- 3 At traffic signals where accidents occur due to high speed, or transgression of posted speed limits occurs, consideration may be given to the measures given above as well as the following corrective measures:
  - (a) law enforcement of the speed limit;
  - (b) high visibility warning signs in advance of the signals;
  - (c) skid resistant road surface, particularly on downhill approaches to the signals;
  - (d) speed calming measures (e.g. rumble strips), but only if they are not distracting to drivers (such measures should preferably be introduced in advance of the traffic signal and not at the traffic signal); or
  - (e) converting the traffic signal to a traffic circle.



Speed limit or advisory speed (km/h)	Minimum for urban conditions (where signals are expected)	Preferable for urban conditions and minimum for rural conditions	Adjustments for grades			
			Add for a downgrade of:		Subtract for an upgrade of:	
			-5%	-10%	+5%	+10%
40 km/h (*)	55 m	130 m	0 m	5 m	0 m	5 m
50 km/h (*)	80 m	160 m	5 m	10 m	5 m	5 m
60 km/h	110 m	190 m	10 m	20 m	5 m	10 m
70 km/h	140 m	215 m	10 m	25 m	10 m	15 m
80 km/h	170 m	240 m	15 m	35 m	10 m	20 m
90 km/h	210 m	270 m	20 m	45 m	15 m	25 m

(\*) To be used only in conjunction with an advisory speed sign, e.g. at a horizontal curve

### 6.2.22 Optical requirements

- 1 The optical components of a traffic signal are important and care should be taken to ensure that they meet minimum requirements. Compliance with SANS 1459: *Traffic lights* is recommended (prescribed in South Africa).
- 2 The luminous intensity level of a signal aspect defines the brightness of a light. Two intensity levels are available, namely NORMAL or HIGH. Normal intensity lights should always be specified for pedestrian signals. Normal or high intensity lights may be used for vehicular signals, depending upon the operating conditions. Conditions where high intensity lights should be used, include any one or more of the following:
  - (a) Where the speed limit on a road is 80 km/h or higher.
  - (b) Where increased visibility is necessary due to a confusing background of bright lights or other traffic lights or signs.
  - (c) Where visibility is affected by a rising or setting sun in the east/west direction.
  - (d) Where drivers would not normally expect to encounter a signal, such as in rural areas or on the edges of a town or city.
- 3 High intensity traffic lights may cause "discomfort glare" or "disability glare" at night, especially in dark surroundings and in the absence of street lighting. It is recommended that, in such situations, a facility for automatically dimming signal lamps at night should be provided. Such dimming can be operated by a photo-electric cell.
- 4 Flashing signals shall operate at a frequency of between one and two flashes per second and the luminous intensity shall be zero for 30% - 50% of the period and not less than the specified minimum for 30% - 50% of the period.
- 5 Two sizes of signal aspects may be used, namely 210 mm and 300 mm nominal diameter. Either size may be used for pedestrian and vehicular signals. The larger aspect is not often used because it does not contribute significantly to visibility as much as luminous intensity, particularly when used to display disc light signals.
- 6 Pedestrian aspects of 210 mm diameter should be adequate for normally-sighted people up to a distance of 35 m. The larger aspect may be considered for crossings wider than 35 m, but then it would be preferable to provide a staggered crossing. The larger aspect can be used at a crossing that is regularly used by elderly people or people with impaired vision.
- 7 Louvers and visors are provided to modify the angular visual coverage of the light signal and/or to shield the optical system from incidental light that may cause sun-phantom effects. The use of louvers should be restricted because of the loss of efficiency of the optical system. They should only be used when the visors alone are unable to provide the necessary cut-off. Louvers SHALL not be used in association with symbolic displays such as arrows, pedestrian and pedal cyclist signals.
- 8 A suitably designed visor SHALL be fitted to each vehicular signal aspect. Pedestrian and pedal cyclist signal aspects may also be fitted with visors. The visor shall have a length of at least 160 mm at the top. The visor should not prevent required visibility standards from being achieved. Cut-away visors may be used to increase visibility from one side. Shorter visors should preferably be used, unless additional cut-off is essential.
- 9 **A background screen (backboard) SHALL be provided for each vehicular signal face while background screens may be provided (but are not necessarily recommended) for pedestrian and pedal cyclist signal faces. Where it is necessary to increase the conspicuity of a traffic signal, the border of the white background screen provided for a signal face may be white retro-reflective.**
- 10 Traffic signal posts should have a diameter of at least 100 mm. **The standard, post or cantilever shall be golden yellow (portions of which may be retro-reflective).** However, **this provision shall not be applicable to an overhead traffic signal mounted on a GANTRY.**

11 Retro-reflective strips may be provided on traffic signal posts to increase the conspicuity of the posts at night, particularly when there is a loss in the electricity supply. Three horizontal yellow retro-reflective strips can be fitted on ALL yellow signal posts. The width of the strips may be between 120 and 150 mm. The width of the openings should be about the same as that of the strips. The bottom strip should not be installed lower than 1,2 m and the top strip not higher than 2,1 m above the ground level.

### 6.2.23 Visibility requirements

- 1 Under normal atmospheric conditions, traffic signal faces should be clearly visible and recognisable on approaches to a signal. Where the principal signal faces alone cannot provide the required visibility, additional traffic signal faces must be provided to supplement the principal signal faces.
- 2 The overriding objective in deciding the number and location of supplementary traffic signal faces is that light signals should be clearly visible to the approaching vehicles for which they are intended, taking into account:
  - (a) the position of the vehicle on the approach;
  - (b) the alignment of the approach;
  - (c) obstructions to visibility (including other vehicles that may be queued on an approach);
  - (d) distracting lights and signs; and
  - (e) required sight distances.
- 3 Street lights, illuminated signs and distracting advertising signs close to, or behind traffic signals may be confusing and distracting to drivers. Such distracting features should not be permitted.
- 4 Signal faces should be visible over the minimum distances described below. In each case, all light signals in a face must be visible from a reference point 1,05 m above the centre line of each lane of traffic for which the signal face is intended.
- 5 At least two traffic signal faces - principal or supplementary - should be visible at any one time over the minimum sight distances from the stop line given in Table 6.1. The sight distances given in the table allow for driver recognition, reaction and stopping times from the speed limit or posted advisory speed.
  - (a) Minimum and preferable sight distances are given for urban roads. The minimum sight distances given for rural roads are the preferred distances for urban roads. The minimum sight distances are based on a shorter reaction time, and should only be used at junctions where drivers would expect a traffic signal. The longer sight distances should be used when traffic signals are not expected and a longer reaction time is required to respond to the signals.
  - (b) The sight distances also vary according to the approach grade to a junction or crossing. Note that sight distances for speeds lower than 60 km/h should be permitted only in circumstances where the geometry of the approach ensures that vehicles reduce speed, and an appropriate advisory speed and warning sign is posted.

