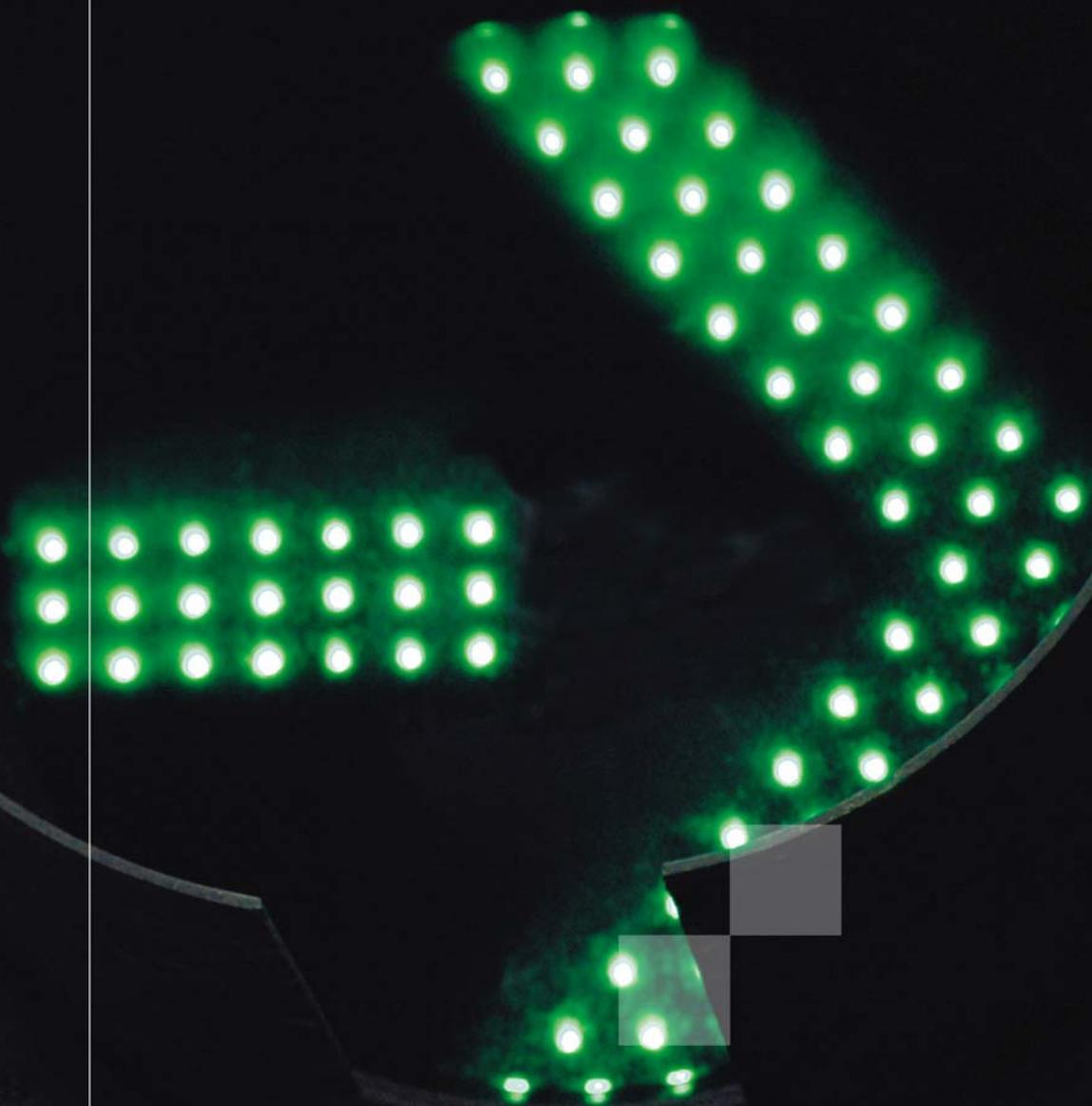




# Traffic signal design

Section 11 - Detectors



The traffic signal design guidelines have been developed to assist in designing traffic control signals.

The guidelines are to comprise 16 sections and 5 appendices. These are initially being released individually and in no specific order. The sections which are to be released are as follows:

| <b>Part</b> | <b>Title</b>  |
|-------------|---|
| Section 1   | Investigation   |
| Section 2   | Warrants  |
| Section 3   | Design Process  |
| Section 4   | Plan Requirements   |
| Section 5   | Geometry  |
| Section 6   | Pavement Marking  |
| Section 7   | Phasing and Signal Group Display Sequence                 |
| Section 8   | Lanterns  |
| Section 9   | Posts   |
| Section 10  | Signs   |
| Section 11  | Detectors   |
| Section 12  | Controller  |
| Section 13  | Provision for Future Facilities                           |
| Section 14  | Signalised Mid-block Marked Footcrossings                 |
| Section 15  | Special Situations  |
| Section 16  | References  |
| Appendix A  | Design Plan Checklist                                     |
| Appendix B  | Traffic Signal Symbols                                    |
| Appendix C  | Location and Function of Lanterns                         |
| Appendix D  | Location and Dimensions of Components                     |
| Appendix E  | Left Turn on Red  |
| Appendix F  | Level Crossing Interface – Concept of Operations          |
| Appendix G  | Level Crossing Interface – Traffic Signal Design Guidance |

To determine which sections are currently available go to:

[www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/trafficsignaldesign\\_dll.html](http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/trafficsignaldesign_dll.html)

The information contained in the various parts is intended to be used as a guide to good practice. Discretion and judgement should be exercised in the light of the many factors that may influence the design of traffic signals at any particular site. The guidelines make reference, where relevant, to current Australian Standards and are intended to supplement and otherwise assist in their interpretation and application.

