

10.1 Introduction

This section provides the basic information to effectively use portable traffic signals (PTS) to control traffic. It applies equally to both RTA and other bodies working on roads such as Councils, contractors and public utility authorities. It gives a description of the operational features of the equipment including details for the selection of appropriate signal timings and model situation diagrams showing the required signposting and site layout for the signals.

Portable signals are only intended for traffic control applications lasting up to three or four weeks maximum. For sites where work will continue for longer periods, without the location of the work site changing, consideration should be given to the installation of temporary traffic signals rather than using portable signals.

10.2 Requirements and legislation

Within the RTA a person at or above the level of Section Manager has the delegated authority to authorise the installation of traffic control signals.

Councils have been given delegated authority to use portable traffic signals for some purposes.

No other authority or person has been given such a direction. This means that public utility authorities and contractors working on public streets have no delegated authority in themselves to use portable traffic signals and will need to apply to the relevant Regional Manager of the RTA for authorisation to do so.

A general condition applying to all delegations will be that portable traffic signal equipment used shall comply with Specification PTS/3A.

Specification PTS/3A requires that each set of type approved signals has a durable marking plate indicating that type approval has been obtained. A list of type approvals is held by RTA's Manager, Traffic Equipment and Standards. In addition, the equipment is to be operated in accordance with this section and the manufacturer's instructions. A record (refer to Table 10.7) must be kept of the approval and the period of operation of the traffic signals and may be required in Court in case of an accident or traffic infringement.

Temporary traffic signal installations, using fixed equipment and cables, are not covered by these arrangements and will need to be authorised and inspected in the same manner as permanent installations.

10.3 Specifications

The Equipment Specification PTS/3 for PTS portable traffic signals is:-

- PART A – General Requirements (Revision 1) Originally issued August 1990. Revision 1 issued April 1992.
- PART B – Special Requirements (Issued October 1990).

Part A of Specification PTS/3 covers the minimum requirements for traffic control and safety and apply to any user within NSW. Part B covers additional requirements for PTS used by the RTA's own personnel.

Requests for copies of Specification No. PTS/3, a list of type approved equipment, and arrangements for type approval of equipment should be directed to:-

Manager, Traffic Equipment and Standards
Roads and Traffic Authority NSW
99 Phillip Street
PARRAMATTA NSW 2150
Telephone (02) 8837 0116
Facsimile (02) 8837 0056

10.4 Definition of terms

See also, Section 2.3, *Definitions*.

Actuation – the electrical action produced by a vehicle (by means of a vehicle detector) to enable the controller to recognise its presence.

All-red – a period of time for the clearance of traffic within the controlled areas, during which red displays are shown to all approaches.

Aspect – a single optical system of a signal lantern (i.e. a three-aspect lantern has a red aspect uppermost, a yellow aspect below it and a green aspect at the bottom).

Controller – the device which regulates the order and duration of the displays of the signal lanterns.

Controlled area – the area of roadway shared by conflicting traffic streams controlled by traffic signals.

Cycle Length – the time interval between the start of the green display on two successive cycles of the same phase.

Demand – the request for a green signal by traffic on a phase which has a red signal display (ie. which does not have right-of-way on arrival).

Display – an aspect which is illuminated/

Extension – the additional green time allocated to a vehicle actuating the detector during the green period.

Gap – the time interval between the detection of two successive vehicles in a traffic stream.

Maximum green period – the maximum time that a green display can show for one phase when a demand has been made for another phase.

Minimum green period – the shortest time for which the green display shows following the all-red period. No change of vehicle displays can occur during the Minimum Green Period.

Phase – an interval which permits a particular traffic movement or combination of compatible movements.

Portable traffic light signals – traffic light signals and associated equipment used at work sites and operated in one of the following modes:-

- **Manually Operated Mode (MAN)** – in which the duration and the sequence of displays, are varied by an operator manually controlling the signals. MAN/1 refers to one-way or shuttle manual control and MAN/2 refers to two-way manual control.
- **Vehicle-actuated mode (VA)** – in which the duration and the sequence of displays vary automatically in relation to the traffic flow into the controlled section
- **Fixed-time mode (FT)** – in which the duration and the sequence of displays are preset and do not vary with traffic flow.