- 6 At least two traffic signal faces on the far side of the stop line should be visible from a distance of 50 m or more, up to the stop line.
- 7 At least one traffic signal face should lie within the average driver's "cone of vision". The cone of vision is measured from the stop line position, 20 degrees on either side of the continuation of the centre line of each approach lane.
- 8 At least one traffic signal face on the far side should be visible for right-turning vehicles waiting inside the junction to turn right. This traffic signal should preferably be located on the far right-hand corner of the junction.
- 9 Additional supplementary signal faces may (and preferably should) be provided to ensure consistency and uniformity along a road or street. For instance, if an overhead mounted signal face is provided at one location, then such signals should be provided at other junctions and pedestrian and pedal cyclist crossings on the road or street (but only while roadway and other characteristics remain the same along the road or street and when signals are spaced at distances closer than 1 km apart).
- 10 The optical axis of each light signal should be positioned and aligned so that it is at the greatest effectiveness to the approaching traffic for which it is intended. The optical axis of each light signal should be aligned on the reference point in the centre of the approach lane or lanes midway over the distance that it is intended to control.
- 11 CARE SHOULD BE TAKEN TO ENSURE THAT NO TRAFFIC SIGNAL FACE INTENDED FOR TRAFFIC ON ONE APPROACH IS ALIGNED SO THAT IT COULD BE WRONGLY TAKEN TO APPLY TO ANOTHER APPROACH AT THE SAME JUNCTION.
- 12 The provision of road lighting at signalised junctions and mid-block pedestrian crossings will promote safe operations at night. Consideration should therefore be given to providing such lighting at all signalised junctions and crossings.

### 6.2.24 Mounting of vehicular signal faces

- 1 Traffic signal faces may be mounted on one of the following supports:
  - (a) standard post;
  - (b) extended (longer) post; or
  - (c) overhead cantilever or gantry;
 Supporting traffic signal faces by means of catenary wires or cables, is NOT allowed.
- 2 A lateral clearance of at least 0,5 m should generally be provided from the edge of a roadway and any post or any part of a signal face, including the backboard (background screen). If there is a significant tipping of vehicles to one side due to camber or crossfall on the road, or where vehicles tend to cut corners, it is preferable to increase the clearance to 1,0 m or more.
- 3 On medians, where insistence on the 0,5 m lateral clearance would mean that signal faces cannot be provided on the median, the lateral clearance can be reduced to an absolute minimum of 0,1 m, but only if the camber or crossfall of the roadway falls away from the median.

- 4 Principal traffic signal faces should preferably be post-mounted at the side of the road. Supplementary traffic signal faces may be either post-mounted or mounted above the road surface on a gantry or cantilever. Traffic signal faces on the left-hand side of the road, should generally be located not more than 2 m to the left of the continuation of the left-hand edge of the approach roadway, measured parallel to the road centre line and excluding any approach splay.
- 5 Traffic signal faces that are mounted on posts at the side of the road, should be not less than 2,3 m and not more than 3 m above the level of a point on the road surface nearest to the post, measured to the centre of the lowest (green) signal aspect. A minimum clearance of not less than 2,1 m above the sidewalk should also be provided.
- 6 Where it is necessary to achieve the minimum visibility requirements (e.g. on a vertical curve), supplementary traffic signal faces may be mounted on posts at the side of the road at a height exceeding 3 m. These supplementary traffic signal faces may be mounted on the same post, provided that the two traffic signal faces shall be not less than 1 m apart, measured from the centres of the two nearest light signals on the two signal faces. There is no maximum limit, but line-of-sight and stability factors should be taken into consideration and a practical limit would be 5 m (between centres of two closest light signals).
- 7 Overhead mounted signals would be required when it is not possible to comply with the requirement that principal signal faces may not be further than 20 m apart (preferably not further than 16 m apart).
- 8 Consideration should also be given to providing overhead mounted signal faces as supplementary signal faces at junctions or crossings where accidents occur due to high speed, or to ensure consistency and uniformity along a road or street.
- 9 Any traffic signal face that is mounted on a gantry or cantilever above the roadway SHALL have a minimum clearance above the road of not less than 5,2 m. The height to the lowest light signal should not exceed 6,2 m on a level road. The vertical part of the gantry or cantilever structure may be used to mount a signal face at the side of the road. The cantilever may be of any horizontal reach, although in practice a reach that exceeds 5 m will present stability problems. Alternatively, an overhead gantry can be used when a longer reach is required.
- 10 The position of the traffic signal face mounted on a gantry or cantilever, relative to the traffic lane over which it is located, is not of significance in the meaning of the signal. However, the cantilever should preferably be located on the left-hand side of the road.

**6.3 PEDESTRIAN AND PEDAL CYCLIST SIGNALS**

**6.3.1 Introduction**

- 1 Pedestrian and pedal cyclist traffic is subject to control by any traffic signal that is intended for vehicular traffic. Separate signals, however, can be provided for the control of pedestrians and pedal cyclists.
- 2 Pedestrian and pedal cyclist signals SHALL be operated only in conjunction with vehicular traffic signals. They will normally be provided where a significant number of pedestrians or pedal cyclists experience difficulty and/or delay in crossing a road at certain times during the day. Situations in which pedestrian or pedal cyclist signals may be used are:
  - (a) at signalised road junctions; and
  - (b) at signalised mid-block pedestrian and pedal cyclist crossings.
- 3 Warrants for the provision of signals at pedestrian and pedal cyclist mid-block crossings are given in Volume 3: *Traffic signal design*.
- 4 The general provisions for vehicular traffic signals shall also apply to pedestrian and pedal cyclist signals and to vehicular traffic signals used in conjunction with pedestrian and pedal cyclist signals, except where otherwise noted in this chapter.
- 5 Where pedestrian signals are not provided at a junction, vehicular traffic shall yield right of way to pedestrians lawfully in the junction. Pedal cyclists, however, do not have the same right of way and are treated similar to vehicular traffic when pedal cyclist signals are not provided.

