Guideline

Traffic Management at Works on Roads

July 2023

Queensland Government

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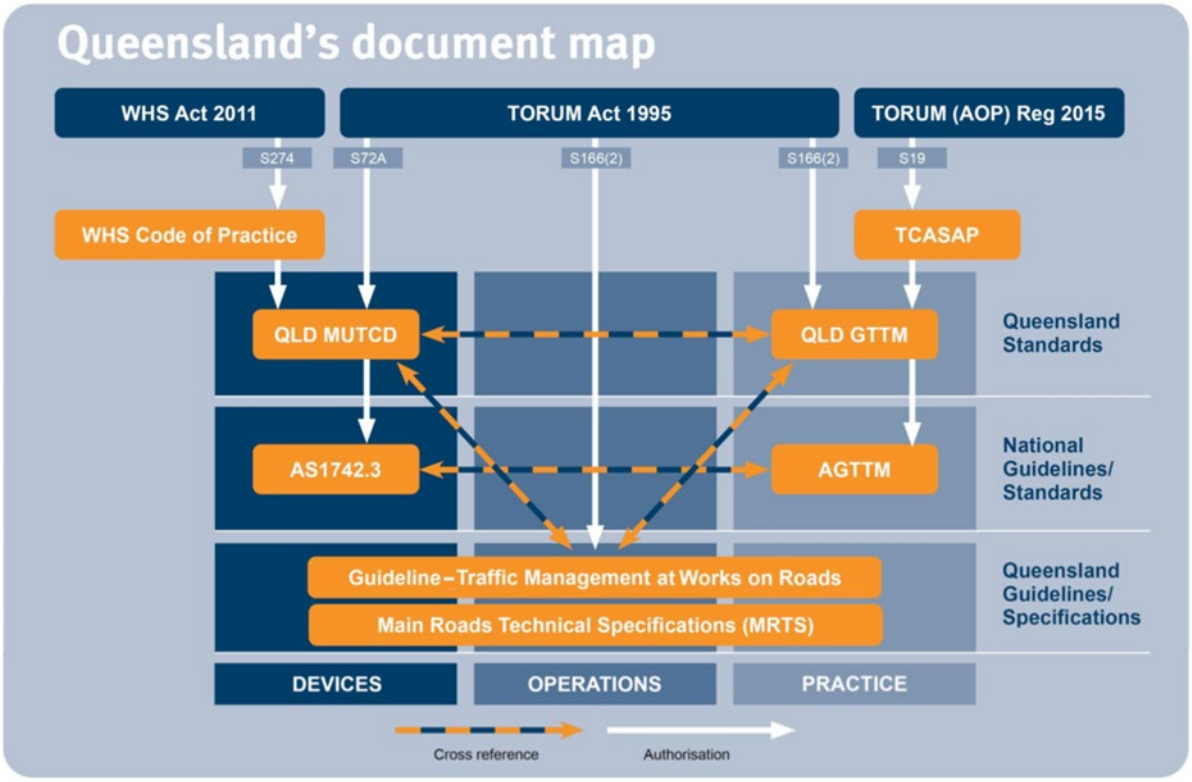
About this document

This document provides operational guidelines for the provision of Temporary Traffic Management (TTM) and supplementary information to the Queensland *Manual of Uniform of Traffic Control Devices* (MUTCD) and *Queensland Guide to Temporary Traffic Management* (QGTTM) and shall be read in combination with these documents.

How to use this document

This document is designed to be read and applied together with the Queensland MUTCD Part 3 and QGTTM. You must have access to these documents to understand what applies in Queensland.

A summary of the documents relevant to TTM practice in Queensland, and their links, is provided following:



Definitions

The following general amended definitions apply when reading this guideline.

Reference to…	Means
AGTM	Austroads *Guide to Traffic Management*
AGTTM	Austroads *Guide to Temporary Traffic Management*
AS 1742	Australian Standard AS 1742 *Manual of Uniform Traffic Control Devices*
QGTM	*Queensland Guide to Traffic Management*
QGTTM	*Queensland Guide to Temporary Traffic Management*
Queensland (Q) series / Traffic Control (TC) signs	MUTCD (Q) series and TC signs.

Reference to…	Means
Queensland MUTCD	Queensland *Manual of Uniform Traffic Control Devices* which supplements AS 1742.

Contents

Chapter 1: Signs and devices

Traffic control devices are generally installed at roadwork sites in accordance with Part 3 of the Queensland *Manual of Uniform Traffic Control Devices* (MUTCD) and the *Queensland Guide to Temporary Traffic Management* (QGTTM). These documents provide for the minimum signage and traffic control devices at roadworks sites; however, there is provision for alternative signage and devices to be installed based on a risk assessment (Clause 1.9 of Queensland MUTCD Part 3, QGTTM).

1 Use of supplementary devices at roadworks to reduce speed

1.1 Purpose

The purpose of this section is to provide options and guidance on the use of supplementary traffic control devices at roadwork sites to reduce the incidence of speeding within roadwork zones.

1.2 Background

The suite of signs and traffic control devices provided in the Queensland MUTCD has typically proved to be adequate and effective in achieving the desired result of reducing vehicle speeds at most roadworks sites.

To improve safety for workers and road users, reduce the risk of incidents and increase the level of compliance with temporary speed limits, the following options can be used to supplement traffic control devices at roadwork sites:

1. speed indicator devices (Clause 1.3)
2. rumble strips/rumble mats (Clause 1.4)
3. UHF radio broadcast (Clause 1.5)
4. temporary speed humps (Clause 1.6)
5. variable message sign with automatic number plate recognition speed indicator device (Clause 1.7)

The use of a combination of different options to reduce traffic speeds at roadwork sites is permitted.

1.3 Speed indicator devices

1.3.1 General

Speed indicator devices use a radar unit which displays a vehicle's speed with messages requesting a driver to SLOW DOWN if they are exceeding the speed limit or thanking those who are observed to be complying with the speed limit. The speed display is set to not display a speed in excess of 10 km/h over the speed limit to avoid drivers trying to record a high reading.

Speed indicator devices are also capable of recording the speed of every vehicle that approaches the roadwork zone and can be used to determine speed characteristics through the roadwork zone.

Speed indicator devices may be installed at a roadwork site where speed compliance with the reduced roadwork speed limit is poor. The speed indicator device should be installed sufficiently in advance of the roadwork that motorists have adequate time to read, comprehend the message and react accordingly to reduce speed.

The speed indicator device should be programmed to display the speed and a SLOW DOWN message only to vehicles that are travelling over a set threshold.

1.3.2 Technical requirements

The speed indicator device should be capable of the following:

1. ability to display speed and message for a minimum period of five seconds
2. have a minimum 100 metre detection range and the ability to display a message every three seconds
3. provide remote access to the signs for the purpose of programming and data collection; this feature is only required for signs that are permanently installed for the duration of the project
4. provide adequate storage capacity to store data for up to one week
5. ability to obtain speed data and prepare reports using proprietary software for export to Excel file
6. ability to switch off the device remotely
7. operate through the use of solar power with battery back-up, and
8. be designed in accordance with TC1833 (other devices not conforming to TC1833 may be considered).

1.3.3 Speed display

The speed indicator device shall be set to activate as follows:

1. vehicles travelling less than or equal to speed limit: Display actual speed and THANK YOU message
2. vehicles exceeding speed limit by up to 10 km/h: Display actual speed and SLOW DOWN message, and
3. vehicles exceeding speed limit by more than 10 km/h: Display SLOW DOWN message only.

1.3.4 Site installation

The speed indicator device shall be installed in advance of where a Traffic Controller operates or where traffic signals or give way signs are installed within the 60 km/h speed zone. The device shall be installed:

1. to face traffic approaching the roadwork zone
2. on the shoulder of the road, a minimum of 1.5 m clear of the traffic lane, and
3. radar should be angled to capture traffic approaching the roadwork zone and not traffic leaving the roadwork zone.

1.3.5 Data collection

If possible, data should be downloaded on a daily basis where traffic volumes are high to avoid loss of data through a full memory bank. The proprietary software available with the speed indicator device should be capable of data manipulation to determine average speed and 85th percentile speed of vehicles by time and day. The software should also be capable of filtering data by time and day. The software should also be capable of converting data to an Excel format for further analysis and reporting.

A record of traffic conditions, weather patterns, changes to signage, enforcement and other factors that may have an impact on driver behaviour should be kept.

1.4 Rumble strips/rumble mats

1.4.1 General

Rumble strips or rumble mats may be installed on the approach to the 60 km/h speed limit in a roadwork zone to make motorists aware of the reduced roadwork speed limit and to influence the driver to decrease speed.

1.4.2 Installation

Rumble strips shall only be installed where the following conditions are met:

1. speed limit less than 80 km/h, and
2. minimum visibility distance of 80 m to the rumble strips / rumble mats.

Note: A trial conducted in Queensland showed speed reduction was greatest when rumble strips were set up in sets of two with three rows of strips in each set. The two sets of rumble strips on the approach were separated by a distance of 200 m.

1.4.3 Technical requirements

Rumble strips or rumble mats should only be used at roadwork sites when the reduced speed limit in the roadwork zone is required for the safety of the road worker or for traffic safety. Rumble strips or rumble mats should comply with the following:

1. rumble strips or rumble mats should not exceed 20 mm in thickness
2. rumble strips or rumble mats should be yellow in colour
3. should be installed without the need for tie down, and
4. should be easy to handle onsite and quick to install.

1.4.4 Signage requirements

Where rumble strips are installed at roadwork sites, an advance warning sign shall be installed to warn motorists of the rumble strip ahead (T1-Q18 or TM1-Q02). Rumble strip warning sign shall be installed adjacent to the rumble strip (TM2-Q02).

1.4.5 Removal from site

Rumble strips or rumble mats must only be used when the roadwork speed limit of 60 km/h is maintained. Rumble strips or rumble mats and all associated signage must be removed from site when the reduced speed limit is no longer required, and a higher speed limit is reinstated.

1.5 UHF radio broadcast

1.5.1 General

This system allows vehicles that are fitted with UHF radios to receive pre-recorded voice messages warning of traffic conditions ahead (for example, SLOW DOWN warnings) which can be automated or set to run periodically. Typical applications include:

1. SLOW DOWN notifications due to temporary road hazards ahead
2. changed traffic conditions ahead for temporary traffic-controlled sites
3. reduced speed ahead, and
4. other applications approved by the Intelligent Transport Systems and Electrical Unit.

1.5.2 Technical requirements

The UHF broadcast device shall comply with the following requirements:

1. The operating range of broadcast (km) of this type of system shall be up to 2 km; however, this will depend on the transmit power, type of antennae used (for example, directional Yagi / Omni Directional / Parabolic Dish antennae) as well as the usage of RF attenuators.
2. The frequency (band) is to be 477 MHz within the UHF band (300 MHz–3 GHz).
3. The RF equipment operating frequency shall not conflict with or cause interference to any other service within this band (such as Queensland Fire and Rescue Service, Queensland Police Service, Queensland Ambulance Service and other emergency services).
4. The RF equipment shall conform to all the requirements of the Australian Communications and Media Authority.
5. Pre-recorded messages shall be configured to play through external system activation (for example, induction loop detection, radar speed detection and other methods) or manual voice message on location.
6. Voice messages can be recorded onsite using a CB radio microphone unit or pre-recorded messages stored on external memory card (for example, SDRAM card).
7. All equipment shall be extra low voltage.
8. All equipment shall be protected from water ingress (minimum IP rating of IP67) and suitably robust and protected against damage from the elements.
9. All equipment shall be able to be easily handled by no more than two persons.
10. The system should only be installed in remote locations that minimise the reception of voice messages by parties not intended to receive the messages.
11. Installed equipment shall not installed in positions so as to divert or catch driver attention.

12. All messages shall be preceded by soft audible tones to alert drivers of an impending message or announcement.
13. All pre-recorded messages to be submitted to a departmental representative for approval prior to installation of the system.
14. All manual messages shall be approved by the onsite departmental representative or other Transport and Main Roads authorised representative.

1.5.3 Clearance from traffic lanes

The UHF broadcast device shall be installed outside the clear zone required for that site or shall be shielded by means of barrier so that it does not present a hazard to errant vehicles.

1.6 Temporary speed humps

1.6.1 General

Speed humps may be used to increase compliance with the 40 km/h speed limit. The speed hump must be removed when the 40 km/h speed limit is no longer required (that is, when workers have left).

1.6.2 Application of a speed hump device

Prior to the use of any temporary speed hump device on a 40 km/h work site, a Traffic Guidance Scheme (TGS) shall be developed for the relevant work site. If higher order devices (such as safety barriers) are considered to be inappropriate temporary speed humps can be considered, subject to a risk assessment being undertaken.

These temporary speed humps shall only be used:

1. on a short-term roadworks site with a construction posted speed limit of 40 km/hr
2. as per the manufacturer’s specifications
3. in daylight hours or under floodlighting at each temporary speed hump location point
4. within the confines of the area defined by the relevant Traffic Guidance Scheme
5. in conjunction with appropriate warning signs; and
6. when the work site is attended (temporary speed humps shall be removed when no roadworks are being undertaken).

1.6.3 Number of temporary speed humps at a work site

Generally, a minimum of two temporary speed humps shall be used at a work site, one at each end of the road work area.

If the length of the work area is greater than 200 metres, or there is an interrupted line of sight between each end of the work zone, then intermediate temporary speed humps and their associated signing shall be installed at intervals of not less than 100 metres.

One temporary speed hump may be suitable for small work areas on local roads. The single temporary speed hump is to be located immediately prior to the work area.

In two directional arrangements, it may only be necessary to install temporary speed humps in the lane closest to the work site.

1.6.4 Speed hump warning signs

Temporary advance warning signs (TM1-38A) shall be installed in advance of the first temporary speed hump. TM1-38A shall be included in a multi message sign.

Warning signs (TM2-51A) shall be located at each of the temporary speed hump locations, including any intermediate temporary speed humps. These warning signs shall only be visible in the direction in which the hump is traversed (in the case of humps only being installed, in the lane closest to the work site).

1.6.5 Speed hump installation requirements

Speed humps shall be positioned to allow a bicycle rider to safely manoeuvre around the end of the hump without hitting any other object or hazard. A minimum clearance of 0.5 metres should be provided. Installation, maintenance and removal of temporary speed humps are to be as per the relevant manufacturer's specifications. Traffic control, if required, shall be controlled by accredited Traffic Controllers during all installation, maintenance or removal activities.