# Traffic Signal Design

## Section 11

# DETECTORS

Special Note:

As of 17 January 2011, the RTA is adopting the Austroads Guides (Guide to Traffic Management) and Australian Standards (AS 1742, 1743 & 2890) as its primary technical references.

An RTA Supplement has been developed for each Part of the Guide to Traffic Management and relevant Australian Standard. The Supplements document any **mandatory** RTA practice and any complementary guidelines which need to be considered.

The RTA Supplements **must** be referred to prior to using any reference material.

This RTA document is a complementary guideline. Therefore if any conflict arises, the RTA Supplements, the Austroads Guides and the Australian Standards are to prevail.

The RTA Supplements are located on the RTA website at [www.rta.nsw.gov.au](http://www.rta.nsw.gov.au)





**Roads and Traffic Authority**

[www.rta.nsw.gov.au](http://www.rta.nsw.gov.au)

**VERSION:** 1.0  
**ISSUED:** February 2008  
**AMENDMENTS:** Refer to Amendment Record

**APPROVED BY:**

**SIGNED**

Phil Margison  
General Manager  
Traffic Management

**SIGNED**

Steve Levett  
A/General Manager  
Safer Roads

**AUTHORISED FOR USE BY:**

**SIGNED**

Michael Bushby  
Director  
Network Management

© 2008 Roads and Traffic Authority NSW

Extracts from these guidelines may be reproduced providing the subject is kept in context and the source is acknowledged.

Every effort has been made to supply complete and accurate information. However RTA, NSW assumes no responsibility for its use.

All trade name references herein are either trademarks or registered trademarks of their respective companies.

***For policy and technical enquiries regarding these guidelines please contact:***

Traffic Management Branch  
Email: [technical\\_directions\\_publication@rta.nsw.gov.au](mailto:technical_directions_publication@rta.nsw.gov.au)

***To access electronic copies of these and other guidelines go to:***

[www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/technicalmanuals\\_d11.html](http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/technicalmanuals_d11.html)

***For the latest amendments (if any) to these guidelines go to:***

[www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/trafficsignaldesign\\_d11.html](http://www.rta.nsw.gov.au/doingbusinesswithus/downloads/technicalmanuals/trafficsignaldesign_d11.html)

ISBN 978-1-921242-95-3 (Electronic only)  
RTA/Pub. 08.092



# Contents

|          |   |       |
|----------|---|-------|
| 11.1     | INTRODUCTION .....                              | 11-1  |
| 11.2     | TYPES AND USES OF DETECTORS.....                | 11-1  |
| 11.3     | VEHICLE LOOP DETECTORS .....                    | 11-2  |
| 11.3.1   | Characteristics.....                            | 11-2  |
| 11.3.2   | Installation and location.....                  | 11-2  |
| 11.3.3   | Modes of operation .....                        | 11-2  |
| 11.3.4   | Types of vehicle loop detectors.....            | 11-3  |
| 11.3.4.1 | General.....                                    | 11-3  |
| 11.3.4.2 | Stop line .....                                 | 11-3  |
| 11.3.4.3 | Queue.....                                      | 11-4  |
| 11.3.4.4 | Advance.....                                    | 11-4  |
| 11.3.4.5 | Violation.....                                  | 11-4  |
| 11.3.4.6 | Counting .....                                  | 11-5  |
| 11.3.4.7 | Bicycle loop detectors .....                    | 11-5  |
| 11.4     | PEDESTRIAN PUSH-BUTTON DETECTORS .....          | 11-5  |
| 11.4.1   | General.....                                    | 11-5  |
| 11.4.2   | Audio-tactile pedestrian facilities.....        | 11-6  |
| 11.4.3   | Tactile only pedestrian facilities .....        | 11-7  |
| 11.4.4   | Pedestrian facilities on medians.....           | 11-7  |
| 11.5     | LABELLING OF DETECTORS.....                     | 11-8  |
| 11.6     | NUMBERING OF DETECTORS.....                     | 11-8  |
| 11.7     | DETECTOR LOGIC .....                            | 11-9  |
| 11.7.1   | General.....                                    | 11-9  |
| 11.7.2   | Independently-timed marked foot crossings ..... | 11-10 |
| 11.7.3   | Advance push-button calls .....                 | 11-11 |

### Amendment record

Please note that the following updates have been made to this document.