**6.3.2 Pedestrian and pedal cyclist signals**

- 1 The operation of pedestrian and pedal cyclist signals in the Recommended and Alternative Systems is the same except for one aspect, namely the flashing signal used to indicate the “do not start to cross” message. This flashing signal is given as follows:
  - (a) Recommended System – indicated by a FLASHING RED MAN or PEDAL CYCLIST LIGHT SIGNAL (See Figure 6.5a).
  - (b) Alternative System – indicated by a FLASHING GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL (See Figure 6.5b).
- 2 Pedestrian light signals shall comprise:
  - (a) a STEADY GREEN MAN LIGHT SIGNAL, followed by:
  - (b) a FLASHING RED OR GREEN MAN LIGHT SIGNAL, followed by:
  - (c) a STEADY RED MAN LIGHT SIGNAL.
- 3 Pedal cyclist signal installations shall comprise:
  - (a) a STEADY GREEN PEDAL CYCLIST LIGHT SIGNAL, followed by:
  - (b) a FLASHING RED OR GREEN PEDAL CYCLIST LIGHT SIGNAL, followed by:
  - (c) a STEADY RED PEDAL CYCLIST LIGHT SIGNAL.
- 4 Pedestrian and pedal cyclist light signals shall have the significance assigned to them in the National Road Traffic Regulations.



Pedestrian Signal Face S11P



Pedal Cyclist Signal Face S11C

Figure 6.5a: Recommended system - Pedestrian and pedal cyclist signal sequence



Pedestrian Signal Face S11P



Pedal Cyclist Signal Face S11C

Figure 6.5b: Alternative system - Pedestrian and pedal cyclist signal sequence

- 5 A STEADY GREEN MAN LIGHT SIGNAL indicates to a pedestrian that he or she may cross the roadway within the pedestrian crossing markings RTM3 or RTM4 as appropriate, and that the driver of a vehicle shall yield right of way to a pedestrian crossing such roadway.
- 6 A STEADY GREEN PEDAL CYCLIST LIGHT SIGNAL indicates to a pedal cyclist that he or she may cross the roadway within the pedal cyclist crossing, and that the driver of a vehicle shall yield right of way to a pedal cyclist crossing such roadway.
- 7 A FLASHING RED or GREEN MAN LIGHT SIGNAL indicates to a pedestrian (a) who has not yet commenced crossing the roadway that he or she shall not cross the roadway until the steady green man light signal is displayed, or (b) who is within a pedestrian crossing that the steady red man light signal will follow shortly.
- 8 A FLASHING RED or GREEN PEDAL CYCLIST LIGHT SIGNAL indicates to a pedal cyclist (a) who has not yet commenced crossing the roadway that he or she shall not cross the roadway until the steady green pedal cyclist light signal is displayed, or (b) who is within a crossing that the steady red pedal cyclist light signal will follow shortly.
- 9 A STEADY RED MAN LIGHT SIGNAL indicates to a pedestrian that he or she shall not cross the roadway until the steady green man light signal is displayed.
- 10 A STEADY RED PEDAL CYCLIST LIGHT SIGNAL indicates to a pedal cyclist that he or she shall not cross the roadway until the steady green pedal cyclist light signal is displayed.
- 11 A GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL shall not be displayed at the same time as a STEADY RED or FLASHING RED or GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL on the same crossing.
- 12 A pedestrian signal face shall comprise two light signals, one depicting a red standing man and the other depicting a green walking man. The standard signal face Type S11P shall be used. The red man shall be located in line directly above the green man signal aspect.
- 13 A pedal cyclist signal shall comprise two light signals, displaying a green and red pedal cycle symbol respectively when illuminated. The standard pedal cyclist signal face Type S11C shall be used. The red pedal cyclist shall be located directly in line above the green pedal cyclist aspect.
- 14 Pedestrian and pedal cyclist signal aspects may have a 210 mm or 300 mm nominal diameter. The larger diameter may be used for improved visibility or conspicuity.

### 6.3.3 Operation of pedestrian and pedal cyclist signals

- 1 The function of the steady GREEN MAN and GREEN PEDAL CYCLIST LIGHT SIGNAL is to provide a limited initial "step off" or "launching" interval for pedestrians and pedal cyclists. It SHALL always be followed immediately by a FLASHING RED or GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL.
- 2 The STEADY GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL shall be displayed for an interval appropriate for the particular traffic conditions and shall be not less than a minimum of 4 seconds. A longer interval of 5 to 7 seconds, however, is usually more desirable.
- 3 Sufficient time must be provided after the green man or pedal cyclist light signal for a pedestrian to walk or pedal cyclist to push his or her bicycle across the roadway to the other side of the road, or up to the median island where such median is provided. Where the median is set back from the pedestrian crossing, sufficient time must be provided to allow crossing of the junction in one stage.
- 4 A design walking speed of 1,2 m/s should be used for calculating the pedestrian or pedal cyclist clearance time under normal operating conditions. A slower speed of 1,0 m/s may be used for elderly or infirm pedestrians. The pedestrian or pedal cyclist must be able to clear the roadway by the time the parallel vehicular intergreen ends (end of the all-red interval).
- 5 The FLASHING RED or GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL should not be displayed for a period longer than the duration of the pedestrian or pedal cyclist clearance time. The flashing signal can, however, be displayed for a shorter period if a STEADY RED MAN or PEDAL CYCLIST LIGHT SIGNAL is displayed for the remainder of the clearance time. The flashing signal should not be displayed for a period shorter than the minimum of the following two values:
  - (a) 75% of the clearance time; or
  - (b) the clearance time less the parallel vehicular intergreen period.
- 6 At road junctions, the pedestrian or pedal cyclist phase may run concurrently with a parallel vehicular phase. The vehicle phase, however, SHALL not include any exclusive turning phase in conflict with the pedestrian or pedal cyclist green phase.
- 7 The green man (and pedal cyclist) signal normally starts at the same time as the vehicular green. The vehicular green light signal, however, may be delayed to allow pedestrians to enter the roadway ahead of vehicles. Care should be taken in using delays longer than 3 seconds as such delays can lead to undesirable behaviour. Such behaviour may include illegal turning manoeuvres by drivers and pedestrians (or pedal cyclists) utilising the delay to cross the junction in the wrong direction.