1.6.6 Delineation

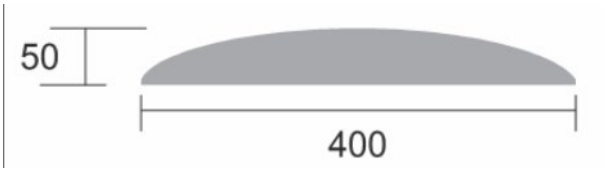
Where two-way traffic passes through the work area, there will be a need to ensure traffic does not attempt to bypass the temporary speed humps. Delineation may be required between each of the lanes to guide vehicles over the temporary speed humps.

Traffic cones and bollards should be considered for this purpose. Onsite procedures should be put in place to ensure traffic signs, cones and bollards are regularly inspected to ensure they are located in accordance with the Traffic Management Plan.

1.6.7 Approved profiles

Speed humps are official traffic devices. The profile outlined in Figure 1.6.7 has been tested and the Department of Transport and Main Roads is satisfied that it is acceptable for the purpose of slowing vehicles without posing any driver control or behaviour concerns.

Figure 1.6.7 – Speed hump profile



1.7 Variable message sign with automatic number plate recognition speed indicator device

1.7.1 General

Variable Message Signs (VMS) may use Automatic Number Plate Recognition (ANPR) devices with speed radar detection systems to provide travel speed feedback with number plate identification to drivers and may be installed at roadworks sites to encourage compliance with reduced roadworks speed limits.

Like the speed indicator devices in Clause 1.3, VMS / ANPR speed indicator devices use a radar unit and display a vehicle's speed but, in addition, include the displays of the vehicle's registration plate as part of the feedback message.

VMS / ANPR speed indicator devices also display messages requesting a driver to SLOW DOWN if they are exceeding the speed limit or thanking those who are observed to be complying with the speed limit. The speed display is set to not display a speed in excess of 10 km/h over the speed limit to deter drivers trying to record a high reading, but instead displays a REDUCE SPEED message (see Figures 1.7.4(a), (b) and (c) for display examples).

VMS / ANPR speed indicator devices are also capable of recording the speed of every vehicle that approaches the device and can be used to determine speed characteristics through the roadworks zone.

VMS / ANPR speed indicator devices, when used, should be installed sufficiently in advance of the area so motorists have adequate time to read, comprehend the message and react accordingly to reduce their speed. The location of the VMS / ANPR device shall be included on the Traffic Guidance Scheme (TGS).

1.7.2 Technical requirements

The VMS / ANPR speed indicator device should be capable of the following:

1. ability to display speed, vehicle registration, and message for a minimum period of five seconds
2. have a minimum 100 metre detection range and the ability to display a message every three seconds
3. provide remote access to the signs for the purpose of programming and data collection; this feature is only required for signs that are permanently installed for the duration of the project
4. provide adequate storage capacity to store speed data for up to one week
5. ability to obtain speed data and prepare reports using proprietary software for export to Excel file
6. ability to switch off the device remotely
7. operate through the use of solar power with battery back-up
8. on two-way roads, the device's radar and ANPR units only capture traffic approaching the device (roadworks zone) and not traffic travelling away from the device, or have the device's radar and ANPR units able to be angled as per Clause 1.7.5 (4) to achieve this outcome, and
9. on multi-lane roads, the device must be capable of detecting vehicle speeds and reading number plates for all lanes of traffic on approach to the device and be able to pair the relevant speed and number plate data accurately per lane, or the device cannot be used on multi-lane roads.

The VMS is to be designed in accordance with requirements of Technical Specification MRTS262 *Transportable variable message signs*.

1.7.3 Variable message sign size

There are three different sizes of VMS (Type A, B and C) in Australian Standard AS 4852.2 *Variable message signs Part 2: Portable signs*, and their use is dependent on the traffic speed where they are located. The VMS size shall be included on the TGS and should be as per Table 1.7.3 following.

Table 1.7.3 – Variable message sign type

Traffic speed	VMS
≤60	Type A
61–90	Type B
>90	Type C

1.7.4 Variable message sign message display

Due to the configuration of the VMS display in AS 4852.2, consisting of a matrix of three lines of eight characters per line, the messages displayed shall conform with this requirement. Due to this, the messages for items 1 and 2 following have been abbreviated. Where the VMS is capable of displaying the full words, 'THANK YOU' or 'SLOW DOWN' should be displayed unabbreviated. Where possible, the messages should be centred on the display screen.

The VMS / ANPR speed indicator device shall be set to activate as follows:

1. vehicles travelling less than or equal to speed limit: display vehicle registration number, actual speed and 'THANK U' message, see Figure 1.7.4(a) for examples
2. vehicles exceeding speed limit by up to 10 km/h: display vehicle registration number, actual speed and 'SLOW DN' message, see Figure 1.7.4(b) for examples, and
3. vehicles exceeding speed limit by more than 10 km/h: display vehicle registration number and 'REDUCE SPEED' message only, see Figure 1.7.4(c) for examples.

While the colour for fonts displayed on VMS screens is typically yellow, the use of green fonts (for item 1) and red fonts (for item 3) shall be used for VMS / ANPR speed indicator devices to assist quick glance understanding by drivers. Additionally, to separate the vehicle registration number from the message, the vehicle registration number shall be displayed in a white font (see Figures 1.7.4(a), (b) and (c) for display examples).

VMS / ANPR speed indicator devices shall use a single screen per message and shall not be used for other messages while being used as a VMS / ANPR speed indicator device.

Figure 1.7.4(a) – Variable message sign display examples (equal to or below the speed limit)

Figure 1.7.4(b) – Variable message sign display examples (up to and including 10 km/h above the speed limit)

Figure 1.7.4(c) – Variable message sign display examples (more than 10 km/h above the speed limit)

1.7.5 Site installation

The VMS / ANPR speed indicator device shall be located in accordance with the provisions for VMS devices in AGTTTM and QGTTM Part 3, Section 6.10 in addition to the following:

1. the device should be close enough to the travelled path to enable approaching drivers to easily read the device as they pass
2. when located on the shoulder of the road, the devices shall be a minimum of 1.5 m clear of the travelled path (including any space for cyclists)
3. the device shall be separated from all other signs by at least one sign spacing
4. on two-way roads, the device's radar and ANPR units should be angled to capture vehicle speeds and number plates for traffic approaching the device only, and
5. on multi-lane roads, the device's radar and ANPR units should be angled to capture vehicle speeds and number plates for all lanes of traffic on approach to the device.

1.7.6 Data collection

Speed and volume data shall be recorded and retained and logged for later retrieval.

ANPR data for the display of vehicle registration numbers shall only be required during the display of that vehicle's speed and shall not be recorded for future use.

If possible, speed and volume data should be downloaded on a daily basis where traffic volumes are high to avoid loss of data through a full memory.

The proprietary software available with the VMS / ANPR speed indicator device should be capable of data manipulation to determine average speed and 85th percentile speed of vehicles by time and day. The software should also be capable of filtering data by time and day. The software should also be capable of converting data to an Excel format for further analysis and reporting.

A record of traffic conditions, weather patterns, changes to signage, enforcement and other factors that may have an impact on driver behaviour should be kept.

2 End-of-queue risk control measures

Additional advance warning may be required to manage the risk of end-of-queue crashes. QGTTM Part 3, Section 4.8.3 identifies when end-of-queue risk control measures are required.

The use of a combination of different end-of-queue risk control measures on approach to the end of a traffic queue is permitted. Different end-of-queue risk control measures may be applied on approach to different traffic queues at the one work site.

End-of-queue risk control measures (in order of preference) for managing the risk of end-of-queue crashes include:

1. managing speed on approach to the traffic queue (Clause 2.1)
2. use of enhanced queued traffic warning signs, TM1-46-Q01 (Clause 2.2)
3. use of an additional Traffic Controller (Clause 2.3)
4. use of signs to encourage the use of hazard lights by last vehicle in queue (Clause 2.4)

2.1 Managing speed on approach to the traffic queue

Traffic speeds on approach to the end-of-queue may be managed in accordance with the options and guidance of Chapter 1, Clause 1.

2.2 Use of enhanced queued traffic warning signs (TM1-46-Q01)

An enhanced queued traffic warning sign may be installed to supplement the treatment provided in the Queensland MUTCD Part 3 and QGTTM.

The Department of Transport and Main Roads has developed a suite of design drawings in TM1-46-Q01 (see Figures 2.2 below) that provide sign design details. A single sign is generally installed on the left-hand side of two-lane two-way roads, while a second sign may be installed on the right-hand side of multi-lane roads.

There are a number of activation options, including activation when queued traffic is detected, manual activation by the Traffic Controller or continuous operation. It is, however, considered that activation based on vehicle approach speeds is more effective as it provides a targeted message to drivers who are fatigued or have failed to anticipate the presence of queued traffic ahead. Alternative enhanced or active queue warning signs and activation methods may be developed. These shall be approved by Transport and Main Roads prior to installation at any work site.

Figure 2.2(a) – Variable message sign (electronic version of the static queued traffic ahead sign)

TM1-46-Q01_1

Figure 2.2(b) – Variable message sign with alternating QUEUED TRAFFIC AHEAD and queued vehicle symbol

Frame 1 Frame 2

TM1-46-Q01_2

Figure 2.2(c) – Static queued traffic ahead sign supplemented with alternating wig-wag lights

TM1-46-Q01_3

2.3 Use of an additional Traffic Controller

The following requirements and recommendations apply to the provision of an additional traffic controller for end-of-queue protection where significant queues are expected to form:

1. an additional second Traffic Controller may be employed to shift the PREPARE TO STOP sign(s) and the ROADWORK AHEAD sign as necessary to maintain the minimum required distance in advance of the end -of- queue. The additional Traffic Controller may also display the SLOW bat at each location, in which case the 60 km/h temporary speed zone shall be extended to cover that position.
2. distant advance warning using variable message signs should also be used where practicable.
3. all other advance and position signs required for the work site shall be located at the distances otherwise specified from the start of the work area.

2.4 Signs to encourage the use of hazard lights by last vehicle in queue

Section 221 of the *Transport Operations (Road Use Management – Road Rules)* Regulation 2009 permits the use of hazard warning lights on a vehicle to warn other road users under the following conditions:

a) the vehicle is stopped and is obstructing, or is likely to obstruct, the path of other vehicles or pedestrians, or

b) the vehicle is a slow-moving vehicle and is obstructing, or is likely to obstruct, the path of other vehicles or pedestrians.

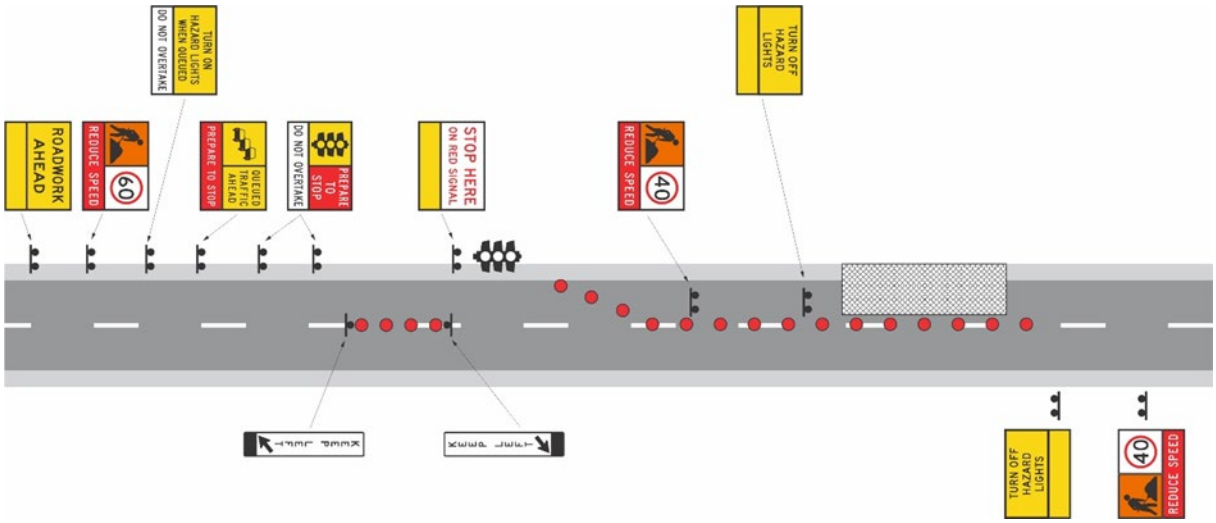
A TURN ON HAZARD LIGHTS WHEN QUEUED sign (TC1992_1) or MMS arrangement (TC2362_1) has been developed to encourage the driver of the last vehicle in the queue to activate the vehicle's hazard warning lights. This draws upon experience in Europe where drivers routinely activate their hazard warning lights in hazardous situations. The TURN ON HAZARD LIGHTS WHEN QUEUED sign shall be located at least a single sign spacing prior to the primary Prepare to Stop (PTS) sign.

If this is also the location of the speed reduction sign for the traffic control station, then relocate the speed limit reduction sign a further sign spacing away from the primary PTS sign. The TURN ON HAZARD LIGHTS WHEN QUEUED sign may be repeated if the anticipated queue lengths are long during certain periods of the day and shorter queues form at other times. When using the MMS arrangement, a DO NOT OVERTAKE panel should also be used.

The TURN OFF HAZARD LIGHTS sign (TC1992_2) or MMS arrangement (TC2362_2) shall be installed past the traffic control station (generally after the traffic control taper) to remind drivers to turn off their hazard warning lights. If there is a speed restriction sign (or other sign) at this location, locate the TURN OFF HAZARD LIGHTS sign a further sign spacing along the travel path away from the traffic control station.

The signs TURN ON HAZARD LIGHTS WHEN QUEUED and TURN OFF HAZARD LIGHTS signs shall be separated from other signs by at least a single sign spacing. See Figure 2.4 for example locations.

Figure 2.4 – Example locations for hazard light signs



3 Anti-gawking screens

3.1 Background

Anti-gawking screens should be used at work sites to minimise visibility of construction activities to the travelling public where specified in the Department of Transport and Main Roads Technical Specification MRTS02 *Provision for Traffic*.

Department of Transport and Main Roads SD1473 *Single Slope Concrete Barrier – Precast Concrete Barrier Installation Details* provides typical details for a fabricated timber screen installed on a Single Slope Precast Concrete Barrier (PCB).

Use of anti-gawking screens constructed from other materials shall be as per the relevant manufacturer's specifications and only used with the relevant Transport and Main Roads approved proprietary temporary barrier system.