| Amendment No | Page    | Description   | Issued      | Approved By   |
|--------------|---------|---|-------------|---|
| 1            | 11-11   | Fig 11.2 amended to reflect new marked foot crossing markings     | August 2008 | R O'Keefe<br>Mgr Policies & Guidelines                      |
| 2            | Various | Drawings VD018 series updated to TS-TN series                     | August 2009 | R O'Keefe<br>Mgr Policies & Guidelines                      |
| 3            | 11-5    | Amendment to Section 11.3.4.7 regarding on-road bicycle detectors | August 2012 | R O'Keefe<br>Mgr Traffic Policies, Guidelines & Legislation |

## 11.1 INTRODUCTION

Detectors are used to register the presence and/or passage of vehicles and pedestrians. Demands are generated by the detection of vehicles, operation of pedestrian push buttons and other sensors, switches and devices. These demands allow the controller to determine the signal displays required, their initiation and duration.

This section discusses the various types of vehicle and pedestrian detectors and their location, labelling and numbering. There are also brief comments on detector operation and detector logic, but full details of these topics may be found in *Traffic Signal Operation* and drawing No. TS-TN-020 respectively.

## 11.2 TYPES AND USES OF DETECTORS

Figure 11.1 shows the types of detectors currently in use:

- vehicle detectors
- push button detectors
- special detectors

The use of these detectors is determined by the type of traffic to be detected. This includes:

- vehicles
- pedestrians
- priority traffic (e.g. emergency services vehicles and trains)
- specific vehicles (e.g. buses, bicycles and wheelchairs)

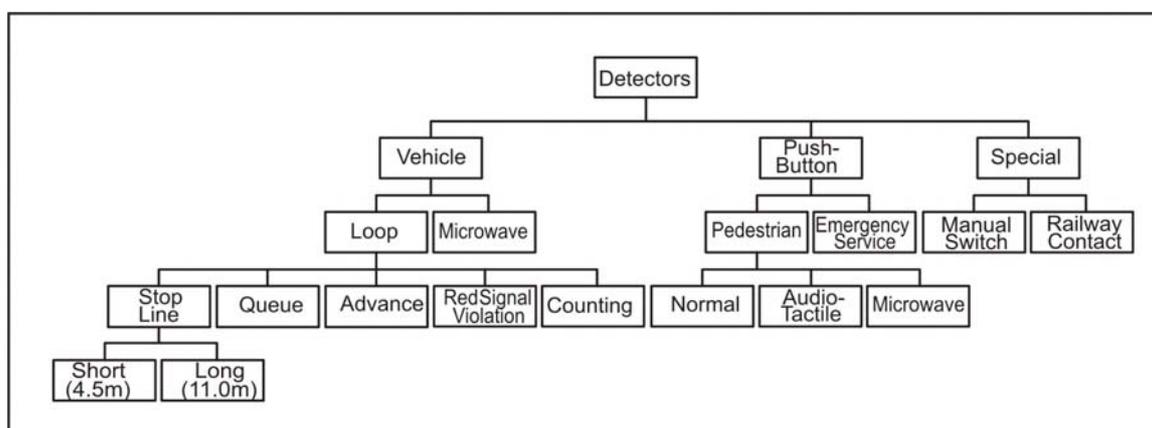


Figure 11.1 Types of detectors

Vehicle detectors are the most common. Many physical principles (such as radar, light and sound) have been used in vehicle detectors. The two types currently in use are the inductive loop detector and the microwave (radar) detector. The microwave detector cannot detect stationary vehicles and is only used as a temporary measure when loop detectors fail and is not further described here. Push-button detectors are usually provided for the use of pedestrians, however, in some instances they are also provided for either on-road or off-road bicycle riders.

## 11.3 VEHICLE LOOP DETECTORS

### 11.3.1 Characteristics

The inductive loop detector has proved to be the most reliable vehicle detector. This consists of two parts - a loop and a sensor unit. The loop consists of two to four turns of wire in a special pattern installed in saw slots up to 80 mm deep in the road surface. These loops are connected to the sensor units, which are normally located in the controller.

The sensor units energise the loops with a high frequency signal from 20 kHz to 100 kHz. This sets up an electromagnetic field in the vicinity of the loop. When a metallic object (such as a vehicle) passes over the loop, it causes a change in inductance. The sensor unit detects this and passes a signal to the controller's detector input. The principle is the same as that used in many metal detectors, i.e. when a metallic object enters an electromagnetic field, the field is disturbed.

The detection area is approximately equal to the loop area. The loop area is less sensitive to some vehicles e.g. motorcycles or vehicles with a proportion of non-metal components. The sensor unit can be automatically self adjusting. As the sensitivity is increased vehicles outside the loop area (e.g. in adjacent lanes) are likely to be detected when they should not be detected. The more sensitive it is to vehicles the more sensitive the loop becomes to environmental factors such as temperature, rain and electromagnetic fields.

### 11.3.2 Installation and location

Generally detectors should be located as shown in Appendix D [Location & Dimensions of Components](#). Installation methods for stop-line and advance loop detectors are shown on drawings No. VC005-17 and No. VC005-18, respectively.