Shuttle working – the traffic arrangement used where a portion of the roadway is closed, such that a single lane must be used alternately by traffic from opposite directions.

Signal lantern – an assembly of one or more signal aspects.

Vehicle detector – the equipment which senses the presence or passage of vehicles.

10.5 Approvals

Before using portable traffic signals on a job, two approvals are required:-

- type approval of the equipment to RTA Specification PTS/3 Part A, General Requirements (Revision 1) See Section 10.3.
- project approval for use on each job, see Table 10.7.

10.6 General description of system

Each set of equipment will normally comprise:-

- two signal stands, incorporating signal lanterns, vehicle detectors and control equipment
- power pack of batteries and/or generator
- operational spares, i.e. chassis and plug panel sub-assembly; controller module; lamp switch module; radio module; signal lantern assembly; lamps and fuses; target board assembly; and microwave detector
- detector checking unit, and
- remote manual control box.

10.6.1 Shuttle operation (AS 4.11.2 (a))

For shuttle working on a two lane two-way road, one set of portable traffic signals is required.

The normal mode of operation is vehicle-actuated using microwave detectors mounted above and integrally with the vehicle signal lanterns. It is also possible to use the signal equipment in either manual control mode (shuttle operation) or fixed-time cycle mode, without the use of the detectors. Under shuttle operation, the operator determines which direction of traffic flows at any time. One direction faces a green display whilst the other faces a red display.

10.6.2 Heavy machinery crossing

For heavy machinery crossing applications, one set of portable signals is required. This set is used to control traffic on the public road (one set of lanterns on each approach). Traffic on the haul road is not usually directly controlled.

Manual operation is safer and more effective in preventing delays to both public road traffic and haul vehicles. Under manual control (two-way operation), the operator determines when the public road traffic needs to stop to allow the haul vehicles to cross. Both directions face the same display, either green or red.

If aspects are required to be displayed to haul traffic, then a second set of signals is necessary which are linked to the public road signals. These signals will be arranged to display red when the other set is green and vice versa.

10.7 Signposting and traffic arrangements

10.7.1 General

TCP's 43 and 44 illustrate the use of portable traffic signals.

Since the use of portable traffic signals may require a large proportion of vehicles to either stop or slow considerably, it is critical that the correct signs be erected in the correct sequence. Signs should be located in clear view of approaching drivers, generally on the left side of the road.

However, on winding alignment it may also be necessary to erect a sign or signs on the right hand side. Consider pairs of signs, one on each side of the road, when a driver's view may be obscured by alignment, buildings or traffic. Consider the use of larger signs for high approach speeds.

For shuttle working, the signal stands should normally be located on the shoulder at the start of the taper or at least 30 metres clear of the full lane closure. They should be in clear view of approaching drivers, as shown in TCP 43. However, if it is found that vehicles in the non-barricaded approach lane are disregarding the signals or are travelling too fast through the work site, then consideration may be given to installing a chicane arrangement in this lane in order to slow approaching traffic as well as allowing conspicuous positioning of the signal lanterns. TCP 59 shows a layout for the chicane arrangement. The dimensions should be selected to suit site conditions, such as the prevailing road geometry, sight distance and vehicle speed. However, it should be noted that the use of the chicane arrangement substantially increases the length of the controlled area, and hence imposes the penalty of longer all-red clearance times (and hence increased traffic delays).

10.7.2 Temporary speed limits (AS 4.11.3)

A roadwork speed limit of no higher than 60 km/h shall be imposed if the signals would otherwise be in a higher speed limit zone. Roadwork speed limits require the approval of an RTA Section Manager (RTA Delegation Level 5 officer) who holds a current Design and Inspect Traffic Control Plans card. See Section 8.2, *Roadwork speed zones*.

10.7.3 Sight distance (AS 4.11.3)

Sight distance on the approach to portable or temporary traffic signals shall be a minimum of 150 metres.