Proprietary screens may be adopted, or other screens may be developed on a project by project basis. Such screens should be compliant with the principles set out in this section.

3.2 Considerations

3.2.1 General

When using anti gawking screens at roadworks sites, the following characteristics should be considered:

a) the screens are or of adequate height and opacity to function as a screen

b) installation does not adversely affect or alter the performance of the barrier system

c) installation will not present an undue risk to workers and other traffic during an impact (for example, by spearing / penetrating the passenger compartment)

d) performance will be in a suitable predictable manner should impact occur (for example, will not shatter or create debris which would become a hazard or projectile)

e) resistance to vandalism and vehicle damage

f) ease of repair, and

g) potential to protrude or lean into vehicle path, especially when subject to wind loading.

3.2.2 Specific requirements

Crash testing / analysis barrier performance is tested against the requirements of AS 3845. It should be demonstrated by crash testing or modelling / analysis that any anti gawking screen does not modify the performance of the safety barrier system to which it is to be attached. These requirements notwithstanding, it is expected that anti gawking screens will be independently mounted; that is, will not be connected together across couplings between barriers.

The Austroads *Guide to Road Design* and relevant supplements expressly prohibits the erection of fencing with horizontal rails within the clear zone or in any location where there is the possibility of impaling an impacting vehicle. In this regard, the principles applying to fencing also apply to anti gawking screens; that is, anti-gawking screens erected within the clear zone shall not comprise horizontal rails.

Screens should be constructed from materials that are robust and should demonstrate the following:

- resistant to impact: that is, materials are not brittle or prone to become brittle and do not create a hazard when hit, for example, by shattering or disintegration into sharp edged fragments which would be a hazard to adjacent parties
- durable: that is, resistant to ignition by cigarettes or similar, or defacement by sharp implements, and
- resistant to fatigue failure, for example, due to cyclic wind loading including buffeting from truck movements.

Subject to these, materials used should be appropriate for the design life of the screen.

3.2.3 Stability

Any anti-gawking screening should be designed to withstand design wind loads without toppling, displacing or becoming detached from the barrier system to which it is attached. The method of attachment to the barrier system should not compromise performance of the barrier system.

3.2.4 Delineation

It is recommended that anti-gawking screens do not compromise the capacity of a barrier system to display delineation. Consideration should be given to reflectivity of screen faces, with particular attention to headlight glare under wet conditions.

3.2.5 Installation and maintenance

Screens should be maintained, removed or replaced when damaged or deteriorated through prolonged use. Contractors should be encouraged to attend to damaged or deteriorated screens as soon as practicable. In this regard, manufacturers should give consideration to ease of handling and installation, and method of removal in an emergency.

Anti-gawking screens shall be in accordance with SD1473 *Single Slope Concrete Barrier – Precast Concrete Barrier Installation Details* (if timber) and as per the manufacturer's specifications for other materials and be:

- a minimum of 2.2 m total height
- of sufficient extent to fully screen the work area from the public, and
- designed, installed and maintained to enable the safe and continuous passage of traffic through the construction site.

Chapter 2: Traffic management guidelines

Traffic management at works on roads must consider impacts on the operations of the local road network. Existing and temporary infrastructure used, or impacted, by site operations must be considered and managed to prevent conflicting messaging, reductions to safety, and the operational disruptions to the network.

1 Use of temporary variable speed limit signs in construction and maintenance work areas on motorways

This section provides guidance for the use of Temporary Variable Speed Limit (TVSL) signs in construction and maintenance work areas on motorways and high-speed roads (speed limits of 80 km/h and above) in Queensland. TVSL signs are portable electronic variable speed limit signs and may be used, with local regulatory authority approval, on local government, state controlled and franchised roads.

This document applies only to TVSL signs conforming to Technical Specification MRTS260 *Temporary Variable Speed Limit Signs*.

This document shall be read in conjunction with the Queensland MUTCD and AGTTM. Unless otherwise stated in this supplement, all relevant Queensland MUTCD provisions are required.

> *Queensland Guide to Temporary Traffic Management* (QGTTM) inspection requirements also applies to TVSL signs and TVSL operations at road work sites. The department's Engineering and Technology branch will collaborate performance on road work sites.

This section does not apply to:

i. work sites on roads and tunnels with permanent VSL / LCS (for motorways, the current process is outlined in the *Guideline for Traffic management procedures for tunnel closures* (QGTM Part 9), or

ii. use of TVSL signs for lane control, or to replace static advance roadwork warning or advisory signs, or as a VMS, or

iii. use of VMS as TVSL or lane control, or

iv. direct TVSL control by the Department of Transport and Main Roads Traffic Management Centre (TMC) via the Remote Sign Control System (RSCS) software.

TVSL signs can be placed throughout a road work site to readily allow a change of speed limits displays, for advance warning and guiding traffic, as per an approved TMP and an approved TGS.

Use of TVSL signs shall be included within the scope of the TMP submission and approval process as per MRTS02 *Provision for Traffic*.

1.1 Display

TVSL sign display shall conform to the Queensland MUTCD, QGTTM and MRTS260 *Temporary Variable Speed Limit Signs* requirements.

eTVSL sign display and real time fault alarm monitoring capabilities shall be provided.

To reduce the risk of unsafe and incorrect deployed TVSL sign displays at road work sites:

- The approach (advance buffer zone) TVSL sign/s shall only be able to display three frames:
  - the default posted speed
  - the appropriate temporary (advance buffer zone) speed, and
  - blank.
- These TVSL signs shall also be collocated with a TC1568_1 ‘when sign above is blank’ or, where paired, TC1568_6 ‘when signs are blank’. The TC1568 sign shall display the corresponding appropriate temporary (advance buffer zone) speed.
- The subsequent (work zone) TVSL sign/s shall only be able to display two frames:
  - the appropriate temporary (work zone) speed, and
  - blank.
- These subsequent TVSL sign/s do not require an associated TC1568 sign.

Repeater (advance buffer zone and/or work zone) TVSL sign/s, if needed, do not require an associated TC1568 sign. Repeater sign/s shall only display the appropriate temporary (advance buffer zone or work zone) speed that is specific to the TVSL sign placement.

1.2 Placement

TVSL signs shall be located in a manner that does not constitute a hazard to road users.

1.3 Planning and operations

In addition to the Queensland MUTCD and QGTTM requirements, the following requirements shall be included in the TMP and TGS, where applicable, for TVSL road work sites:

- interaction with the TMC, where applicable
- TVSL signs faults management
- identification (unique identifier) of the TVSL signs within the TGS drawing(s)
- responsibilities for configuring, installing, operating, and monitoring of TVSL signs
- TVSL displays for during work and after hours, and
- procedures for implementing site TVSL display changes.

1.4 Faults management

Refer to MRTS260 *Temporary Variable Speed Limit Signs* for conditions of fault management plans for road work sites operating with TVSL shall define the following conditions.

2 Use of permanent variable speed limit and lane control signs in construction and maintenance work areas on motorways

This section can be applied to permanent variable speed limit and lane control signs at static work sites on motorways and tunnels only. It is not applied to variable speed limit and lane control signs for mobile works or frequently changing work areas.

Guidance for temporary variable speed limit signs used at construction zones is outlined in Chapter 2 Section 1 *Use of temporary variable speed limit signs in construction and maintenance work areas on motorways* of this document.

2.1 Definitions

Table 2.1(a) and Table 2.1(b) show relevant definitions and acronyms for this section.

Table 2.1(a) – Definitions

Term	Definition
buffer	A buffer is a speed zone, of minimal length, and intermediate value between two speed limits that differ by more than 20 km/h; for example, an 80 km/h buffer zone would generally be used as a transition between speed limits of 100 km/h and 60 km/h.
critical fault	A critical fault of the variable speed limit system is a fault that may cause an unsafe situation for the site personnel.
default speed limit	In case of failure of the variable speed limit system, it is necessary to specify a speed limit for motorists to travel at. This is called the default speed limit and will be set to normal posted speed limit (had the road been a static speed zone).
non-critical fault	A non-critical fault of the variable speed limit system is a fault that does not affect the safety of the work site. A non-critical fault might be when a small number of LEDs fail.
secondary contact	A person delegated by the Site Supervisor as the secondary contact person for onsite personnel. The TMC Supervisor or Operator will contact this person in the instance that the Site Supervisor is not able to be contacted.
Site Supervisor	The Site Supervisor is the person responsible for works. This person will be the primary contact for onsite personnel. The TMC Supervisor or Operator will contact this person to coordinate the activation, deactivation and management of the electronic signs.
STREAMS®	STREAMS® Integrated Intelligent Transport System is an enterprise traffic management system developed by the Department of Transport and Main Roads that applies information and communications technology to transport operations to reduce operating costs, improve safety and maximise the capacity of existing infrastructure. STREAMS® provides traffic signal management, incident management, motorway management, vehicle priority, traveller information, flood monitoring and parking guidance within a single integrated system.
TGS	The Traffic Guidance Scheme (TGS) is an arrangement of temporary signs and devices to warn traffic and guide it through or past a work area or temporary hazard.
TMC Operator	This person in the Traffic Management Centre is responsible for activating, deactivating and managing the electronic signs. This person is responsible for communications with the Site Supervisor and other site personnel.
TMC Supervisor	This person is responsible in the Traffic Management Centre for overseeing operations and approvals.
transition	Transitions are automatically implemented by the system and form the intermediate arrangement of signs to allow a smooth conversion between the current and the desired state of signs. Consider the following example of a sign which currently displays 100 km/h: before changing that specific sign to 60 km/h, this sign must transition through an 80 km/h speed limit for a minimal time.

Term	Definition
variable speed limit zone	A variable speed limit zone is defined as a length of road which is controlled by variable speed limit signs. Static speed limits are not used. A variable speed limit zone may also include lane control signs to open and close lanes.

Table 2.1(b) – Acronyms

Acronym	Expansion
ITS	Intelligent Transport System
LCS	Lane control sign
TGS	Traffic Guidance Scheme
TMC	Traffic (or Transport) Management Centre
TMP	Traffic Management Plan
VSLS	Variable speed limit sign
VSL / LCS	Variable speed limit and lane control sign (integrated)

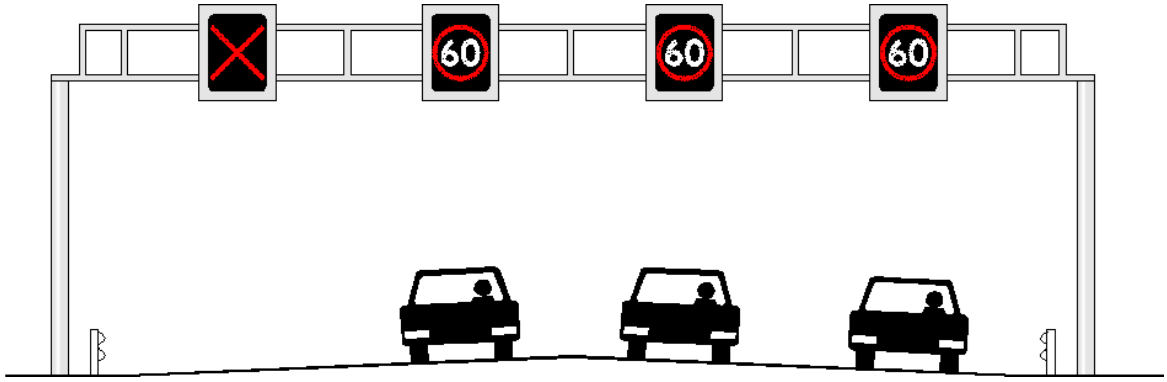
2.2 Background

A variable speed limit zone may be applied on a motorway, long bridge or in a tunnel to allow a reduction in the posted speed limit at times when road safety and performance are compromised, where full time lower static speed limits are inappropriate. The variable speed limit zone is implemented through the use of variable speed limit signs and selected static signs.

Variable speed limits and lane control signs are integrated into a single set of signs as shown in Figure 2.2 where:

- the lane is open to all traffic at the indicated posted speed limit when a variable speed limit is displayed above the lane.
- the lane is soon to close to all traffic when a flashing red cross is displayed above the lane, and drivers must leave the marked lane as soon as it is safe to do so.
- the lane is closed to all traffic when a red cross is displayed above the lane and drivers must not drive in the marked lane past the signal, and
- a driver may enter a closed lane to exit the motorway if a diagonal up arrow (exit arrow) is displayed.

Figure 2.2 – Integrated VSL / LCS



These signs are installed to increase efficiency and safety during times of congestion, incidents, inclement weather and planned events. These signs, when installed permanently, can be used to aid the control of traffic through work areas for maintenance or construction.

The variable speed limit and lane control signs are connected to a central software control system (STREAMS or similar) which allows operators to manage the operation of the signs in accordance with the MUTCD and other principles.

It should be noted that the spacing of signs along the mainline will vary according to the location of entrance and exit ramps, and in accordance with the Austroads *Guide to Traffic Management* and relevant supplements. Variable speed limit signs installed on motorways with more than three lanes are mounted overhead and integrated with lane control signs (Figure 2.2).

Default static speed limit signs TC1568 are installed at entrance points to a variable speed limit zone and at changes of the default speed limit along the mainline carriageway.

2.3 Principles for using VSL / LCS during construction / maintenance

The use of special illuminated variable speed limit and overhead lane control signs to advise drivers of lane closures and associated reduced speed limits ahead on the motorway involves detailed planning involving complex traffic arrangements and liaison with motorway traffic management centre(s).

Planning will comprise a fully documented guidance scheme in accordance with the Queensland MUTCD Part 3 and QGTTM.

General principles applying to planned lane closures on motorways using integrated variable speed limits and overhead lane control signals at roadwork sites and for special events are set out in this section.

2.3.1 General

The spacing of variable speed limit and lane control signs varies according to the location of entrance and exit ramps. Further, the location of the work site may vary between the variable speed limit signs. A number of typical arrangement figures have been developed to assist with the preparation of the Traffic Management Plans. Users should choose these drawings depending on the distance of the work site to the variable speed limit and lane control sign which is immediately upstream.

Figures are included in Section 2.5 of this chapter for work in one lane where the distance between the work sites and the immediate upstream variable speed limit and lane control sign is:

- 0–150 m
- 150–300 m
- 300–500 m
- 500–750 m (60 km/h work area).

Figures are provided in Section 2.5 of this chapter for work in two lanes where the distance between the work sites and the immediate upstream variable speed limit and lane control sign is:

- 0–150 m
- 150–300 m
- 300–500 m
- 500–750 m (60 km/h work area).