When locating detectors the following points should be considered in regard to installation:

- does the pavement in the vicinity of the detector need resurfacing or reconstructing (loop wire is vulnerable to damage, but needs to be close to the road surface for optimum sensitivity)
- loops cannot be installed over any bridges, culverts, stormwater drains or similar structures unless there is at least 80 mm of covering pavement
- loops cannot be installed closer than 300 mm to any ferrous metal object such as a manhole cover or pipe
- the distance between the loop and the sensor unit (normally located in the controller) is limited to about 300 metres.

The location and/or size of any detector may be varied to suit special circumstances such as geometry, location of expansion joints or ferrous metal objects. In the latter case electrical officers should be consulted before determining the location and/or size of any detector. Stop-line detectors should not be located on the departure side of the stop line. Clearances shown in Appendix D [Location & Dimensions of Components](#) must not be reduced. Setting-out details must be shown for any detector which is not located in accordance with minimum clearances to pavement marking and kerbs.

### 11.3.3 Modes of operation

The sensor units for vehicle loop detectors can be operated in one of two modes - passage mode or presence mode.

In passage mode, the sensor unit produces a single pulse when a vehicle enters the detection zone. This effectively detects only moving vehicles, regardless of their length or speed. The time between successive pulses is the headway time.

In presence mode, the sensor unit produces a continuous output whenever a vehicle is in the detection zone. This effectively detects both moving and stationary vehicles. The duration of the output varies depending on the length and speed of the vehicle. The presence time is limited to between five and ten minutes.

### 11.3.4 Types of vehicle loop detectors

#### 11.3.4.1 General

There are several types of vehicle detectors:

- stop-line
- queue
- advance
- violation
- counting

Details of these are discussed in the following sub-sections.

#### 11.3.4.2 Stop line

Stop line detectors are the most common type of vehicle loop detector and are so named because they are located at the stop line. They are always operated in presence mode.

Stop line detectors can be 4.5 m or 11.0 m long. They should be located as set out in Appendix D. In both cases, the approach edge of the detector loop is located 6.0 m before the stop line. The position may be varied up to 5.0 m from the stop line (except for non-locked or presence timed detectors) to avoid utilities or to suit the geometry of the intersection providing the detector's functionality is maintained. Setting-out dimensions for any non-standard location should be shown on the design layout.

The 11 m long detector is used at locations where a shared or exclusive right turn lane permits filtering and a right turn phase is also provided. In practice, the 11 m detector is divided into two 4.5 m loops designated "approach" and "departure" which act together in some conditions and separately in others.

When vehicle actuated traffic signals are intended to always operate in isolated mode (i.e. not part of SCATS), they should have stop line detectors installed in all lanes on all approaches.

For traffic signals operating under SCATS, some of the detectors will have a dual role, i.e. tactical (to determine the demand and/or duration of phases in the same way as isolated traffic signals) and strategic (to provide traffic information to the SCATS regional computer to enable calculation of cycle lengths, phase splits and offsets for system control). In an effort to avoid non-essential detection, detectors should not automatically be provided in every lane of every approach at every signalised SCATS intersection. It is difficult, at the design stage, to determine exactly which detectors will be required for strategic purposes. However, experience has shown that at very simple, minor sites, the detectors on the coordinated route generally are not used either tactically or strategically. Some savings in detector installation and maintenance are achieved by omitting detectors at such locations. In these cases the

decision to not install detectors should be made by the officer responsible for the SCATS operation. If there is any doubt the Manager Network Operations, Transport Management Centre, should be consulted. If it is decided not to install detectors, the controller personality must be designed to terminate the coordinated route on a maximum only (i.e. no gap or waste termination) similar to a pedestrian-actuated site. This is necessary in case the controller ever runs isolated in fallback mode.

#### 11.3.4.3 Queue

Queue detectors are used in special circumstances to detect stationary traffic for queue detection and strategic purposes and must therefore operate in presence mode. The dimensions of queue detectors are the same as a standard 4.5 m long stop-line detector.

Typical applications include detection of:

- traffic blocking the middle of a major intersection
- full or overflowing right-turn bays
- queues on freeway offload ramps that are likely to overflow onto the freeway itself
- queues on or near a railway level crossing adjacent to a signalised intersection

#### 11.3.4.4 Advance

Advance detectors are so named because they are located in advance of the stop-line. They are only used to detect moving vehicles and are therefore operated in passage mode.

Advance detectors should only be considered at sites where the approach speed is high and particularly if there is a large proportion of heavy vehicles. Where possible, they should be located to suit the stopping distance required for the 85th percentile approach speed and may be used in addition to the normal stop-line detectors.

#### 11.3.4.5 Violation

Violation detectors are **not** to be installed at new sites, however, where they currently exist the following criteria explains the installation process and operation features.

Violation detectors are installed in conjunction with a red signal violation camera and flash unit to enable red signal traffic violations to be detected. If a vehicle passes over one of the detectors while facing a red signal, the camera and flash unit are activated.