10.8 Equipment installation

10.8.1 Signal lanterns

Normally one signal lantern is used on each approach, thereby requiring only one set of equipment for effective working on one road. Portable traffic signals complying with specification PTS/3 have a facility to connect a second lantern assembly. This would be useful on a wide carriageway.

The lantern must be placed so as to give approaching drivers a conspicuous signal and also to be clearly visible to drivers stopped behind the stop line. The signal aspects should be aimed towards the vehicular traffic: vertical adjustment is by adjusting the lantern on the stand, horizontal adjustment is arranged by positioning the stand itself on the ground. In practice, the aiming of the vehicle detectors (located on top of the lanterns) is more critical than the lanterns, so the main emphasis of the aiming operation should be as detailed in Section 10.8.5, *Vehicle detectors*.

Generally, the signal unit should be positioned so as to be as nearly as possible in the driver's line of sight. It is essential to locate signals so the driver has sufficient sight distance to stop on a red display. The minimum sight distance to the signal lantern required for stopping depends mainly on the vehicle type and vehicle speed in the approach to the work area. Table 10.1 provides a guide to stopping sight distances on level bituminous or concrete surfaces.

Vehicle speed (km/h)	Stopping sight distance (m)	
	Cars	Trucks
50	60	80
60	80	100
70	100	130
80	120	160
90	140	190
100	170	230
110	210	270

Table 10.1 – Stopping Sight Distances for Cars and Laden Trucks on Level Pavements

Increase the stopping sight distance by 2% for each 1% of downgrade.
Decrease the stopping sight distance by 2% for each 1% of upgrade.

10.8.2 Signal stands

The signal stands must be securely erected and anchored to prevent excess movement or interference by vandals.

10.8.3 Controller

The controllers allow for two-phase operation only. Each stand has a control module, one of which must be switched to “master” operation, the other to “slave” operation. To provide remote manual operation a special box is connected by cable to the “master” unit.

The controller is provided with manual controls (switches) for selecting:-

- power: ON/OFF
- master/slave selection
- mode selection:-
 - ◆ manual (shuttle operation)
 - ◆ manual (two way operation)
 - ◆ fixed-time/vehicle-actuated

- manual advance: for manual selection of phases
- yellow time: pre-select 4 or 5 seconds
- all-red time: pre-select in the range 2 to 100 seconds for fixed-time and vehicle-actuated operation
- maximum green time: pre-select in the range 20 to 150 seconds for fixed-time and vehicle-actuated operation. The minimum green time is fixed at 15 seconds.

The control equipment provides that in the event of internal failure, a loss in radio communications or low battery voltage, the signals revert to flashing yellow.

10.8.4 Communication

The two signal stands, incorporating the signal lanterns and detectors, are linked either by radio or cable control.

10.8.5 Vehicle detectors

Vehicle detectors are used to relay an electrical impulse to the controller when a vehicle approaches. One detector per approach is required.

Microwave detectors may be located on top of the traffic signal lantern and the beam from the transmitter is reflected back to its receiver by the approaching vehicle. The microwave detector will only detect objects moving towards it. Care must be taken to ensure that unwanted vehicles (eg. construction vehicles) do not actuate the detector.

Response of the microwave detector will be dependant upon the speed of movement and the size of the target object. In general terms the unit, when positioned to “look” at an approach, should detect:-

- a motorbike moving within the range, 20 m to 5 m from the unit
- other larger motor vehicles moving within the range, 30 m to 5 m from the unit.