Figures are also provided in Section 2.5 for work on shoulder where the distance between the work sites and the immediate upstream variable speed limit and lane control sign is:

- 0–300 m
- 300–500 m
- 500–750 m.

These distances have been chosen based on the requirement of buffer speed limits in Table 5.5, Part 3 of the QGTTM; that is, a buffer zone in advance of a 40 km/h work site should be 150 m minimum length, and a buffer zone in advance of a 60 km/h work site should be between 300 m in length.

In addition, figures are included for typical entry ramp and exit ramp arrangements:

- lane closed across an exit ramp
- lane closed across an entrance ramp
- variable speed limits at entrance ramp merge.

Note: These diagrams consider an activity where the entry and exit ramps are open, allowing traffic to enter and exit the motorway. If an activity requires the ramps to be closed, a solid red cross would replace the Lane Control (LC) symbols represented in these diagrams.

A special diagram is also included for side mounted variable speed limit signs along the mainline carriageway.

A diagram is also provided for staged implementation of the pre-approved Variable Speed Limit and Lane Control plan.

2.3.2 Speed management

Principle 1: Normal traffic control devices are required

All traffic management and control devices normally associated with work sites are to remain. This includes devices such as truck mounted attenuators, delineation and static signage. One Exception exists for the buffer zone in advance of the work site; static buffer speed limits are not required as these signs will be displayed on the variable speed limit signs instead.

Principle 2: One static speed limit is required at the work site

The work area speed limit (that is, the last speed limit sign before the work area) must be a static sign. Therefore, in the instance that the electronic signs fail, the critical speed limit will be displayed. A back up plan will need to be implemented in this case (refer to Section 2.4 of this chapter).

Principle 3: Variable speed limit signs within the work area

All variable speed limit signs within the work area should be set to the speed limit of the work area.

Principle 4: Speed limit signs just prior to the work site

Where one or more lanes are closed, delineation is specified in the Queensland MUTCD to close the lanes and vehicles need to merge into an open lane. These merging manoeuvres should occur at a maximum speed limit of 80 km/h.

Principle 5: Buffer speed limits

Speeds must be reduced in 20 km/h steps on the approach to a work site in accordance with the Queensland MUTCD even if they are displayed on variable speed limit signs. Minimum distances described in Table 5.5 of the QGTTM Part 3 apply. Note that due to the spacing of variable speed limit signs, the actual distances between variable speed limit signs may exceed the minimum distances. Note that (unless absolutely necessary), it is desirable to keep the buffer distances as close to the minimum as possible. This is likely to increase speed compliance.

The first variable speed limit signs beyond the work site will normally display the appropriate default speed limit for the road continuing beyond the works; that is, the speed does not need to be increased in 20 km/hr steps.

Principle 6: Static speed limit sign at the end of the work site

Static speed limit signs (R4-1 type) are to be placed at the end of the work site to indicate the speed limit beyond the end of the work site and until the next variable speed limit signs are passed. The END ROADWORK (T2-16, T2-17) sign is used together with the static speed limit sign.

Principle 7: Entrance ramps

The variable speed limit on the entrance ramp should be the same as that on the mainline on approach to the entrance ramp merge. This will ensure that vehicles merge at the same speed.

Principle 8: Side mounted variable speed limit sign

Side mounted variable speed limit signs (that is, without overhead lane control signs) along the mainline are used in a similar manner to integrated variable speed limit and lane control signs. A typical arrangement is shown in Section 2.6 of this chapter, Figure 2.6(n).

2.3.3 Lane control

Principle 9: Lane closure on VSL / LCS

Lane closures shall not be implemented on the integrated VSL / LCS until the variable speed limits have been reduced for the temporary roadworks.

Principle 10: Flashing red crosses and red crosses

A continuously flashing red cross must be shown as the first lane control device. One flashing red cross is the minimum amount of lane control.

Normally, the flashing red cross is followed by a continuous red cross at the next gantry. Refer to the figures in Section 2.6 of this chapter.

Principle 11: White arrows

A diagonally upwards white arrow (left or right) overhead lane control signal is used to indicate that an exit ramp from the motorway is open, where a lane closure extends past the exit ramp.

Principle 12: Speed limits in conjunction with lane control

At the introduction of lane control signs (flashing or continuous red cross); the speed limit shall be reduced to 80 km/hr (maximum). This reduced speed limit should assist merging.

Where it is necessary to close two lanes with a separation between the taper for each lane closure, a similar staggered warning shall be provided to drivers on the integrated VSL / LCS.

At no time shall flashing red crosses be displayed in adjacent lanes, except where a parallel lane type merge is closed adjacent to a closed main motorway traffic lane.

Principle 13: Closure of a central lane

Consistent with normal roadworks signing practice, a central traffic lane should not be closed in isolation. An adjacent lane(s) should also be closed.

Principle 14: Low flow conditions

In low flow conditions, extra lanes may be closed to provide sufficient space for worker safety and the method of work. This may increase lateral clearance and allow a higher work zone speed, reducing delays to drivers. This should be done in accordance with QGTTM Part 3, including Table 5.5, however, the available trafficable lanes must be able to service the traffic capacity.

2.3.4 Other

Principle 15: Variable message signs

Where available, permanent variable message signs should be used to display a message about the road work: for example, ROAD WORK AHEAD / REDUCE SPEED; LEFT LANE CLOSED / MERGE RIGHT.

2.4 Planning

Detailed planning for the work will need to be commenced well in advance of construction to allow discussion with the Traffic Management Centre and Department of Transport and Main Roads Regional Director or his or her delegate or responsible authority and to allow for any refinements to the submitted Traffic Management Plan. This will ensure traffic operations are safe and efficient and will allow sufficient time for any system changes to be implemented by the Traffic Management Centre in an orderly manner.

The Department of Transport and Main Roads regional office and / or asset owner / manager gives the approval for the proposed traffic control methodology for the lane closures using the VSL / LCS. These approvals are the final part of a process which includes assessment of the impacts of the works on traffic flows, formulation of Traffic Management Plans, making an application and finally, execution of the plans. For projects on state-controlled roads, a pre-start meeting with the Road Operations business unit (or relevant area) may be necessary in order to assess how the VSL / LCS can assist with traffic management of the work site. A representative from the Traffic Management Centre should also attend to discuss operational detail of the VSL / LCS. Part of this discussion should include a brief formulation of a back-up plan if a critical error occurs with any aspect of the execution of the VSL / LCS assisted Traffic Management Plans. The level of traffic management needed for particular construction and maintenance activities will determine the degree of support to be provided by the VSL / LCS.

The suggested processes are summarised in Figure 2.4(a) and Figure 2.4(b) of this chapter, with the development of a Traffic Management Plan, approval and review procedures and work site operations detailed in Sections 2.4.1, 2.4.2 and 2.4.3 of this chapter.

Figure 2.4(a) – Process for pre-approval of ITS component of the Traffic Management Plan

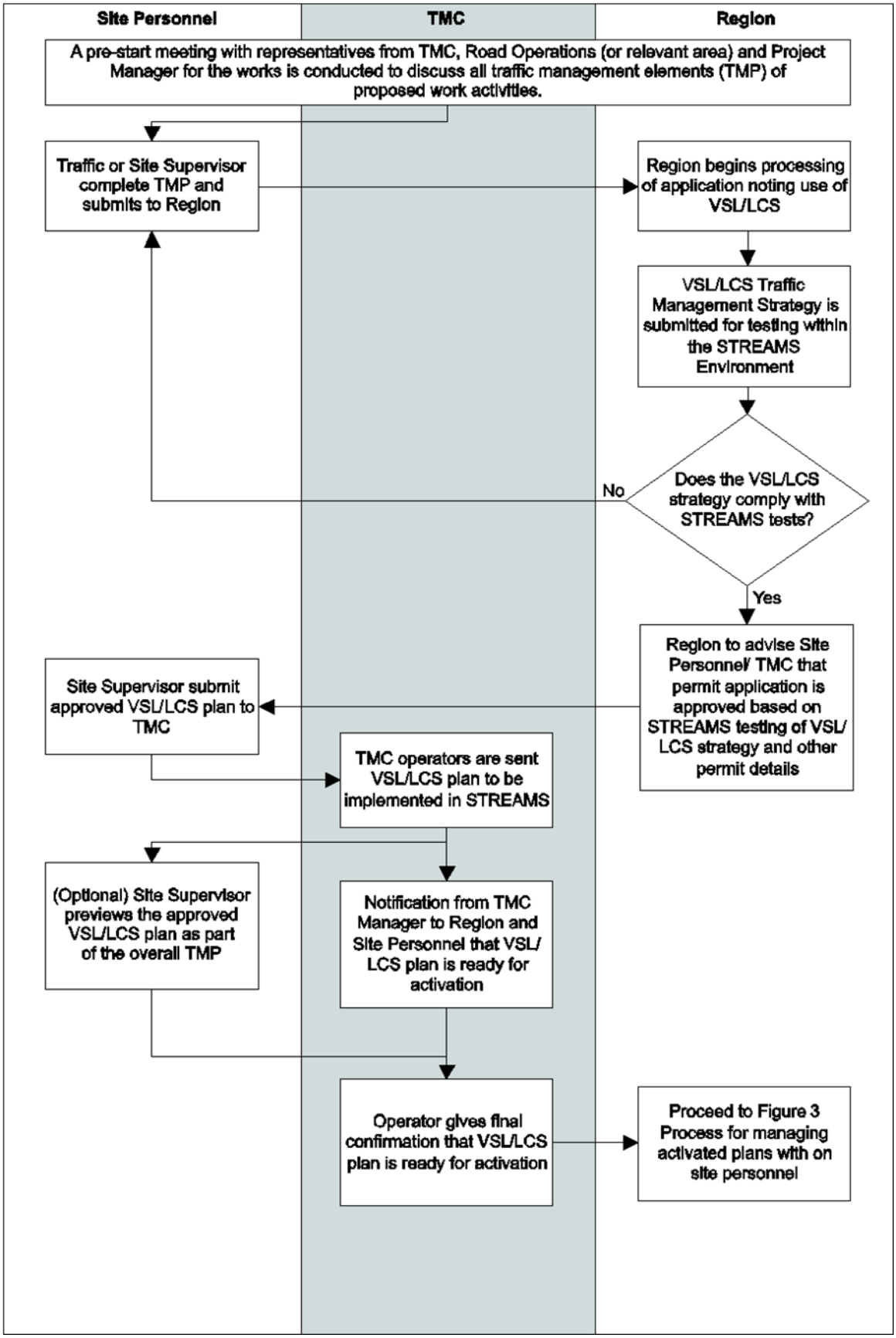
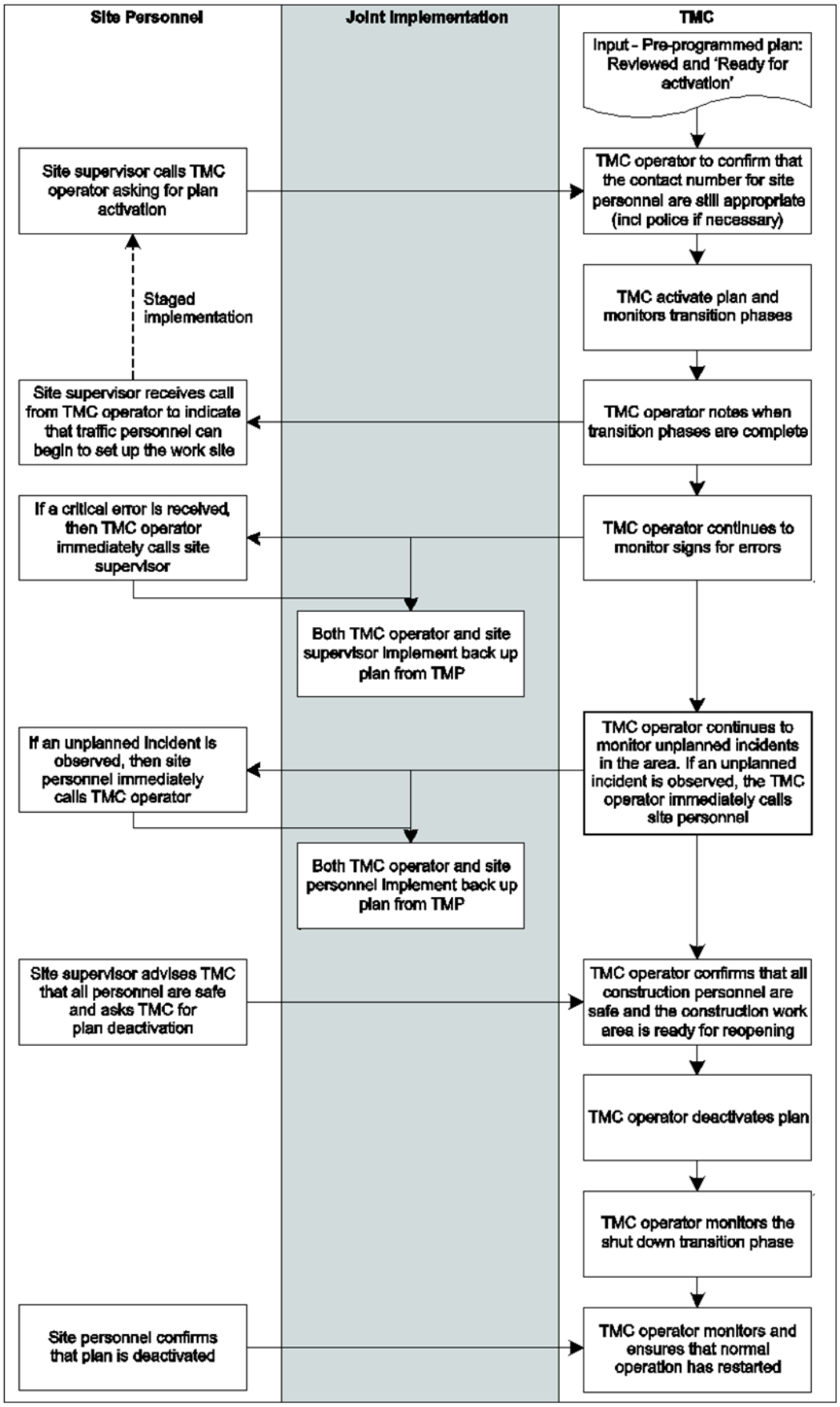


Figure 2.4(b) – Process for managing activated plans with onsite personnel



2.4.1 Preparation of Traffic Management Plans

Preparation of the Traffic Management Plan proposed for the works on the motorway includes a fully documented Traffic Guidance Scheme providing the following information:

- the limits of the work site
- defined lane closures
- types of signs and devices needed for the lane closure; for example, temporary static signs, bollards and so on
- proposals for lane closure and variable speed limits on integrated Variable Speed Limit / Lane Control Signals or Variable Speed Limit Signals only located on approach to, at, and departure from the work site. This will need to include consideration of the following:
  - ensuring that there is no conflict between static signs, or the static lane closed signs and the overhead lane control signals
  - ensuring that the principles described in Section 2.4 of this chapter are applied; for example, variable speed limit sign(s) on the entrance ramp show the same speed limit as the main motorway traffic lanes, and
  - a staged implementation of the VSL / LC plan due to the work method or sign set out / retrieval.
- a sketch of the location of the signs and devices, including the variable speed limit / lane control signals proposed at each gantry or pole mounted variable speed limit sign
- the time, day and date expected for the start and finish of the work, and
- contact details of the Site Supervisor (primary contact), secondary contact (for example, traffic supervisor) and Queensland Police Service representative where applicable. Mobile phone numbers or details of radio communications should be provided.