- 8 At a mid-block pedestrian or pedal cyclist crossing, other than where a "Pelican" phase has been provided, a vehicular red light signal SHALL be displayed for at least the full duration of the green and flashing red or green man or pedal cyclist intervals. It may also be necessary to introduce an "all-red" interval.
- 9 At a mid-block pedestrian or pedal cyclist crossing, a "Pelican" phase may be provided to indicate to drivers of vehicles that pedestrians may be clearing the road and have right of way. During the "Pelican" phase, vehicular FLASHING DISC LIGHT SIGNALS are displayed at the same time as the FLASHING RED or GREEN MAN or PEDAL CYCLIST LIGHT SIGNAL. Pedestrians may not enter the crossing on the flashing red or green man, and the duration of this interval should therefore NOT exceed the time required by pedestrians to clear the crossing.
- 10 When vehicular signals are in flashing mode, pedestrian and pedal cyclist signals must be switched off, giving no pedestrian or pedal cyclist indications (except when the signal is operating in pelican mode).

#### 6.3.4 Layout of pedestrian and pedal cyclist signals

- 1 A pedestrian signal face Type S11P or a pedal cyclist signal face Type S11C is provided for each direction of movement at a junction or mid-block crossing (both sides of the roadway).
- 2 The signal faces may be mounted on the same posts as vehicular signal faces, either parallel or perpendicular to the vehicular faces. The following criteria should be used in selecting posts for the mounting of pedestrian signal faces:
  - (a) The signals should be in line with the pedestrian crossing, at a position where pedestrians can readily see the signals.
  - (b) The signals should not be located at a position where vehicles stopping at, or slightly beyond, the stop line may obstruct the visibility of the signals. Attention must particularly be given to the possible obstruction of the signal face by buses and heavy vehicles.
  - (c) The signal posts should not impede the flow of pedestrian traffic.
  - (d) The number of signal posts should be restricted to avoid clutter on the sidewalk and to reduce installation and maintenance costs.
- 3 At signalised mid-block pedestrian or pedal cyclist crossings, type S1 traffic signal faces SHALL be used to control vehicular traffic. The left-hand S1 signal faces should not be located more than 2 m laterally from the edge of the roadway.

#### 6.3.5 Mounting of pedestrian and pedal cyclist signals

- 1 Pedestrian and pedal cyclist signals should preferably be post-mounted. The signals should have a minimum clearance above the sidewalk of not less than 2,1 m. The signal face should be not more than 3,0 m above the level of a point on the road surface nearest to the post, measured to the centre of the lowest (green) light signal.
- 2 Where the pedestrian or pedal cyclist signal face is mounted adjacent to a vehicular signal face, the red man or pedal cyclist signal aspect SHALL not be mounted higher than the level of the lowest vehicular green signal aspect. The pedestrian or pedal cyclist signal faces should not be located in a line vertically with any vehicular signal aspect facing the same direction and should be offset to the left or right of such signal aspect.
- 3 The pedestrian or pedal cyclist push button should be mounted approximately 1,1 m above the sidewalk surface. A pedestrian or pedal cyclist sign should preferably be placed immediately above or below the push button.



## 6.4 TRAFFIC SIGNALS TO CONTROL INDIVIDUAL VEHICLES

### 6.4.1 Operation

- 1 Traffic signals for the control of *individual* or *single* vehicles, as distinct from those that give right of way to groups of vehicles, are used to control traffic at locations such as freeway on-ramps, toll booths and roadside checkpoints.
- 2 The Type S12 traffic signal face is used for the control of individual vehicles as shown in Figure 6.6. The signal face comprises only a RED DISC and a GREEN DISC LIGHT SIGNAL.
- 3 A yellow signal aspect is not provided in the S12 signal face. The signals should therefore not be used to control vehicles other than those that are stationary or travelling at low speed. This can be achieved by:
  - (a) displaying the green signal only to a vehicle that has already stopped at a stop sign, or other similar sign, near to the signal (such as at toll booths and checkpoints); or
  - (b) resting the signal in red and displaying the green signal ONLY when required, and then only for a few seconds to allow one stopped vehicle to depart at a time (such as when ramp metering is applied).
- 4 Where it is required to give continuous right of way to all approaching vehicles, the green light signal may be displayed continuously. When it is necessary to switch the signal to red, a flashing red light signal should first be displayed for a duration of at least 5 seconds.
- 5 At no time SHALL an operational traffic signal be intentionally switched off and blacked out, other than for maintenance or repairs or when controlled by a traffic officer or an authorised pointsman. Flashing red light signals may also be used to indicate that the signals are out of order.

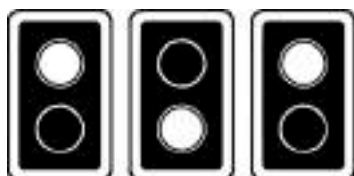


Figure 6.6: Single vehicle release operating sequence

### 6.4.2 Application at toll booths and checkpoints

- 1 The S12 traffic signal face is used at toll booths and checkpoints to instruct vehicles either to stop or to continue.
- 2 A STOP sign R1, or any other sign that instructs the driver to stop, should be displayed at the stopping point. At least one S12 traffic signal face should then be provided per lane of traffic, located on the right-hand (driver's) side of the lane. The signal face should be located not less than 6 m beyond the stop position.
- 3 The signal should wherever possible, be controlled automatically. The duration of the green light signal and change to red can best be controlled by the output from vehicle detectors in each lane. The illumination of the green light signal may be performed automatically, e.g. linked to a toll booth cash register, or manually.

### 6.4.3 Application in ramp metering

- 1 Ramp metering is applied to restrict the number of vehicles allowed to enter a freeway in order to ensure an acceptable level of service on the freeway or that the capacity of the freeway is not exceeded.
- 2 For the purpose of ramp metering, a STOP LINE RTM1 shall be provided on the on-ramp. At least two S12 traffic signal faces should be provided for ramp metering at a distance not less than 6 m (preferably not less than 10 m) beyond the stop line.
- 3 When ramp metering is in operation, the S1 signals should normally rest in red, and a green light signal displayed ONLY when required and then only for the time required by a departing vehicle to clear the line of vision of the signal face. Such timing should preferably be achieved by means of vehicle detectors. Two detectors would normally be required for this purpose, namely the check-in and check-out detectors.
- 4 The check-in detector is located at the position where vehicles would normally stop at the stop line. The check-in detector is used to actuate the green light signal when an approaching vehicle is detected AND a minimum red period has expired.
- 5 The check-out detector actuates the red light signal as soon as a vehicle is detected. The detector must be located beyond the last traffic signal at a point where the red light signal will not be visible to the departing vehicle.