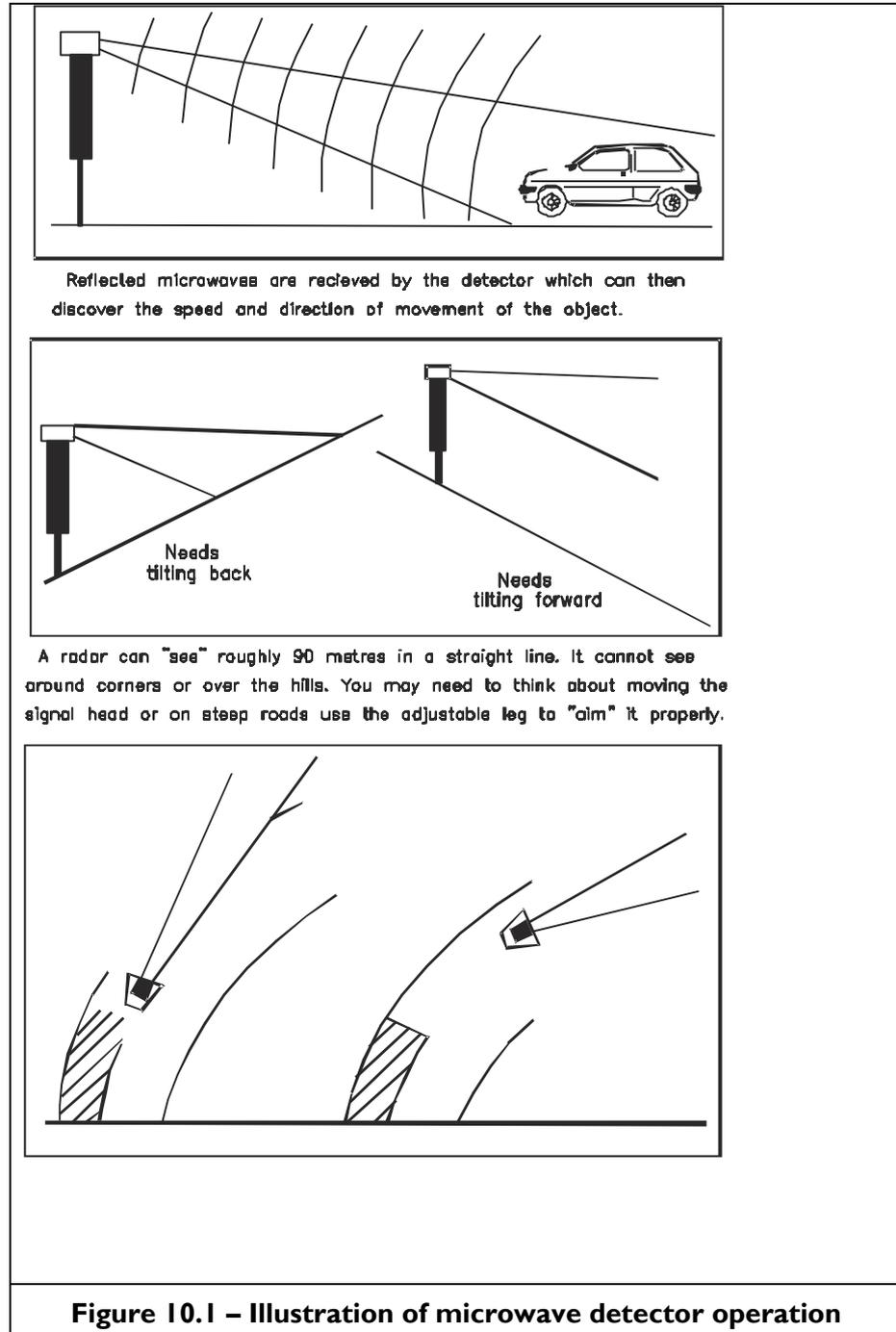
This is assuming that the detector is mounted at a height of between 2.5 m and 3 m and the object being detected is moving at a speed of greater than 5 km/h.

It must be emphasised that the detector should be positioned in such a way that its beam axis is pointed at the centre of the target area and at a distance of approximately 25 m to 35 m ahead of the unit.

For single lane approaches it is suggested that the unit be aimed more towards the road edge. This will result in an increased “sensitivity” to the desired vehicular movements but at the same time decrease the sensitivity to vehicles travelling away (on the departure side of the street). Although the departing vehicle will not produce a detection output, it can cause a “swamping” or masking of a signal being reflected by an approaching vehicle.

In practice, aiming of the microwave detector is achieved by moving the complete stand (adjustment in the horizontal plane) and by tilting the lantern by the adjustment at the top of the stand (adjustment in the vertical plane). A visual indicator built into the rear of the detector case assists in the aiming operation. Vehicles should be able to be detected (as indicated by the visual monitor) at a distance of 5 m to 30 m ahead of the signal stand.