The camera equipment can only accept a single red input. This normally comes from the full red, hence violation detectors should only be installed in lanes where all traffic is stopped by the full red. This includes exclusive through lanes and shared lanes where there is no left- or right-turn green arrow displayed in conjunction with the full red. Alternatively, selected detector inputs can be used for vehicles controlled by a specific red signal, but it cannot be used with left turn on red.

The location and dimensions of violation detectors are shown on drawing No. VC005-30. As they are located 0.2 m past the stop-line and parallel to it, they cannot be used where an 11 m stop-line detector is installed. Installation details are shown on drawing No. VD002-38. Note that if the stop-line is located on an angle, then the shape of the detector is a parallelogram because of the fact that it must be parallel to the stop-line. This is the only type of detector where this is permitted. In order to avoid false actuations, no part of the loop should be any closer than 1.2 m to the trajectory of cross or turning traffic of another phase.

There is a limit of four detectors per camera. These should be labelled as "Violation Detectors" and numbered 1 to 4 from the kerbside lane. It is not necessary to provide lane identification, i.e. L, C, R, etc. The numbering of violation detectors is independent of the numbering of other detectors. However, the normal detector input for detector 16 is connected to the camera unit so that camera alarms (brought about by no film, camera faults, etc.) can be conveyed to the SCATS master. Therefore, detector 16 must not be used for normal detectors when a red signal violation camera is installed.

#### **11.3.4.6 Counting**

SCATS can be used to obtain approximate vehicle counts by recording the number of detector actuations from the detector inputs. To obtain a complete count, special counting detectors can be provided in any lanes in which detectors would not normally be provided - usually uncontrolled left-turn slip lanes. These detectors have no effect on the controller operation, but use the controller's detector inputs. They must be placed on a detector input in the range of 1 to 24 and are usually operated in passage mode.

Counting detectors should be located in the same position as if a stop-line was provided, but clear of any vehicles that are not intended to be detected. Dimensions and installation details are the same as for the detectors used for permanent counting stations as shown on drawing Nos VC005-20 and VC005-27.

A counting detector has no effect on controller operation, hence it does not have a detector label. Instead, the detector should be labelled "Counting Detector". If there is more than one at a particular site, each can be distinguished by simple numbering, 1, 2 etc. If there are two or more adjacent detectors, they are further identified with a lane label as described in Section 11.5.

#### **11.3.4.7 Bicycle loop detectors**

On-road bicycle detectors are different from the normal vehicle detectors in that they consist of 2 separate overlapping loops with each having 3 turns and laid in a figure 8 with separate sensor inputs to the controller (refer to drawings VC005-36 and VC005-38). The overall width of the double detector can vary up to 1.5 m depending on the width of the bicycle lane and the need to allow a 0.2 m offset from the detector edge to the edge of the bicycle lane. Multiple bicycle detectors would be required when installing an expanded bicycle storage area, one double detector for each lane being provided.

Off-road passage bicycle detectors are 1.1 m long and vary in width to allow a 0.1 m offset from the detector to the edge of the bicycle path. They are cut at a 45 degree angle to the path flow and laid in a figure 8 induction loop.

All bicycle detectors should also be used for bicycle counting purposes.

### **11.4 PEDESTRIAN PUSH-BUTTON DETECTORS**

#### **11.4.1 General**

Pedestrian push-button detectors are used to register demands by pedestrians and in some cases either on-road or off-road cyclists. They should be provided on the posts on each approach to a marked foot crossing and on any median post adjacent to a marked foot crossing. The push-button should be mounted on the post 1m above ground level.

Kerbside push-buttons are generally oriented so that the face of the assembly is normal to the longitudinal axis of the marked foot crossing. A single, vertical arrow disc is fitted to such assemblies as shown on drawing Nos VD001-7 and VE530-8. This orientation is important to many visually impaired pedestrians who are taught to determine the crossing direction by feeling the face of the push-button housing, especially audio-tactile types. Any push-buttons which are not normal to the crossing can be confusing to visually impaired pedestrians. This unnecessarily complicates their use of the crossing and compromises safety. If the correct orientation cannot be achieved, the arrow disc must be adjusted to indicate the approximate direction of the crossing. The push-button symbol on the plan must be oriented accurately to show its orientation in the field.

Where a median post is provided, the face of the push-button assembly is parallel to the marked foot crossing and fitted with a two-way arrow disc.

Mounting two push-buttons on the one post should be avoided. However, where this is unavoidable each should be oriented such that a single horizontal arrow disc may be fitted pointing in the actual direction pedestrians are required to cross the road. Audio-tactile driver units must not be fitted to the post in this situation (see Section 11.4.2).

#### 11.4.2 Audio-tactile pedestrian facilities

Audio-tactile pedestrian facilities provide guidance to assist visually impaired pedestrians to cross safely at signalised marked foot crossings.

The audible cue assists to locate the signal post and push-button and the change in pulse indicates the green "walk" and the red "don't walk" phases of the crossing. The audible cue also provides guidance to locate the opposite side of the crossing. The tactile cue provides additional assistance to the vision impaired pedestrian by indicating the crossing phase and the direction of the crossing.