**6.5 LANE DIRECTION CONTROL SIGNALS**

**6.5.1 General**

- 1 Lane direction control signals are used to signalise reversal of traffic flow along a road lane to accommodate the tidal nature of traffic flow during different times of a day. The signal shall be used to *indicate the permitted direction of traffic movement along a lane of a road and to prohibit the entry of traffic into, and the movement of traffic along, that lane from the opposite direction.* In this way, right of way can be allocated alternately on a predetermined basis, to one of two possible directions of traffic movement in the lane, or lanes, so signalised.
- 2 Lane direction control signals shall ONLY be used to permit or prohibit traffic movements in situations where *at least one lane is subject to reversals of the direction of traffic flow.* If there is a need for such application, use can be made of VARIABLE MESSAGE SIGNS.
- 3 The signal faces that may be used for lane direction control are the S16, S17, S18 and S19 signals shown in Figure 6.7a. Permitted variants of the S16 and S17 signal faces are shown in Figure 6.7b. The variants S(16)-17 and S16-(17) may be provided as variable signals where both the cross and arrow can be displayed on a single matrix.

- 4 The STEADY GREEN DOWNWARD-POINTING ARROW SIGNAL S16 is used to **indicate to the driver of a vehicle that he or she may drive his or her vehicle in the lane over which the arrow is displayed.**
- 5 The STEADY RED CROSS SIGNAL S17 is used to **indicate to the driver of a vehicle that he or she shall not drive his or her vehicle in the lane over which the cross is displayed and that the lane is open to vehicles travelling in the opposite direction.**
- 6 The YELLOW LEFT AND RIGHT ARROW SIGNALS S18 and S19 are used to **indicate to the driver of a vehicle that the lane over which the arrow is displayed is closed ahead and that he or she shall leave the lane in the direction of the arrow when it is safe to do so.**

**6.5.2 Installation**

- 1 LANE DIRECTION CONTROL SIGNALS shall comprise of two independently illuminated signal aspects, Types S16, and S17. The signals SHALL be mounted in PAIRS as shown in Figure 6.7c, one facing in each direction, centrally over the traffic lane subject to reversal in direction of use.
- 2 PAIRS of the lane direction control signals S16 and S17 shall be placed at the beginning and end of each lane subject to reversed flow and at intermediate points along the lane that will enable a driver to see at least two light signals at any time, the distance apart not exceeding half the minimum sight distance for urban conditions given in Table 6.1.



Figure 6.7a: Standard lane direction control signals

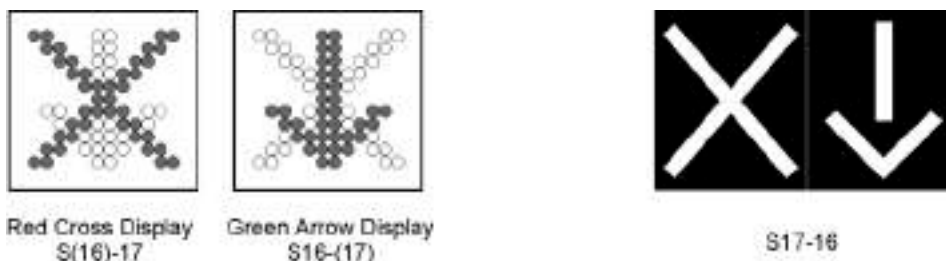


Figure 6.7b: Permitted variants of lane direction control signals

- 3 It is recommended that fixed display lane direction control signals, or fixed "arrow" or "cross" signs, be placed over all OTHER lanes that are not subject to reversible traffic flow, to supplement the LANE DIRECTION CONTROL SIGNALS.
- 4 LANE DIRECTION CONTROL SIGNALS S18 or S19 may be placed in advance of the lane closure, over the centre of the lane to be closed. Signals S18 or S19 shall be operated on the basis that they are either illuminated or switched off. The signals shall be illuminated when they precede an illuminated S17 RED CROSS signal over the reversible flow lane. If it is necessary to provide a long merging distance, more than one S18 or S19 signal may be used, in sequence, over the approach lane. These signals do not have to be mounted in pairs.
- 5 The roadway signals S18 or S19 should be located in advance of the lane closure at a distance as given in Table 6.1. This distance should be increased in accordance with the difficulty which traffic may experience in merging with traffic in the adjacent lane.
- 6 The lane direction control signal faces are normally gantry mounted and the standards for height and clearance are the same as for other signals. The faces may NOT be mounted with the centre of the signal aspects at a height exceeding 6,2 m above the road. There shall also be a vertical clearance of not less than 5,2 m from the road to the lowest part of any light assembly or supporting structure.

### 6.5.3 Operation

- 1 Reversal of the direction of traffic flow along a road lane, or lanes, may be used where it will be beneficial to make use of the tidal nature of traffic flow. Such traffic flow reversals, however, shall be used only where it can be certain that it will operate safely. The technique is not recommended for use on roads with a speed limit exceeding 80 km/h.
- 2 Careful attention should be given to capacity requirements and channelisation of traffic at each end of the lane(s) subjected to reversed traffic flows. Inadequate capacity to meet the increased directional flow will mitigate against the effectiveness of the action. Some drivers may get confused as to which lanes to use at the terminal points and extra control signals or other measures may be needed at these locations.
- 3 Traffic flow in any one direction shall be for continuous periods of not less than one hour. Changeover should preferably occur at the same time of each day of the week and when traffic volumes are not at, or near, the peak. It is recommended that there should be no more than two changeovers in one day, i.e. one period of reversed flow per day.
- 4 Prior to permitting vehicles to use a reversible direction lane, all the signals along each section shall show crosses in both directions to provide sufficient time to ensure that the traffic lane is free of moving or trapped vehicles.
- 5 Signals may be switched off when not required, provided that in such circumstances the direction of flow of traffic and the bounds of traffic lanes are obvious from other permanent road traffic signs.