An illustration of how the detectors work is given in Figure 10.1.



10.9 Manufacturer's instructions

Operators should familiarise themselves with the manufacturer's Instructions. Section 10.10, *Performance*, discusses the appropriate traffic conditions and performance for the four possible operating modes.

Field service usually covers:-

- simple fault diagnosis and associated replacement of the faulty modules
- routine maintenance, including replacement of lamps and other expendable components.

Note that this section does not replace the field service manual and operating instructions accompanying each set of equipment. It is most important that operators make themselves fully acquainted with the manufacturer's instructions and recommendations before attempting to operate the equipment.

10.10 Performance

For manual operation, a remote control box would generally be connected by cable to the “master” unit, although the equipment can be manually operated at the “master” stand (note that either unit will operate as a “master” or “slave”). Use of a cable enables the operator to be located safely away from the road in a position where both approaches to the work area are visible. The “master” unit should then be selected on the basis that the connecting cable should not cross the roadway. For automatic operation, there is no need for a full-time operator. The operator fixes the initial settings and then only needs to monitor performance intermittently.

10.10.1 Manual Mode (Shuttle Operation) (MAN/I)

With manual mode (shuttle operation), the operator controls the sequence in which green aspects are displayed, and also the “all-red” and “green” times. The “minimum green” time cannot be varied by the operator and is fixed at 15 seconds. The “yellow” time is pre-selected, as appropriate, to 4 or 5 seconds. The “all-red” time has a minimum value of 2 seconds but the termination of this period is controlled by the operator. The length of the “all-red” period should be kept to a minimum consistent with the need to clear the controlled area of opposing traffic.

Manual shuttle operation is applicable when:-

- a) movement of works traffic prevents the effective use of vehicle-actuated or fixed-time operation, or
- b) a detector fails, when using the vehicle-actuated mode and it is not desired to use fixed-time mode.

10.10.2 Manual Mode (Two-way operation) (MAN/2) (AS 4.11.2 (c))

With manual mode (two-way) operation the duration and sequence of displays is determined as in Section 10.10.1. The length of the “all-red” period should be kept to a minimum consistent with the need to provide for movement of road machinery without interference from normal traffic.

Manual two way operation is applicable when:-

- a) all traffic needs to be stopped to allow the passage of traffic on a haul road
- b) traffic must be kept out of the work area for an extended period, eg. during blasting, priming or full width bitumen sealing.

10.10.3 Vehicle-actuated operation (VA) (AS 4.11.2 (a))

This mode of operation allows the signals to operate automatically in response to vehicle demands. The signals will change in response to a demand registered by vehicles as they actuate a vehicle detector and the cycle length is adjusted automatically to suit traffic flows.

Vehicle-actuated operation is applicable when:-

- a) automatic control is required during working hours – this allows the signals to operate unattended while still being responsive to changes in traffic flows, or
- b) traffic control is required outside working hours – the signals can operate unattended provided the power supply is maintained.

The signals must be inspected by the operator at least once per day to ensure that the detectors are functioning correctly and that there are no burnt out lamps and to arrange the daily change of batteries or other servicing. This is particularly important if the site is unattended, as on weekends. On weekdays, the signals should be checked immediately prior to start and completion of work.

If a detector malfunction is found, the equipment should be switched to fixed-time operation or if an operator is available, to manual operation.

Following the initial switch on and “master/slave” selection, the operation is as follows:-

- a) initially red is displayed on all approaches for a period of at least 10 seconds then each approach in turn receives a green display for its selected “maximum green” time with a “yellow” display and “all-red” display between each green display.

If the signals are switched from the “manual” or “fixed-time” modes of operation to the “vehicle-actuated” mode, the control equipment will automatically register an artificial demand for each phase for the first cycle.