Submission of the plan to the Regional Director or his or her delegate for approval shall occur prior to installation.

2.4.2 Review of Traffic Management Plan by the Traffic Management Centre

Following approval of the Traffic Management Plan (by Regional Director or his or her delegate); it is then forwarded to the Traffic Management Centre. This is to allow assessment of the plan in relation to the VSL / LC components of the plan. This allows the Traffic Management Centre to preview the changes needed to the variable speed limit and lane control signals before, during and after the temporary roadworks; and to detect any errors or anomalies in the system and correct them well in advance of the commencement of the works.

Assessment of the plan by the Traffic Management Centre will also include preparation of strategies for managing the work site with variable speed limits and lane control signs with regard to:

- the communication process for activating and deactivating plans, and managing critical / non-critical faults, and
- procedures needed should the variable speed limit and lane control signs fail critically (for example, failure of the communications link or power supply) during the management of the works in the event that an unplanned incident occurs near the roadworks, affecting traffic control at the temporary roadworks.

These issues and strategies proposed by the TMC should be discussed with and reviewed by the Site Supervisor prior to their finalisation.

Upon completion of the pre-approval process, the Site Supervisor and traffic supervisor are advised that the VSL / LC plan is ready for activation.

2.4.3 Operation

Good communication between site personnel and the Traffic Management Centre is essential before, during and upon completion of the works. It is important to note that only pre-approved VSL / LC plans that have been marked by the Traffic Management Centre as ‘Ready for Activation’ may be activated.

Before starting the work

Prior to the commencement of temporary works on the motorway, the Site Supervisor requests the Traffic Management Centre to:

VSL/LC plan (Speed reductions only)

i. Activate the speed reductions of the pre-approved plan.

Following activation of the plan, and when the transition from the normal speed limits to the pre-approved speed limits is completed, the Traffic Management Centre will then advise the Site Supervisor that the site traffic personnel can begin to set out advance roadwork signage and set up the work area. This shall ensure that Traffic Controllers are setting up in a safer, reduced speed environment.

Full implementation of the VSL / LC plan (speed reduction and lane control)

ii. Activate the pre-approved VSL / LC plan.

Following activation of the plan, and when the transition from open lanes and normal speed limits to closed lanes and work zone speed limits on the integrated VSL / LC signals is completed by the Traffic Management Centre, the Traffic Management Centre will then advise the Site Supervisor that site traffic personnel can begin to set up the work site with static signs, bollards and so on.

The reduced speeds and lane control signs should assist in creating a safer environment for Traffic Controllers to set up signing for the work site.

Note: Site personnel should not set up the traffic management devices for the work site (static signs, bollards and so on) until advised by the Traffic Management Centre that the VSL / LC plan is fully operational.

Staged implementation of the VSL / LC plan (speed reduction and lane control)*

iii. Activate the speed reductions of the VSL / LC pre-approved plan if a staged implementation is considered necessary.

Following activation of the plan, and when the transition from the normal speed limits to the pre-approved speed limits is completed, the Traffic Management Centre will then advise the Site Supervisor that the site traffic personnel can begin to set out advance signage only. This shall ensure that Traffic Controllers are setting up in a safer, reduced speed environment.

After all advance roadwork signage has been set out, the Site Supervisor shall request that the Traffic Management Centre activate the pre-approved lane control of the VSL / LC plan. Once lane control has been completed the site personnel may then begin setting up the work area with static signs, bollards and so on.

Note*: A staged implementation of the VSL / LC plan may be necessary to safely support the set out of the advance roadwork signage. For example, if the VSL / LC plan contains a left lane closure, however, the advance signage being placed on the median closes the right lane, a staged implementation shall ensure that the left lane remains open to traffic whilst still providing a safe, low speed environment for set out.

During the work

The Traffic Management Centre continually monitors the activated plans. If there is an unplanned incident nearby, possibly requiring an even lower speed limit or closing an additional lane, the Traffic Management Centre will immediately contact the work site personnel to advise / discuss any changes needed to work site arrangements.

Should a failure occur in the communications link or power supply associated with the variable speed limit / lane control signals, resulting in the variable speed limit and lane control signals being blanked, the Traffic Management Centre will immediately contact the work site personnel. Site personnel would then implement the appropriate strategy from the traffic management and VSL / LC plans.

At the end of the work

At the end of the work – after all plant, equipment, workers and traffic management devices, for example, static signs, bollards and so on have been removed from the traffic lanes – the Site Supervisor, after verifying that all lanes are clear of obstacles, advises the Traffic Management Centre that the work has been completed and the motorway can be returned to normal operating conditions.

Note: All plant, equipment, workers and traffic management devices for the work site (static signs, bollards and so on) shall be removed from the traffic lanes before advising the Traffic Management Centre to re-open the lanes.

Consideration is required to determine if the VSL / LC plan is to be deactivated in a staged approach, that is, deactivate LC, and then deactivate speed reductions.

2.5 Planned events (other than roadworks)

Planned events other than roadworks are not normally permitted on motorways as they significantly adversely affect traffic flow and safety on such high speed, high volume roadways as well as on the adjacent road network.

Where a planned event, for example, major international bike race, is proposed to be allowed along a motorway where variable speed limit / lane control signals are installed, the procedures detailed in this supplement are to be followed.

However, there are a number of additional principles to be considered during the preparation of the traffic management and VSL / LC plans. These are:

a) Such an event would be considered as a mobile, or continually moving, event across all lanes of the motorway. Occupation of the sections of motorway should be limited to a short duration to minimise impacts on traffic using the motorway.

b) A very high degree of safety security would need to be provided, for example, police vehicles before and after the bike pack.

c) Entry ramps would need to be closed (using police control) on a continually moving basis to limit impacts on general traffic.

d) All lanes would need to remain open and be subject to the same speed for example, 60 km/hr.

e) Traffic management and VSL / LC plans are prepared and approved in accordance with this supplement.

f) Preliminary approval of the proposed event is granted by police, local government, Department of Transport and Main Roads, fire and ambulance services, and so on.

g) Final approval would be given only after all conditions by the agencies listed previously.

h) The principles listed here have been met.

2.6 Example figures for VSL / LC signs used for roadworks

Typical arrangement figures which illustrate the application of variable speed limit and lane control signals to various work site situations are shown in Section 2.5 of this chapter. These figures indicate a nominal spacing of 750 m; however, the spacing between gantries may be larger or smaller depending on road geometry.

Work site situations which are not specifically covered by the figures should be signed by adopting the most appropriate figure according to the principles outlined in this chapter.