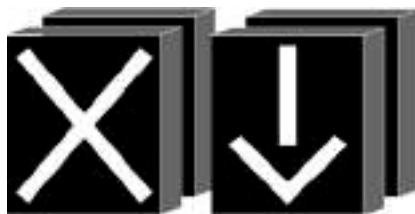


Figure 6.7c: Back-to-back mounting of lane direction control signals

## 6.6 FLASHING RED DISC LIGHT SIGNAL AT RAILWAY CROSSINGS

### 6.6.1 Recommended system for railway crossings

- 1 The National Road Traffic Act permits the railway operator (Transnet Limited) to erect road traffic signs at railway crossings as they may deem expedient. However, provision is also made in the act that such operator can be directed to display or remove signs as may be required.
- 2 No person shall stop a vehicle on the roadway of a public road within the railway reserve at a level crossing, except in order to avoid an accident, or in compliance with a road traffic sign or with a direction given by a traffic officer.
- 3 Railway crossings should be marked with the rail crossing warning signs W403 or W404. Sign W403 is displayed on approaches to single railway level crossings, while sign W404 is displayed on approaches to level crossings with more than one railway line. In addition to these signs, the advance warning sign, W318, can be applied with good effect, particularly under circumstances where visibility is obscured.
- 4 A number of road signs may be used for the control of traffic at level railway crossings. These include the use of FLAG SIGNALS SS2 as well as STOP SIGNS R1 and YIELD SIGNS R2 singly or in combination with the W403 or W404 warning signs.
- 5 FLASHING RED DISC LIGHT SIGNALS (FRD) may also be used to warn drivers that a train is approaching a level crossing. Two such signals shall be used in conjunction with a STOP SIGN R1 and a warning sign W403 or W404. The signals shall be mounted below the stop sign R1 and above the warning signs W403 or W405 as shown in Figure 6.8a. The flashing red disc signal indicates **to the driver of a vehicle that he or she shall stop his or her vehicle and shall not proceed until it is safe to do so, and such signal shall have the same significance as stop sign R1.**
- 6 The two flashing red light signals are used to indicate to a driver that he or she shall stop his or her vehicle. The preferred mode of operation is that a flashing red disc signal is displayed at least 30 seconds before the arrival of a train. If gates or barriers protect the crossing, the flashing red light signal should start 20 seconds before the gate or barrier closes.
- 7 The two flashing red disc light signals shall be arranged to flash alternately in such a way that the alternating flashes remain constantly out of phase i.e. when one disc is fully illuminated the other disc has zero luminous intensity and vice versa.
- 8 The flashing red light signals at railway crossings SHALL be situated on the near side of the railway crossing, on the left side of each approach roadway. The flashing red light signals shall conform in all respects to the requirements laid down for vehicular traffic signals at road junctions and pedestrian crossings, except that:
  - (a) The signal face shall comprise a single red disc aspect and shall be mounted on the same post as the stop signs R1 and the warning signs W403 or W404.
  - (b) The red disc aspect shall be displayed only in flashing mode, as and when required to warn of the approach or presence of a train, and shall not display a steady red light signal at any time.
  - (c) Two flashing red disc signal aspects shall be provided on the same post.
  - (d) The flashing red disc signal may be accompanied by an audible signal.
  - (e) The signal posts shall be as for road signs.



Figure 6.8a: Recommended system - Flashing red disc light signals at railway crossings

### 6.6.2 **Alternative system** for railway crossings

- 1 In the alternative system, a number of road signs may be used at level railway crossings. These include the railway level crossing warning signs W403 or W404 and other control signs. Sign W403 is displayed on approaches to single railway level crossings, while sign W404 is displayed on approaches to level crossings with more than one railway line. In addition to the railway crossing signs, the advance warning sign W318 can also be used where the visibility to the crossing is obscured for whatever reason.
- 2 Additional road signs that may be used, include FLAG SIGNALS SS2 as well as STOP SIGNS R1 and YIELD SIGNS R2 singly or in combination with the W403 or W404 warning signs.
- 3 A FLASHING RED DISC LIGHT SIGNAL (FRD) may be used to warn drivers that a train is approaching a level railway crossing. One such signal SHALL be used in conjunction with a warning sign W403 or W404. The signal shall be mounted above the warning signs W403 or W405 as shown in Figure 6.8b. The red flashing light signal shall be used to **indicate the approach of a train and that the driver of a vehicle shall stop his or her vehicle and shall not proceed until the signal ceases to flash, and it is safe to do so.**
- 4 It is recommended that at other times, when there are no approaching trains, a FLASHING WHITE DISC LIGHT SIGNAL be displayed to **indicate to drivers of vehicles that the railway crossing light system is operational, that there are no trains approaching, and that they may proceed across the lines PROVIDED it is otherwise safe to do so.**
- 5 The preferred mode of operation is that a flashing red disc light signal is displayed at least 30 seconds before the arrival of a train. If gates or barriers protect the crossing, the flashing red light signal should start 20 seconds before the gate or barrier closes. A flashing white light signal is recommended to follow the FRD once the crossing is open to traffic.
- 6 The flashing red light signal at a railway crossing SHALL be situated on the near side of the railway crossing, on the left side of each approach roadway. The signal shall also conform in all respects to the requirements laid down for vehicular traffic signals at road junctions and pedestrian crossings, except that:
  - (a) The signal face shall comprise a single red disc aspect, optionally the signal face may also include a white disc aspect, and the signal face shall be mounted on the same post as and directly above the warning signs W403 or W404.
  - (b) The red disc aspect shall be used to display only a flashing red disc light signal, as and when required, to warn of the approach or presence of a train, and shall not display a steady red light signal at any time.
  - (c) Duplicate aspects may be provided on one signal face and these may flash alternately.
  - (d) The FRD may be accompanied by an audible signal.
  - (e) The signal posts shall be as for road signs.



Figure 6.8b: **Alternative System** - Flashing red disc light signals at railway crossings

## 6.7 HAND AND OTHER SIGNALS

### 6.7.1 General

- 1 This section covers a number of traffic signals that involve manual indications or other signals that are not operated electrically, and include the following:
  - (a) control hand signals for use by traffic officers SS1;
  - (b) flag signals SS2;
  - (c) flashing yellow warning signals SS3; and
  - (d) flare signals SS4.