Audio-tactile facilities must be provided at all signalised marked foot crossings. This requirement is to comply with the *Commonwealth Disability Discrimination Act, 1992*, to ensure that pedestrian facilities at signalised marked foot crossings provide for all road users.

Audio-tactile pedestrian facilities operate at noise levels as specified in *RTA Specification ATS/4*. They must not be turned off or reduced to a level such that they no longer meet the requirements of the vision impaired pedestrian.

It must always be the intention of the designer to install full audio-tactile facilities whenever possible. However, there may be special circumstances, as detailed below, where this may not be desirable.

Audio-tactile pedestrian facilities must not be installed at locations where their installation may not provide a clear unambiguous message to the vision impaired pedestrian. These locations are:

- on a one stage crossing median post where it is not desirable to encourage a pedestrian to store on the median (see Section 11.4.4)
- where there are two independent push-buttons required on the same post #
- where there are two independent push-buttons within 2 m of each other

# If necessary, a short push-button post may be installed to separate two audio-tactile push buttons.

A note must be added to the plan to indicate which posts accommodate the audio-tactile push-buttons as the symbol alone is not strong enough to convey the message. For example:

*"Audio-tactile push-buttons are provided on Posts 1, 2, 5 and 6."*

If an audio-tactile push-button is installed on a short push-button post (i.e. Type 13 post), a note should be provided on the design layout to describe where the audio-tactile driver unit is located. For example:

*"The audio-tactile driver unit for the push-button on Post 9 is mounted on Post 8."*

### **11.4.3 Tactile only pedestrian facilities**

Where it is not suitable to provide audio-tactile pedestrian facilities as defined above, pedestrian push-buttons may be installed as tactile only, as a minimum treatment.

If a tactile only push-button is installed then the correct symbol must be used and a note added to the plan indicating which push-button is tactile only.

In circumstances where tactile only push-buttons are acceptable, they may be installed within the 2.0 m range.

Notwithstanding the requirements above, tactile only push-buttons must not be used without discussion with peak organisations representing the vision impaired (such as Guide Dogs NSW/ACT or Vision Australia) and concurrence by the Manager Network Operations, Transport Management Centre.

### **11.4.4 Pedestrian facilities on medians**

Where a median post is provided at a marked foot crossing, a pedestrian push-button must be provided, regardless of the median width. This is to enable a pedestrian the opportunity to call for a pedestrian phase if they were unable to complete their crossing in one stage (see Section 8.15 in [Lanterns](#) and Section 9.3 in [Posts](#)).

A median, median post, pedestrian push-button and lanterns must be provided if a crossing is greater than 25 m in length.

If a median width of 3.0 m or greater is available, a median post and pedestrian push-button must be provided, irrespective of the availability of an associated mast arm.

The use of audio-tactile push-buttons on medians should be given careful consideration. Audio-tactile pedestrian facilities should be considered where it could reasonably be expected that vision impaired pedestrians will need to cross in two stages and a median of appropriate width is available for safe pedestrian storage. Hence, audio-tactile pedestrian facilities may be considered on straight crossings of 25 m or more and where a median of at least 2.0 m wide is available.

It is also acceptable to use an audio-tactile push-button on a median post in a staggered median crossing situation, where the crossing will be made in two stages (offset), where there is at least 2 m separation of the median posts and the pedestrian movements are controlled by median fencing to direct the vision impaired.

## 11.5 LABELLING OF DETECTORS

Detectors are labelled to indicate which phases they call or extend. For example, a detector that calls A phase and extends A and B phases is called an A-B detector.

Where necessary to distinguish the approach or where detector functions differ within the same approach, a numerical suffix is added to the phase symbol (e.g. A-B1 and A-B2, C1 and C2). This should be shown without any intervening spaces and should not be superscripted or subscripted. The order of allocation of the numerical suffixes is in a clockwise direction from the V1 primary lantern.

When advance detectors and stop-line detectors are provided on the same approach, the numerical suffix is added to the advance detectors before the stop-line detectors.

A group of adjacent detectors on the same approach may have the same call and extend functions and hence have the same label. When this occurs, an identifying lane label is added to distinguish the detectors. The lane label is based on the position of the detector in relation to the others when facing in the direction of travel. The label is selected from L, CL, C, CR and R (for left, centre left, centre, centre right and right respectively) as follows:

- 2 lanes are L and R
- 3 lanes are L, C and R
- 4 lanes are L, CL, CR and R
- 5 lanes are L, CL, C, CR and R

Lane labelling is completely independent of the location of the kerb. Thus, a left detector is the left-most detector in a particular group, and not necessarily the one in the kerbside lane.

## 11.6 NUMBERING OF DETECTORS

Traffic signal controllers have detector inputs which are numbered. All detectors (including push-button detectors) on the design layout are numbered to indicate these inputs. This numbering is required in addition to the labelling described above. Table 11.1 shows an example of detector numbering.