Figure 2.6(a) – Work in one lane – 0–150 m

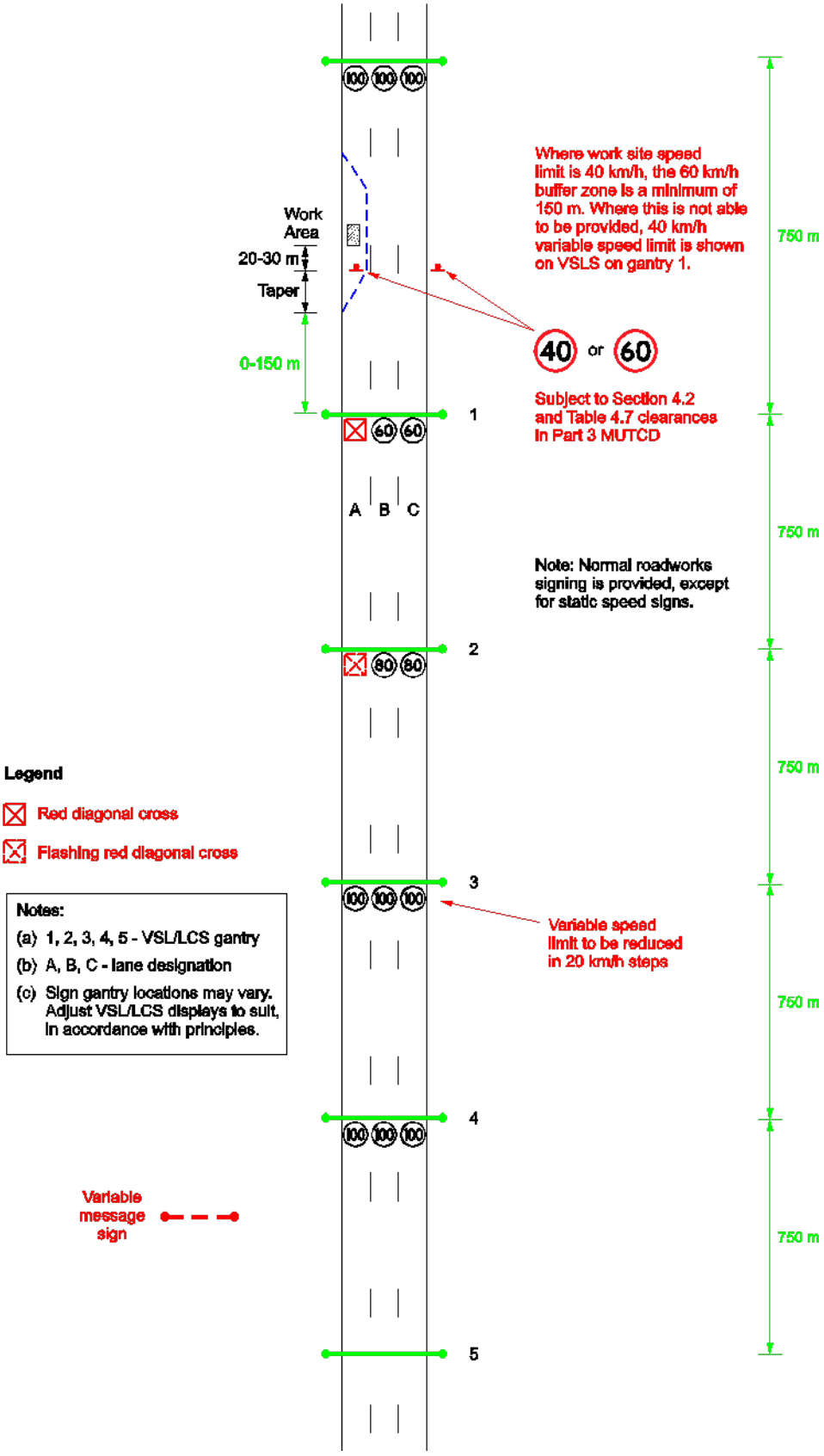


Figure 2.6(b) – Work in one lane – 150–300 m

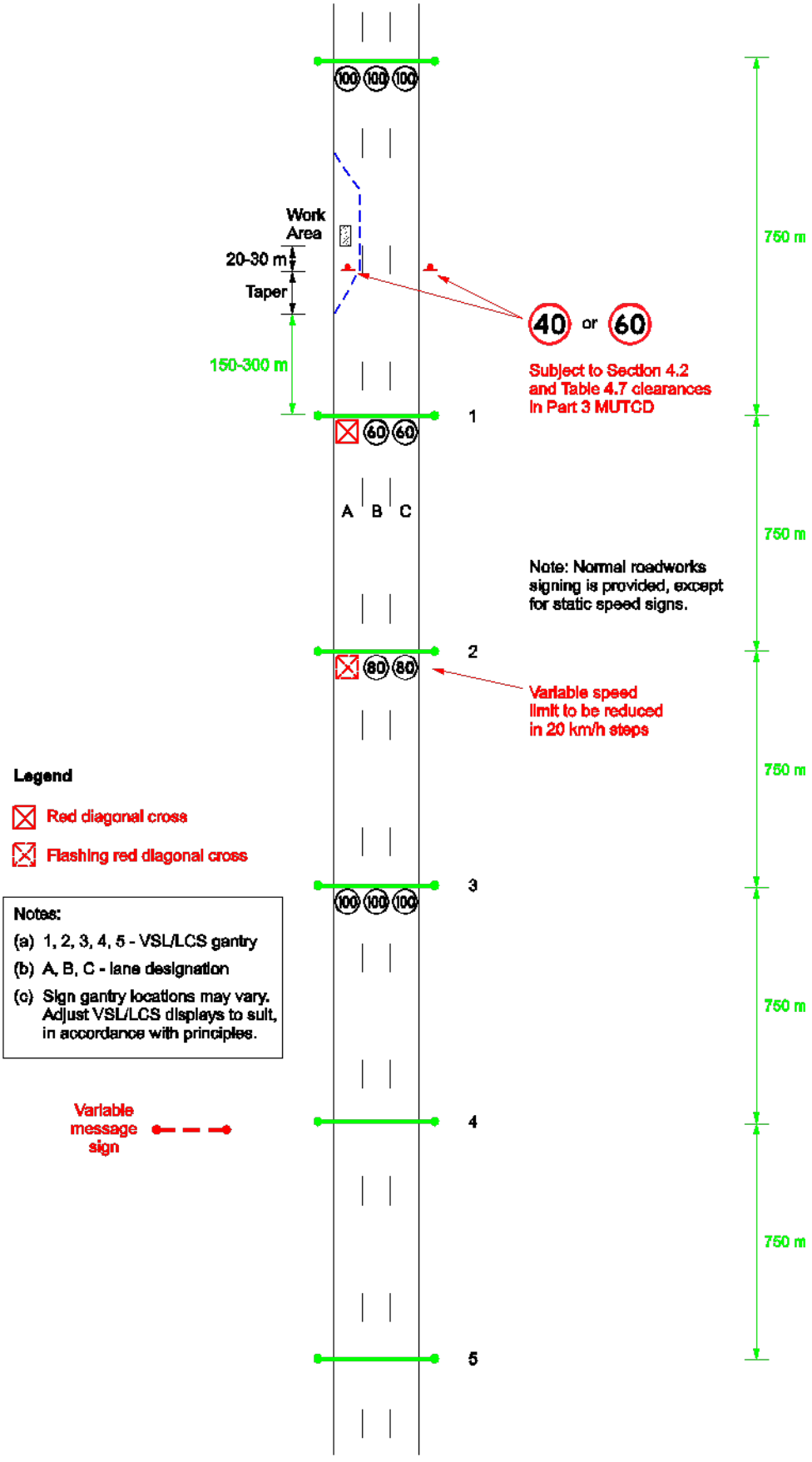


Figure 2.6(c) – Work in one lane – 300–500 m

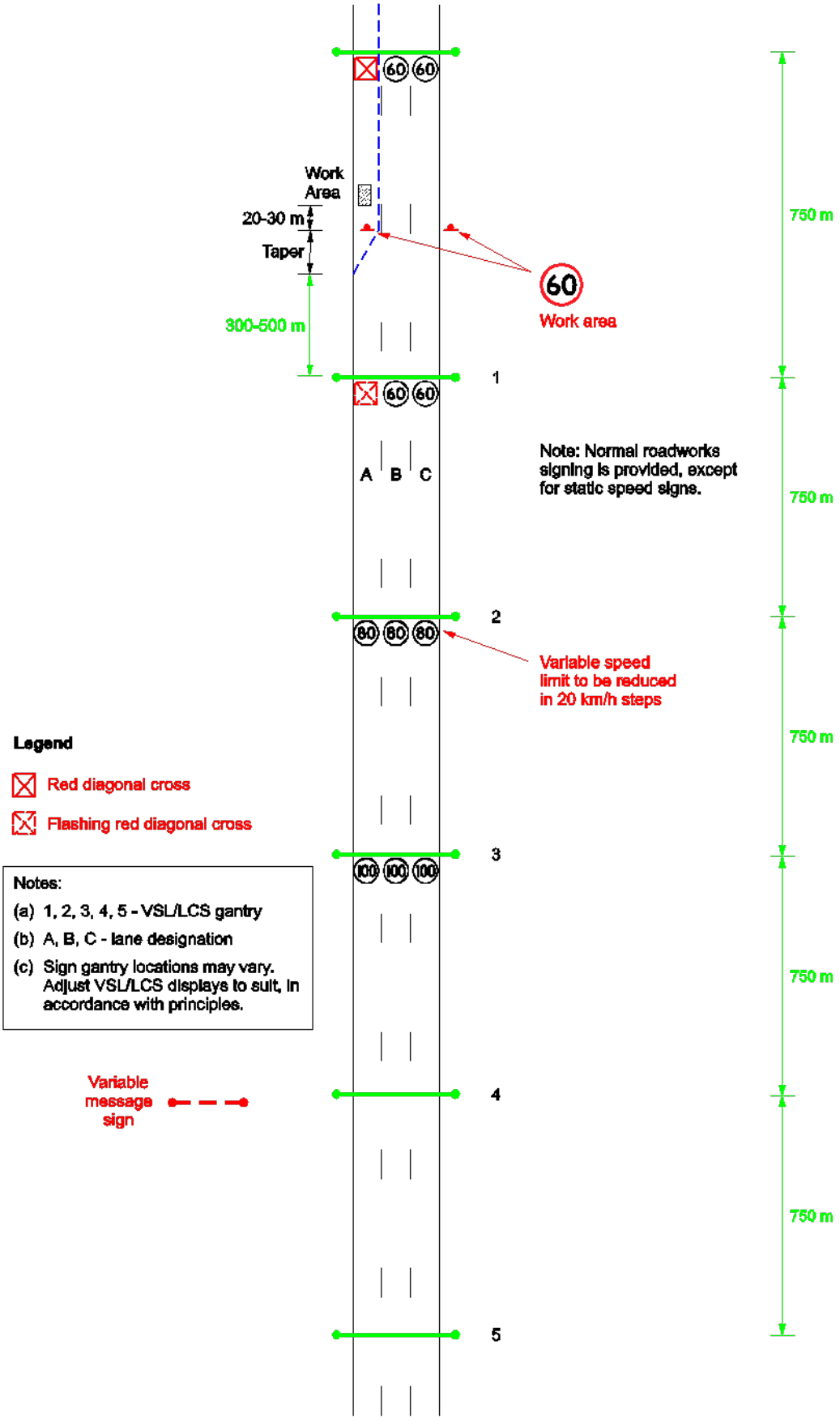


Figure 2.6(d) – Work in one lane – 500–750 m

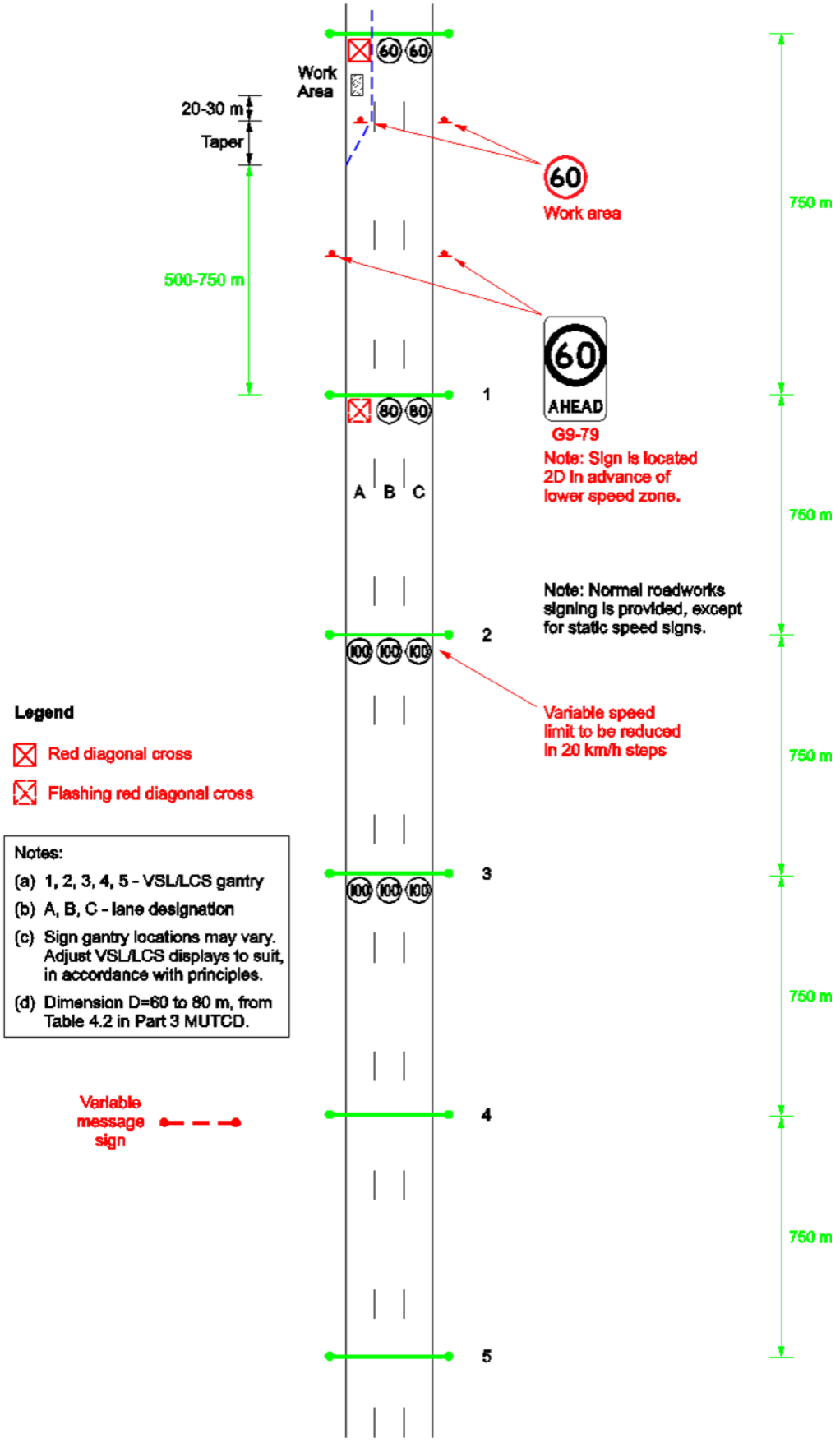


Figure 2.6(e) – Work in two lanes – 0–150 m