### 6.7.2 Control hand signals for use by traffic officers SS1

- 1 CONTROL HAND SIGNALS FOR USE BY TRAFFIC OFFICERS SS1 may be used to control the movement of traffic and/or pedestrians and as such are regulatory signals. Such signals will normally be used when some other form of traffic control is out of operation or when traffic volumes are such that special control needs to be exercised to reduce congestion and establish order, or when there is a need to stop traffic for a specific reason.
- 2 **A control hand signal SS1 shall conform to the requirements of one of the standard hand signals as shown in Figure 6.9a and shall be:**
  - (a) **a hand signal to stop traffic approaching from the front, indicating to the driver of a vehicle approaching a traffic officer from the front, who is displaying the signal, that he or she shall stop until the signal referred to in d) below is displayed;**
  - (b) **a hand signal to stop traffic approaching from the rear, indicating to the driver of a vehicle approaching a traffic officer from the rear who is displaying the signal, that he or she shall stop until the signal referred to in d) below is displayed;**
  - (c) **a hand signal to stop traffic approaching from the front and the rear, indicating to the driver of a vehicle approaching a traffic officer from the front or rear who is displaying the signal, that he or she shall stop until the signal referred to in d) below is displayed; or**
  - (d) **a hand signal to show traffic to proceed from the front, left or right, indicating to the driver of a vehicle that he or she may proceed if a traffic officer displays the signal.**
- 3 In addition to the above hand signals, the traffic officer may use other hand signals to supplement those described above. It is common practice, for instance, for a traffic officer to select the vehicle that he or she wishes to stop some distance back in a traffic stream and to clearly identify it by pointing prior to giving the appropriate hand signal. In a similar way, a traffic officer may indicate by pointing to one of several stopped streams of traffic that the vehicles in the indicated stream may proceed.

- 4 Having given a stop signal to road users the traffic officer may lower the hand used for such signal and use it to execute other hand signals. The road users stopped by such original signal shall not proceed until directed to do so by the traffic officer.
- 5 When dealing with complex traffic movements it may be necessary for a traffic officer to give signals that combine more than one of the elements of those described above. For example, when directing turning traffic, it may be necessary for the traffic officer to cut-off traffic flow from the left by holding his extended arm at 90 degrees to his body instead of parallel to his body.
- 6 A traffic officer using hand signals should be positioned within the junction in a position most visible from all approaches and as close as possible to the centre of the junction, subject to paths of the vehicles that are permitted to enter the junction at any given time.

### 6.7.3 Flag signal SS2

- 1 FLAG SIGNALS SS2 may also be used to control the movement of traffic, and as such are regulatory signals. Such signals will generally be used at roadworks and for the control of traffic during sporting and other events taking place on a public road. It is particularly appropriate for small and mobile works where flags may also be combined with road signs and/or construction vehicles.
- 2 **A flag signal SS2 shall conform to the requirements of the flag signals shown in Figure 6.9b and shall be:**
  - (a) **a flag signal to stop, indicating to the driver of a vehicle that he or she shall stop until the flag signal referred to in b) below is displayed; and**
  - (b) **a flag signal to proceed indicating to the driver that he or she shall proceed when the flag signal is displayed.**
- 3 A WARNING FLAG SIGNAL may also be used to warn a road user to proceed slowly and be alert of a hazard in or adjacent to the roadway ahead.
- 4 Innovative techniques may also be employed with a warning flag signal to good effect. A flagman may, for instance, stand at a particularly important road sign and point to it with a second flag.
- 5 Flagmen should wear conspicuous and distinctive clothing such as fluorescent-coloured helmets, bright coloured overalls together with a safety vest or jacket utilising retro-reflective and/or fluorescent panels in red, yellow, and/or white.
- 6 Flagmen should be located well in advance of the hazard to which attention is being drawn. This distance should at least provide sufficient time for vehicles to slow down before reaching the hazardous location, but not at such a distance that drivers will tend to increase speed. The flagman should stand in a very visible position.
- 7 The flagman should either stand on the shoulder adjacent to the lane of traffic they are controlling or in a barricaded lane. Under no circumstances should they stand in the traffic lane. The flagman should stand alone, and nobody should be allowed to gather around the flagman.

8 FLAG warning signals SS2 should be square with a minimum side length of 450 mm. A side length of 600 mm is preferred for high-speed approaches (over 60 km/h) or high traffic volumes. FLAGS should be made of a bright red or red-orange material attached to a staff approximately 1 m in length. The free edge, and if necessary the diagonal of the flag may be stiffened to maximise the visible area. However, such stiffening should not remove all capability of the flag to be waved. Retro-reflective and/or fluorescent materials are recommended. Flags shall be kept clean at all times.

#### 6.7.4 Flashing yellow warning signal SS3

- 1 The FLASHING YELLOW WARNING SIGNAL SS3 may be used to warn a road user of the presence of a particular hazard or traffic control device. Signal SS3 may be combined with REGULATORY or WARNING signs as illustrated in Figure 6.9c, and it forms part of an emergency flashing light warning sign W346 or TW346.
- 2 The signal light shall conform in all respects to the requirements for a traffic light signal. The exceptions are as follows:
  - (a) The light signal shall be used to display a FLASHING YELLOW DISC LIGHT SIGNAL only, and shall not be used to display a steady light signal.
  - (b) No other light signal shall be displayed at, or alongside, the flashing yellow warning signal.
  - (c) Duplicate light signals, up to a maximum of four, may be provided at one sign and these may flash alternately.
  - (d) Signal posts shall be as for road signs.
- 3 Whilst the signal should be conspicuous, it shall not obscure the sign or distract attention from it. The brightness of the signal should not cause "discomfort glare" or "disability glare", particularly at night. If necessary, provision should be made to reduce the luminous intensity of light signals automatically during the hours of darkness.
- 4 The signal may be operated 24 hours every day, or intermittently, as required. Intermittent operation may be achieved by means of a time switch, or by an external input, for example, upon the actuation of a pedestrian push button at a pedestrian crossing.
- 5 It is recommended that flashing yellow warning signals should only be used in conjunction with road signs. The installation and operation of a flashing yellow warning signal is warranted where hazardous conditions exist on the road and/or it is necessary to draw attention to a road sign and reinforce its effect. If the signal can be warranted, an appropriate road sign must similarly be warranted. The road sign will indicate to drivers the specific nature of the hazard which the flashing signal cannot do. Installations shall be permanent except at roadworks where flashing yellow warning signals may be used with any of the prescribed temporary warning signs.
- 6 Single flashing yellow warning signals can only be used with warning signs where it is necessary to draw attention to the warning sign and reinforce its effect.