**Table 11.1  
EXAMPLE OF DETECTOR NUMBERING**

| Detector Label   | Detector Number |
|------------------|-----------------|
| A Left           | 1               |
| A Centre         | 2               |
| A Right          | 3               |
| A-B1 Departure   | 4               |
| A-B1 Approach    | 5               |
| A-B2 Left        | 6               |
| A-B2 Right       | 7               |
| B-C              | 8               |
| C1               | 9               |
| C2 Left          | 10              |
| C2 Right         | 11              |
| A Push-Buttons   | 12              |
| A-B Push-Buttons | 13              |
| C Push-Buttons   | 14              |

In general, the numbers are allocated in ascending order based strictly on the alphanumeric sequence of the detector labels. If there is more than one detector with the same label, the detector numbers are ordered according to the lane label (i.e. L, CL, C, CR, R) before progressing to the next detector label. For 11 m detectors, the departure section is numbered before the approach section.

The numbering of special counting detectors comes after normal vehicle detectors. As these detectors must be visible to SCATS, they must be numbered somewhere in the range 1 to 24. If there are 24 vehicle detectors in use for traffic signal control, then counting detectors cannot be used unless minor vehicle detectors are moved to detector numbers greater than 24 or the detectors are paralleled, e.g. the L, C and R detectors are placed on the same input.

If there is an emergency service phase, the last detector number after any push button detectors should be allocated to call this phase. If a second (separate) detector is used to call this phase or to call a second phase, then the next detector number should be allocated to the second detector. See drawing No. TS-TN-022 for further details.

In SCATS, only detectors 1 to 24 are available for strategic purposes as vehicle detectors. Where there are more than 24 vehicle detectors, those detectors that are required for strategic purposes are to be numbered in the range 1 to 24 regardless of the alphanumeric detector labelling.

Where sister linking is required, detector number 8 is to be allocated to the repeat detector from the linked site.

Push-button detectors generally follow vehicle detectors. There is a maximum of 8 push button detector inputs in SCATS and these can be numbered up to, and including, number 32.

For sites using the post mounted controller, detectors 1 to 12 are for vehicle detectors and the push button detectors follow the vehicle detectors, with a maximum of 8 push button detector inputs in SCATS, and these can be numbered up to, and including, detector number 20.

The numbering for vehicle detectors is placed within the detector symbol on the plan. Push-button detector numbers are added in brackets following each push-button detector label, e.g. A(12), A-B(13) and C(14). Note that push-buttons with the same detector label are to have the same detector number, unless the push buttons are required to be split, to suit the red arrow protection for a long pedestrian crossing.

Detector numbers are not usually allocated to future detectors. It should only be considered in the case where the addition of a future detector does not warrant a change in the controller's personality, e.g. the addition of a lane due to imminent road widening or sealing. The reserved detector number should be shown on the design layout together with a suitable note requesting provision in the cabling and detector sensors for the reserved detector (see also Section 13 [Provision for Future Facilities](#)).

## 11.7 DETECTOR LOGIC

### 11.7.1 General

Vehicles can be detected during two parts of the traffic signal cycle. Traffic waiting for a green signal registers an initial demand that it requires right-of-way (i.e. calls a phase) and traffic already given the right-of-way via a green signal registers its continuing requirement for right-

of-way so that the green signal can be extended depending on the prevailing traffic conditions (i.e. extends a phase).

Detector logic is used to specify the conditions under which an actuation from a detector can call or extend a phase. For example, the standard detector logic for a stop-line detector is:

- demand a phase except while it is green
- extend a phase while it is green

In the above logic, there is only one phase involved and only one condition for each function. This amount of logic is sufficient for a simple two-phase design, but for most other types of phasing, several conditions may be required and a detector may demand and/or extend more than one phase. When designing detector logic for these situations, the basic aim is to minimise the cycle time while satisfying all the traffic and safety needs of the intersection. This is achieved by:

- avoiding the introduction of unnecessary phases by only registering and maintaining demands which are actually required
- demanding a phase that satisfies the most (or main) vehicle movements
- minimising the variable initial green time by only allowing detectors to increment when a queue is forming
- avoiding unnecessary extension of a phase, e.g. by ceasing extension by vehicles on a given movement when that movement also runs in the following phase

The detector logic should be designed to operate in conjunction with SCATS regardless of whether or not SCATS is in use. Most importantly, the logic should attempt to provide the most efficient operation regardless of the phase sequence. Detector logic may require complex operation and it is imperative that the detector logic is expressed correctly in the manner described in drawing No. TS-TN-020. This facilitates the preparation of the controller personality.

A detector specification schedule must be included on all design plans except for two-phase designs and standard diamond overlaps (see TS-TN-026 and TS-TN-027).

The principles of detector logic, standard detector functions, the symbolic method used to prepare a detector specification schedule and examples are provided in drawing No. TS-TN-020. This includes detector logic for the normal push-button calling functions.

### **11.7.2 Independently-timed marked footcrossings**

Generally two parallel and functionally identical marked foot crossings operate independently of one another so that each displays a walk signal only when demanded. This allows for separate lamp monitoring of each crossing and avoids unnecessarily delaying vehicle movements e.g. when the crossings are different lengths or when pedestrian protection is provided.