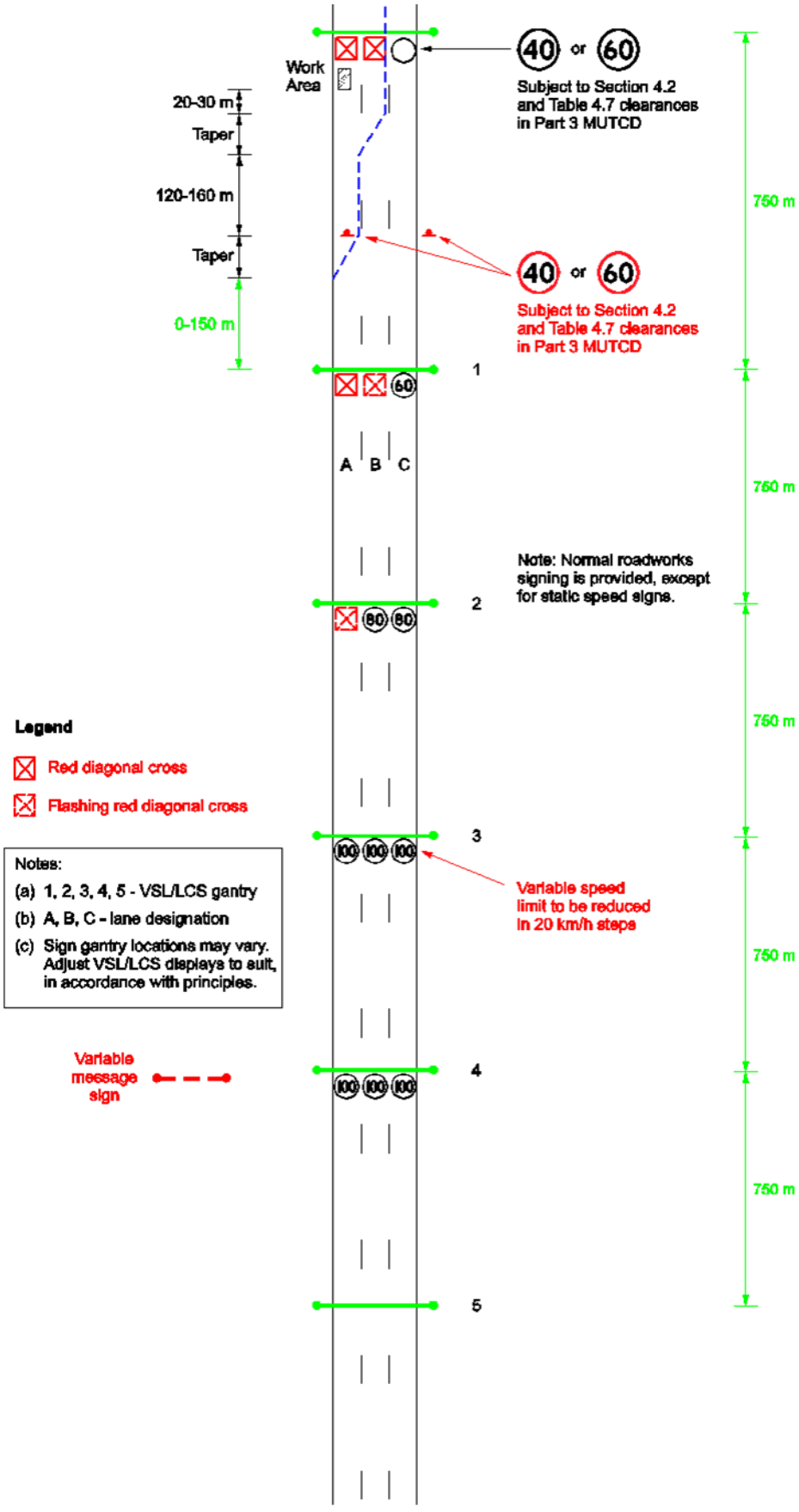


Figure 2.6(f) – Work in two lanes – 150–300 m

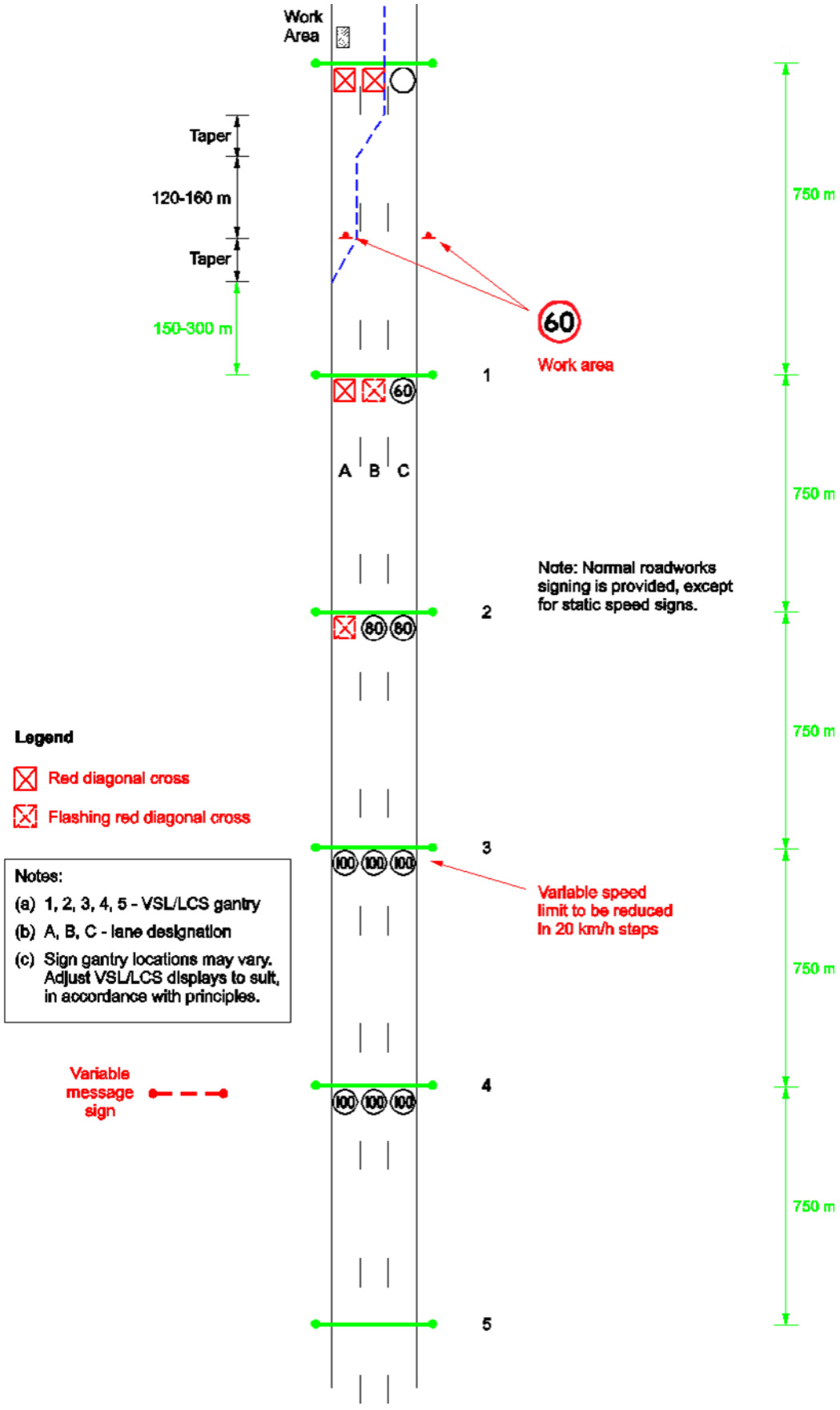


Figure 2.6(g) – Work in two lanes – 300–500 m

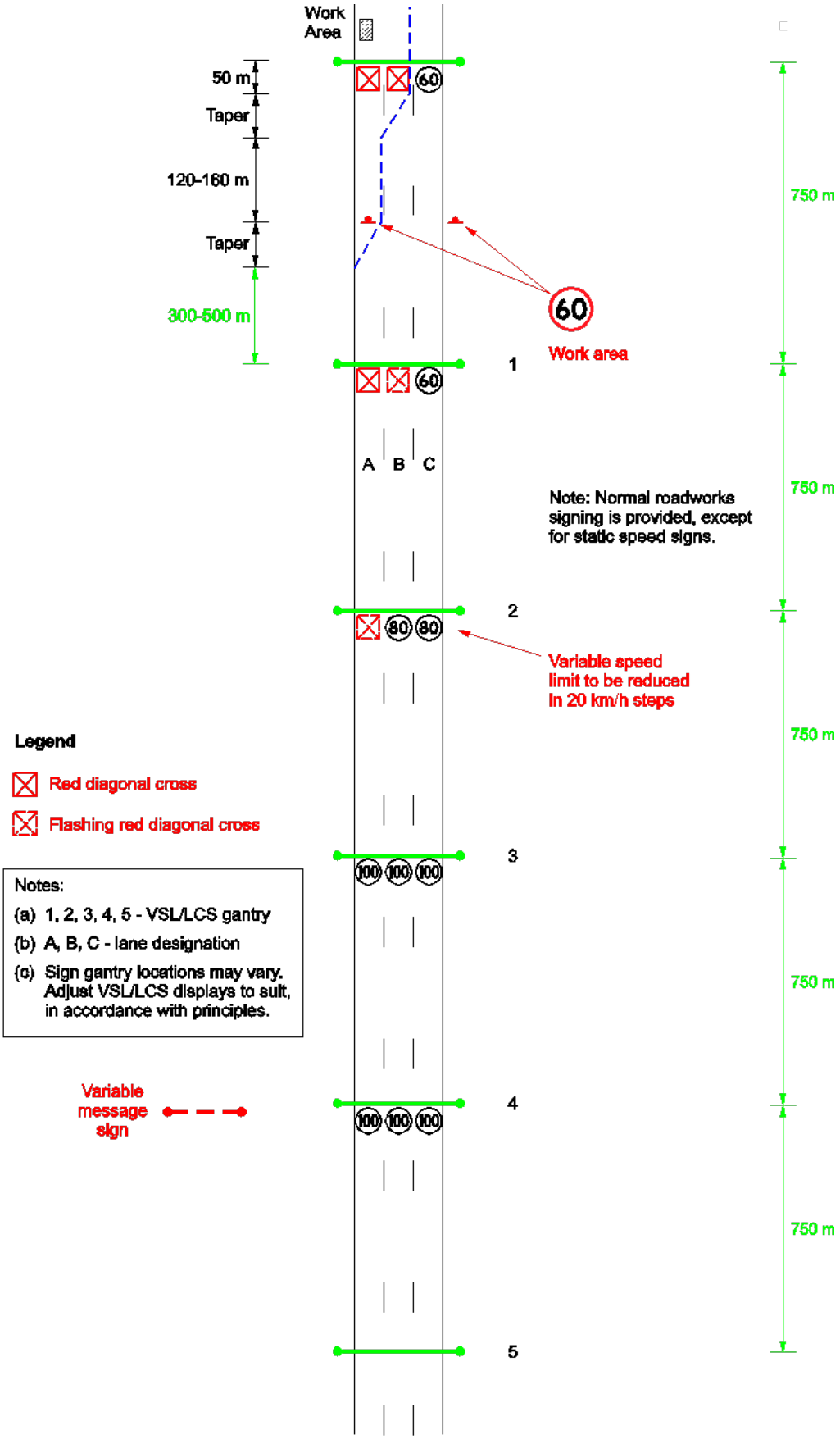


Figure 2.6(h) – Work in two lanes – 500–750 m

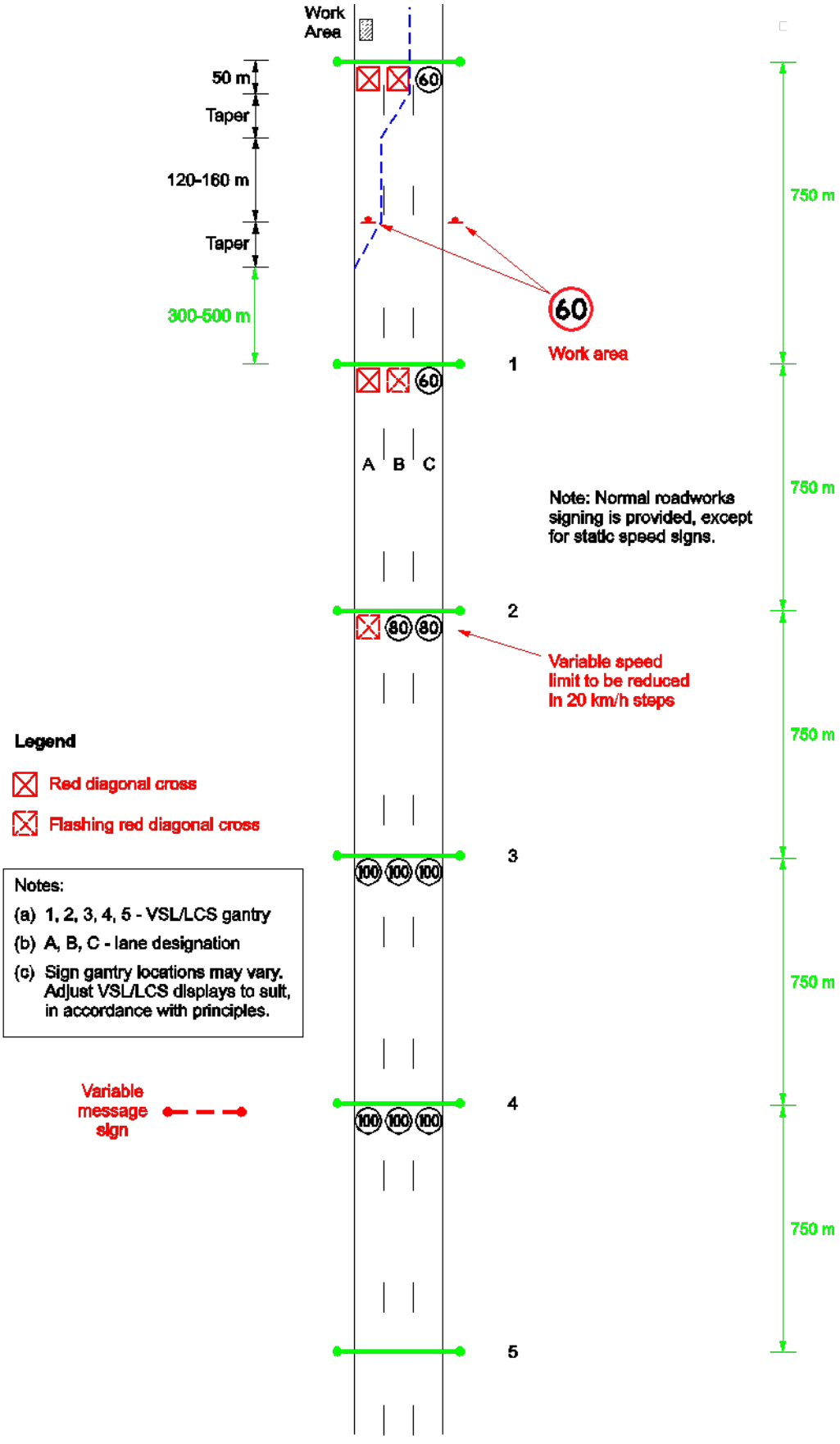


Figure 2.6(h) – Work on shoulder – 0–300 m

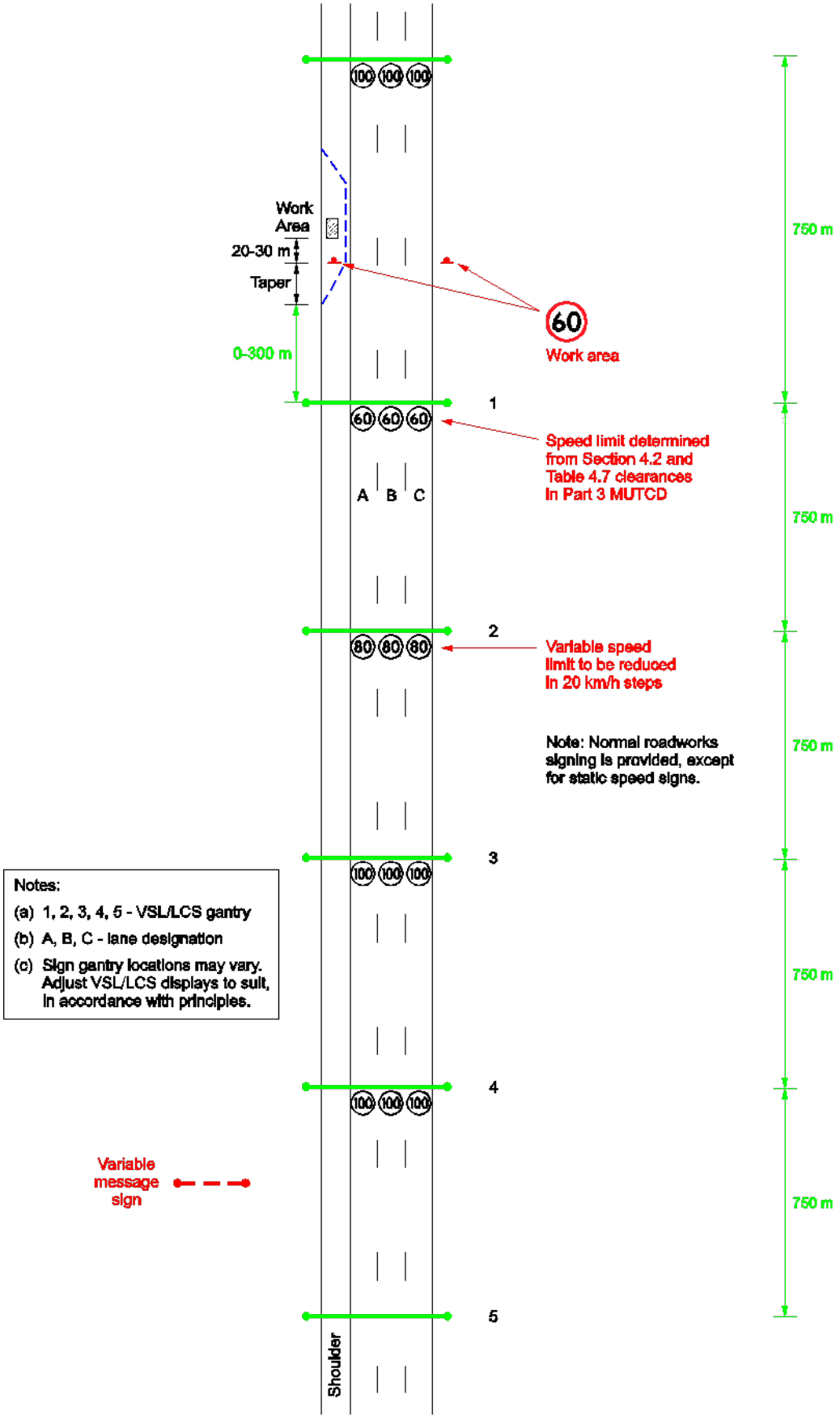