- 7 Two or four flashing yellow warning signals may be used with any road sign, but the arrangement and brightness of the signal should not detract attention from the sign or cause disability glare. The signals should flash alternately (singly or in pairs) and not randomly.
- 8 Flashing signals shall operate at a frequency of between one and two flashes per second and the luminous intensity shall be zero for 30% - 50% of the period and not less than the specified minimum for 30% - 50% of the period.

#### 6.7.5 Flare signal SS4

- 1 The FLARE warning signal SS4 may be used to warn the road user of a temporary hazard in the roadway ahead and to serve as an indication that they should reduce speed immediately.
- 2 Road safety flare signals SS4 are temporary devices with a high visual impact which may be used as an "immediate action" device by traffic officers attending the scene of a collision or other incident which affects the use of all or a portion of a roadway. Such flare signals should emit a red or red/orange light and moderate smoke. Flare signals permit traffic officers to deal as speedily as possible with any life threatening aspects of the incident before giving more detailed attention to traffic control.
- 3 It is recommended that two flares be used at any location. These should be placed well in advance of the incident site. As a guideline the first flare should be located a distance  $2xD$  metres in advance, where "D" is the speed limit in km/h. The second flare should be located at a similar distance in advance of the first flare.
- 4 Before setting out flare signals the following checks should be carried out:
  - (a) Does the incident involve any hazardous/inflammable materials?
  - (b) If it does, can these drain in the direction of the flares?
  - (c) Is the roadside vegetation, in combination with the wind a fire risk?
  - (d) Can the flare signal be made safe from falling over or rolling in the prevailing wind?
 FLARE signals shall not be held in the hand, or waved in the air.

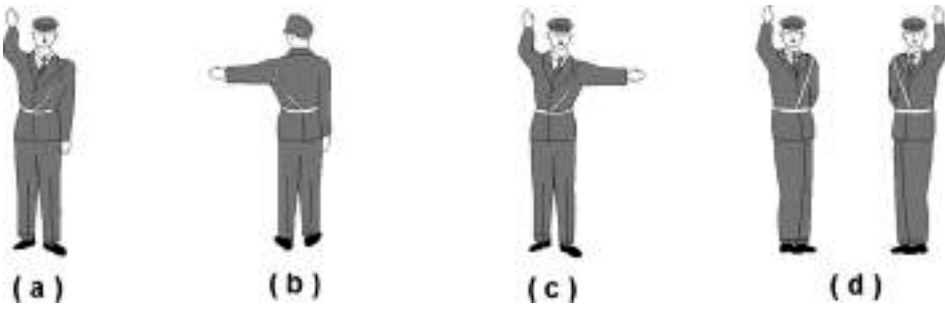


Figure 6.9a: Control hand signals for use by traffic officers SS1

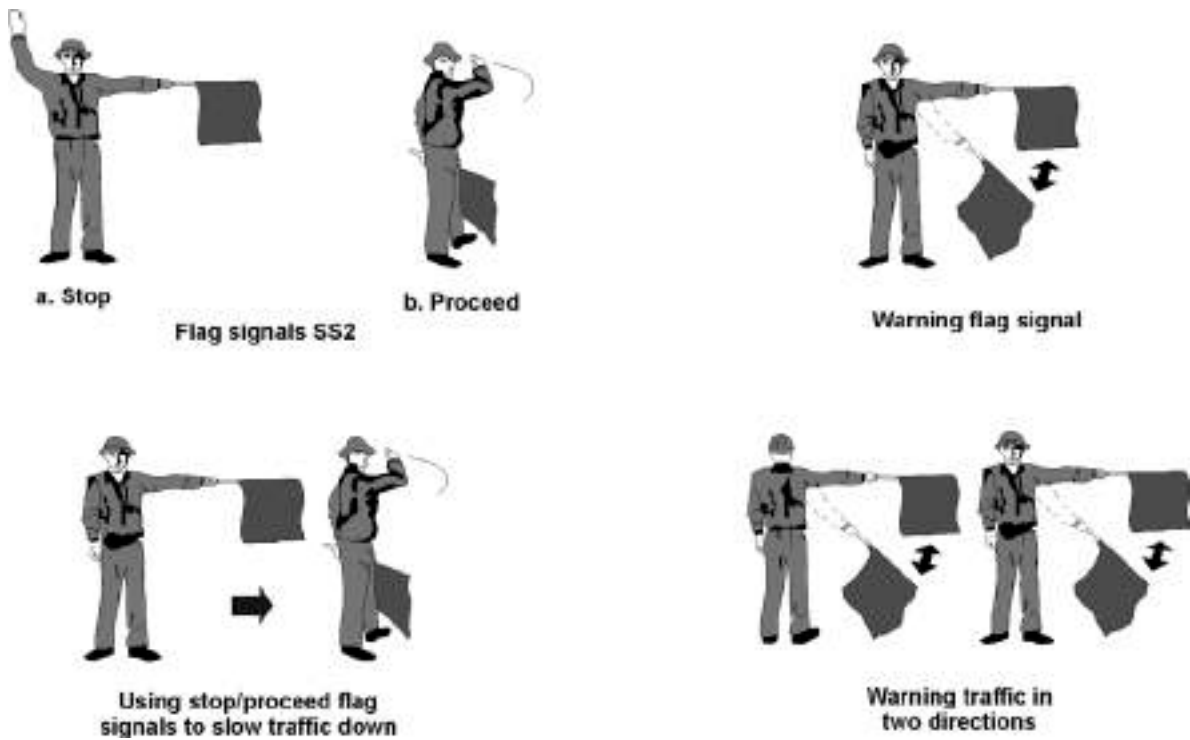


Figure 6.9b: Flag signals SS2

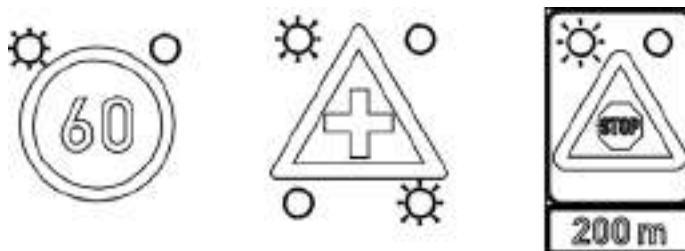


Figure 6.9c: Flashing yellow warning signal SS3