- b) after all phases have been called automatically for the first cycle, the signals will change only in response to vehicle demands
- c) if vehicles approach consistently from only one direction, the controller holds the green display on that approach
- d) when a vehicle is detected on another approach, the signals can change in one of two ways:-
 - i) when vehicles approach the first phase as a steady stream, the phase holds for the “maximum green” time before changing to the new approach, or
 - ii) when the gap between vehicles approaching the first phase is greater than 5 seconds, the signals will change to the new phase, subject to the limitations of the 15 second “minimum green” time, and after the selected yellow and all-red times.
- e) In the absence of any demand, the signals will revert to “all-red” until a vehicle is detected. This feature ensures that the signals are then able to give right-of-way to the first approaching vehicle with minimum delay.

If the phase changes at the “maximum green” time, a new demand is automatically entered for the terminated phase when the phase changes. This ensures that approaching vehicles stopped by the red display will be cleared at an early time. Otherwise, new demands for the terminated phase will only be registered when the arrival of an additional vehicle actuates the detector of that phase.

As a safety feature, when using microwave detectors, an automatic demand will be introduced for any (phase) approach which has not received a detector actuation for approximately 200 seconds.

10.10.4 Fixed-time operation (FT) (AS 4.11.2 (b))

As this form of control does not allow for any response to short-term variations in traffic flow, vehicles may be delayed for no apparent reason when the road is clear. Unattended sites should not be left in FT mode.

FT operation is an automatic mode which is not responsive to vehicle demands. The green time is selected by the “maximum green” switch, and the all-red time is selected by the “All-Red” switch for each phase. The signals will then cycle in a predetermined order at the times selected. Cycle times can only be varied by manual adjustment of the controller.

Fixed-time is most applicable when there is a relatively constant flow of traffic on both approaches. It is also applicable when failure of the vehicle detectors prevents use of the vehicle-actuated mode and/or when a full-time operator is not available.

10.10.5 Limitations on use of microwave detectors

Microwave detectors will only register moving vehicles and so, if for any reason a demand is lost, stationary vehicles waiting at the lights may be ignored by the equipment.

A demand can be lost if vehicles are unable to move off a green display. If vehicles do not start to move within 15 seconds of receiving a green display the controller will terminate the phase and will ignore the waiting vehicles.

To clear these vehicles it is necessary to either:-

- a) wait until a new vehicle joins the queue and actuates the detector, or
- b) change to manual operation (once traffic is running again, the controller can be returned to vehicle-actuated operation), or
- c) wait until the controller (or detector) puts in an artificial demand (it is programmed to place such an artificial demand approximately 200 seconds after the phase was last demanded).



10.10.6 Flashing yellow feature

The control equipment automatically switches all yellow aspects to “flashing yellow” within 0.5 seconds when any hazardous or incompatible conditions occur in the operation of the equipment, as required by RTA Specification PTS/3 – Part A.

In the “flashing yellow” mode, the red and green aspects remain blacked out, and all yellow aspects flash at a rate between 60 and 80 flashes per minute.

If the equipment is allowed to operate for a prolonged period on flashing yellow without a battery change, the signals will eventually turn off.

10.11 Operation

10.11.1 Control modes

Although the layout and switch configuration may differ, all controllers have basically the same functions.

All Red	All displays red. Any running sequence is cleared first.
Manual (MAN)	Control over green displays is via switches or push buttons on the controller. Control can be passed from one phase to another.
Fixed Time (FT)	Control transfers from one phase to the next in a cyclical manner. Each phase receives the green display regardless of traffic flow.
Vehicle Actuated (VA)	The controller responds to signals from the vehicle detectors. With no demands present the signals will rest in the all red period.

The mode of operation (ie. manual, vehicle actuated or fixed time) should be selected having regard to the operating conditions of the particular site as discussed in more detail in Section 10.10, *Performance*.

10.11.2 Time settings

General

These are shown in Table 10.2.

Mode	All red	Minimum green	Maximum green	Yellow
MAN/1	M	F	M	S
MAN/2	M	F	M	S
FT	S	F	S	S
VA	S	F	S	S
F Fixed at 15 seconds M Set the manual control switch each cycle S Needs to be selected and pre-set by the operator for each site				
Table 10.2 – General time settings				

Yellow time

Estimate the 85% percentile approach speed. Select the yellow time from Table 10.3.