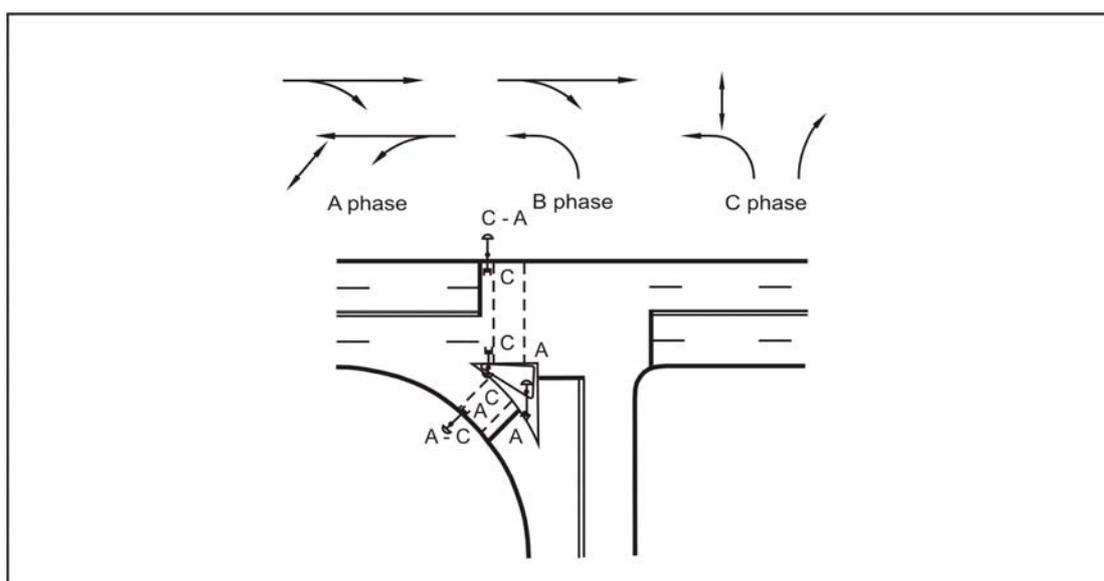
The push-button detectors are given a numeric suffix the same as the associated pedestrian lantern to identify them as being independent and each detector is given a separate entry in the detector specification schedule as shown in Table 11.2.

**Table 11.2  
DETECTOR SPECIFICATION SCHEDULE FOR INDEPENDENTLY TIMED  
MARKED FOOTCROSSINGS**

|    |       |                       |                         |
|----|-------|-----------------------|-------------------------|
|    | FN    | A(PB)                 | C(L)                    |
| A1 | SG/PS | $\overline{A1(WALK)}$ | $\overline{A.A1(WALK)}$ |
| PB | DS -  |                       | $\overline{B.C}$        |
|    | FN    | A(PB)                 | C(L)                    |
| A2 | SG/PS | $\overline{A2(WALK)}$ | $\overline{A.A2(WALK)}$ |
| PB | DS -  |                       | $\overline{B.C}$        |

### 11.7.3 Advance push-button calls

Where the pedestrian is required to cross a street in two separate movements such as the example in Figure 11.2, an advance call for the second movement may be specified in order to provide progression across the whole street. This advance call is generally stored until the first walk is introduced as shown in the detector specification schedule in Table 11.3.



**Figure 11.2 Advance push-button call**

Where the left-turn movement is stopped, the A phase pedestrian movement is allowed to be introduced automatically.

**Table 11.3**  
**DETECTOR SPECIFICATION SCHEDULE FOR ADVANCE**  
**PUSH-BUTTON CALLS**

|     |       |                      |                        |
|-----|-------|----------------------|------------------------|
| A-C | FN    | A(PB).C(PB)*         | C(L)                   |
|     | SG/PS | $\overline{A(WALK)}$ | $\overline{A.A(WALK)}$ |
| PB  | DS -  |                      | $\overline{B.C}$       |
|     | FN    | C(PB).A(PB)*         | A(L)                   |
| C-A | SG/PS | $\overline{C(WALK)}$ | $\overline{C.C(WALK)}$ |
| PB  | DS    | -                    | $\overline{A.B}$       |

\* indicates that this call is stored until the WALK for the first PB demand is displayed

**NOTE:**

If there are three controlled crossings to a corner island, advance push-button calls are inappropriate as there is no way of knowing which pedestrian movement is required. In this case, the control of pedestrian movements across the left-turn slip lane may operate in accordance with one of the techniques described in TS-TN-021. If the traffic in the left-turn slip lane has an exclusive departure lane, then there is no "best" phase during which to stop the left turn. In this case, the slip lane may be controlled by an independently operated pedestrian movement.

[Inside rear cover  
– provided for double sided printing purposes only]

---

**For further enquiries**

**[www.rta.nsw.gov.au](http://www.rta.nsw.gov.au)**

**13 22 13**

---

Roads and Traffic Authority

March 2008

RTA/Pub. 08.092