Approach speed	Yellow time
Below 70 km/h	4 seconds
Above 70 km/h	5 seconds
Table 10.3 – Yellow time settings	

All red time

Measure the distance between the stop lines at each traffic signal. Select an appropriate all red time from Table 10.4 or Table 10.5 depending if the minimum clearance speed is 20 km/h or 40 km/h respectively.

Maximum green time

Select a maximum green time from Table 10.4 or Table 10.5 depending on the minimum clearance speed. In FT mode, adjust the maximum green times by allowing 3 seconds for each vehicle queued at the end of the all-red period on each approach. Note that the minimum setting is 20 seconds.

In VA mode the green time will gap off when traffic clears and only run to the maximum if there is no demand for the other phase. If long queues are regularly occurring in one approach, try increasing the maximum green time on that approach only.

Distance between stop lines at traffic signals (m)	All red period* (seconds)	Max. green period (seconds)
0 – 30	2	30
30 – 45	5	35
45 – 75	10	35
75 – 105	15	40
105 – 135	20	40
135 – 165	25	45
165 – 195	30	45
195 – 250	40	50
250 – 310	50	50
310 – 365	60	60
365 – 415	70	70
415 – 465	80	80
465 – 525	90	90
525 – 575	100	100

Table 10.4 – Initial signal time settings (low speed)

* based on a minimum clearance speed of about 20 km/h

Distance between stop lines at traffic signals (m)	All red period* (seconds)	Max. green period (seconds)
0 – 50	2	30
50 – 90	5	35
90 – 150	10	35
150 – 210	15	40
210 – 270	20	40
270 – 330	25	45
330 – 390	30	45
390 – 500	40	50
500 – 620	50	50
620 – 730	60	60
730 – 830	70	70
830 – 930	80	80
930 – 1050	90	90
1050 – 1150	100	100

Table 10.5 – Initial signal time settings (high speed)

* based on a minimum clearance speed of about 40 km/h

10.11.3 Setting up

- a) Set up stands with signal aspects facing oncoming traffic.
- b) Connect controller to the generator and start generator
DO NOT SWITCH CONTROLLER ON.
- c) Set red & green times as required.
- d) Select mode switch.
- e) Ensure that the shuttle lane or haul road is clear and then switch on controller.
- f) Controller will serve each phase in turn, clearing the initial demand.

Note: Waving a hand smartly toward the detector should place a call on each side for checking VA mode if selected. This will verify that signals are operating properly in this mode even in the absence of traffic.

10.11.4 Trouble shooting in VA mode

Details are shown in Table 10.6

Problem	Possible cause	Remedy
Long queues	<ol style="list-style-type: none"> 1. Green setting too short. 2. Detector fault. 3. Road capacity exceeded. 	<ol style="list-style-type: none"> 1. Increase setting. 2. Call service. 3. Call Supervisor.
Signals do change after one stream has stopped even though traffic is waiting.	Detector fault.	Call service. Operate signals in manual or FT mode until service arrives.
Green period always same length.	<ol style="list-style-type: none"> 1. Detector fault. 2. Green setting too short. 3. Traffic flow very light. 4. Traffic flow too heavy. 	<ol style="list-style-type: none"> 1. Call service. 2. Increase green time setting. 3. No action. 4. Call Supervisor.
Traffic still in shuttle lane at start of opposite green.	<ol style="list-style-type: none"> 1. Traffic running the red light. 2. All-red setting too short. 	<ol style="list-style-type: none"> 1. Call police. 2. Increase all-red setting.
Long gap between last vehicle clearing shuttle lane & start of next green.	<ol style="list-style-type: none"> 1. All-red setting too long. 2. Detector fault. 	<ol style="list-style-type: none"> 1. Decrease all-red setting. 2. Call service.
Signals do not remain on red in absence of traffic.	Detector fault.	Call service.
Table 10.6– Trouble shooting in VA mode		

10.11.5 Examples

Site Details

Work area 100m long, rural highway situation:-

- approach speeds 80 km/h
- distance between stop lines 160 metres
- minimum clearance speed 20 km/h



Figure 10.2 – Illustration of site layout

a) Example of selecting times for “Fixed-Time” operation

(i) From Time Setting Instructions 10.11.2 and Tables 10.3 and 10.4 select initial controller settings:-

- Yellow 5 seconds
- All-red 25 seconds
- Max. green
 - Phase 1 45 seconds
 - Phase 2 45 seconds

(ii) Switch on and observe for three cycles:-

- If all vehicles clear the work area during the all-red period do not adjust “all-red” setting. If vehicles do not clear the work area extend the “all-red” period.
- Count the number of vehicles queued at the end of the all-red period on each approach. Assume the following vehicles queued at the end of the red period:-

	Phase 1	Phase 2
First Cycle	10	1
Second Cycle	15	6
Third Cycle	9	4
Max queued vehicles in any one cycle	15	6



- Adjust “max. green” times for the two phases:-
Phase 1 – $15 \times 3 = 45$ sec
Phase 2 – $6 \times 3 = 18$ sec (use the minimum setting of 20 sec)
- Check regularly that vehicles are not experiencing unnecessary delays due to incorrect settings.

b) Example of selecting times for “Vehicle Actuated” operation

- (i) From Time Setting Instructions 10.11.2 and Tables 10.3 and 10.4 select initial controller settings as for FT operation.
- (ii) Switch on and observe for three cycles:-
 - Check all-red setting as for FT operation.
 - Time the green period for each phase using a stop watch. Assume the following green times were measured.

	Phase 1	Phase 2
First Cycle	45	25
Second Cycle	45	35
Third Cycle	45	30

- (iii) Try extending the max. green time for phase 1 by 5 to 10 seconds.
- (iv) If Phase 1 is still running to its maximum green setting repeat Step iii.
- (v) Check regularly that vehicles are not experiencing unnecessary delays due to incorrect settings.

10.12 Maintenance

10.12.1 General

The equipment should be maintained in good working condition and expendable items such as traffic signal lamps replaced immediately after they fail. If faults develop the signals should be taken out of service and alternative traffic control arrangements made. The signals should not be returned to service until the faults have been rectified.

10.12.2 RTA equipment

Maintenance of the various items of RTA plant, i.e.:-

- signal stands, incorporating signal lanterns, vehicle detectors and control equipment
- battery packs
- battery charger.

This is to be dealt with under established practice for major plant items. Signal lanterns, vehicle detectors and controllers are to be returned for repair with associated operation/maintenance manuals and wiring diagrams to the RTA's Works Centre as follows:-

The Works Supervisor
Roads and Traffic Authority
Traffic Workshop
129A Orchardleigh Street
Yennora 2161
Telephone (02) 9794 4747

Equipment problems such as faulty wiring that can be corrected in the field may be rectified by a qualified electrician or radio serviceman. Expendable items such as traffic signal lamps and fuses should be replaced in the field and small stocks of such items should be kept in field offices.

Note that the signal lamps are a special type with quartz envelopes. These quartz envelopes should never be touched with bare hands as they are easily damaged. The lamps should always be held by the metal bases and fitted using cotton gloves.



Portable Traffic Signals Record of Approval and Use				
<p>Approval: (To be completed by a person with delegated authority)</p> <p style="text-align: center;">Approval is given to the use of portable traffic signals (which have been separately type approved to RTA specification, PTS/3– Part A, as revised 4/92) as detailed hereunder.</p>				
Owner:.....		Signed:		
User:.....		Title:		
Project:.....		Date:		
Use: (To be completed by the Users representative)				
Job location:				
Portable signals in service				
Date	Time (24 hour)	Supervisors name, please print	Initials	Mode* of operation
<p>This completed schedule should be kept by the relevant approving authority for a period of 2 years as a record of the display.</p> <p>Note * MAN/1 – Manual Shuttle Operation MAN/2 – Manual Two Way Operation VA – Vehicle Activated Shuttle Operation FT – Fixed Time Shuttle Operation</p>				
Table 10.7 – Portable traffic signals, record of approval and use				



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