Figure 2.6(i) – Work on shoulder – 300–500 m

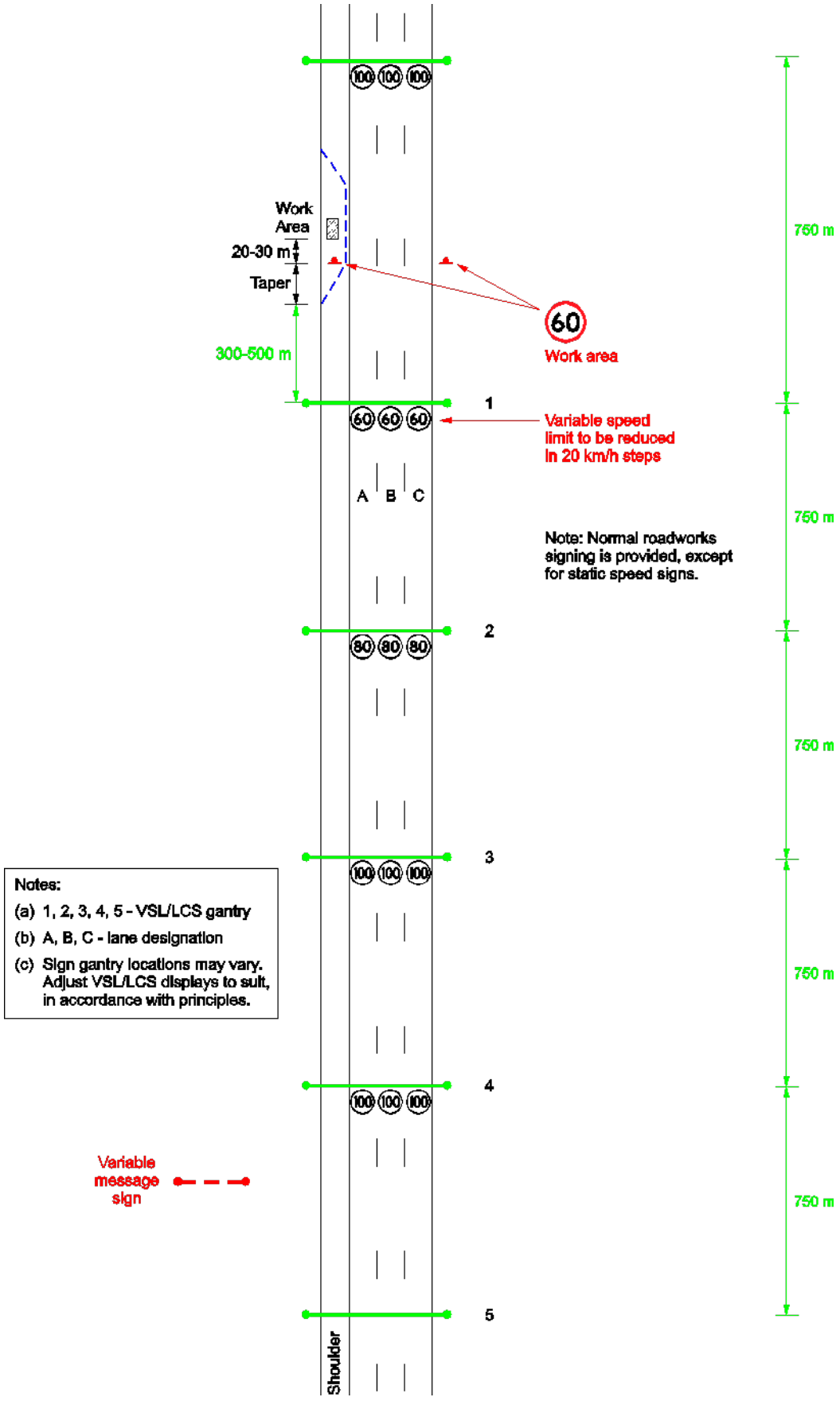


Figure 2.6(j) – Work on shoulder – 500–750 m

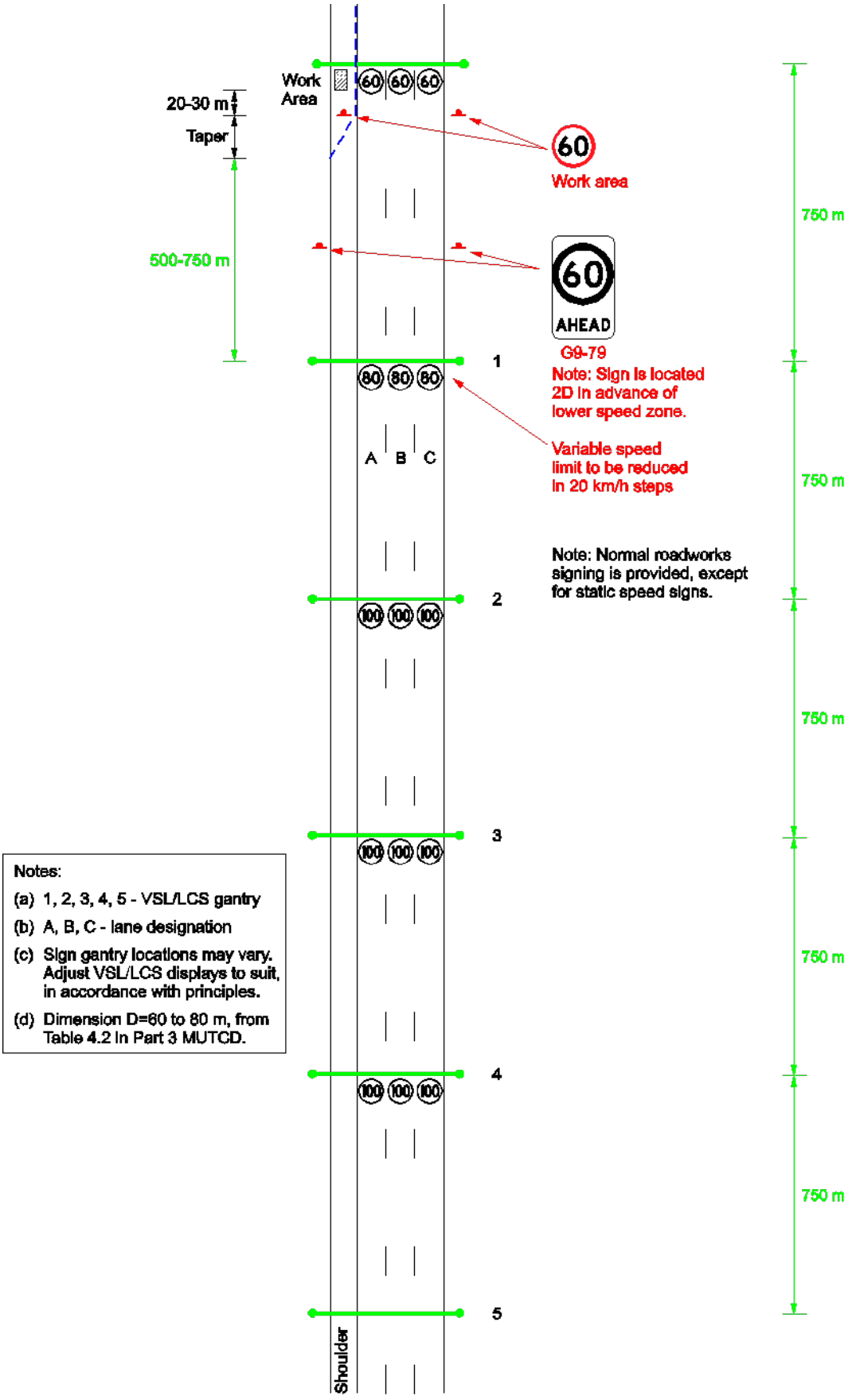


Figure 2.6(k) – Lane closed across an exit ramp

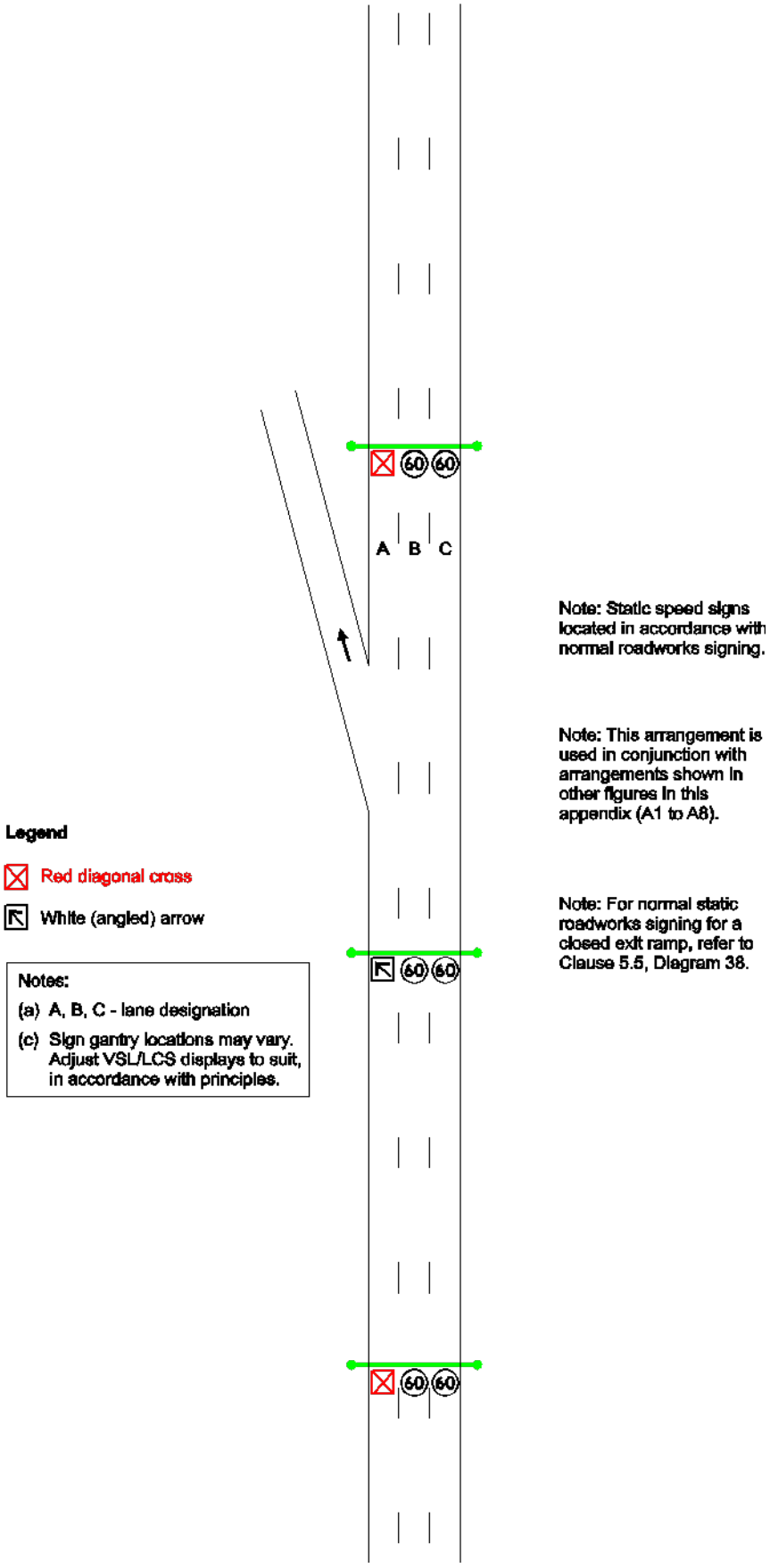


Figure 2.6(l) – Lane closed across an entrance ramp

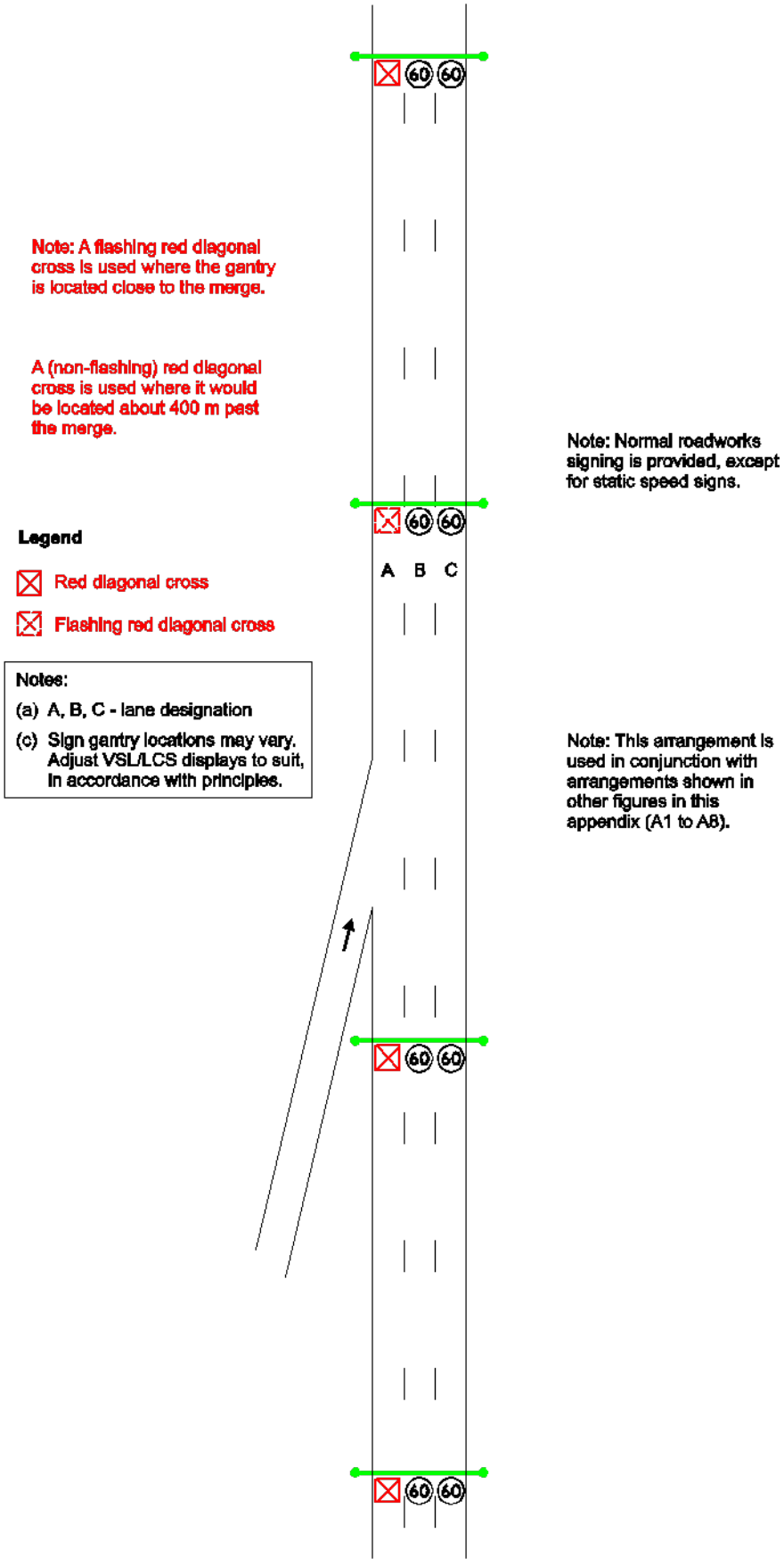


Figure 2.6(m) – Variable speed limits at entrance ramp merge

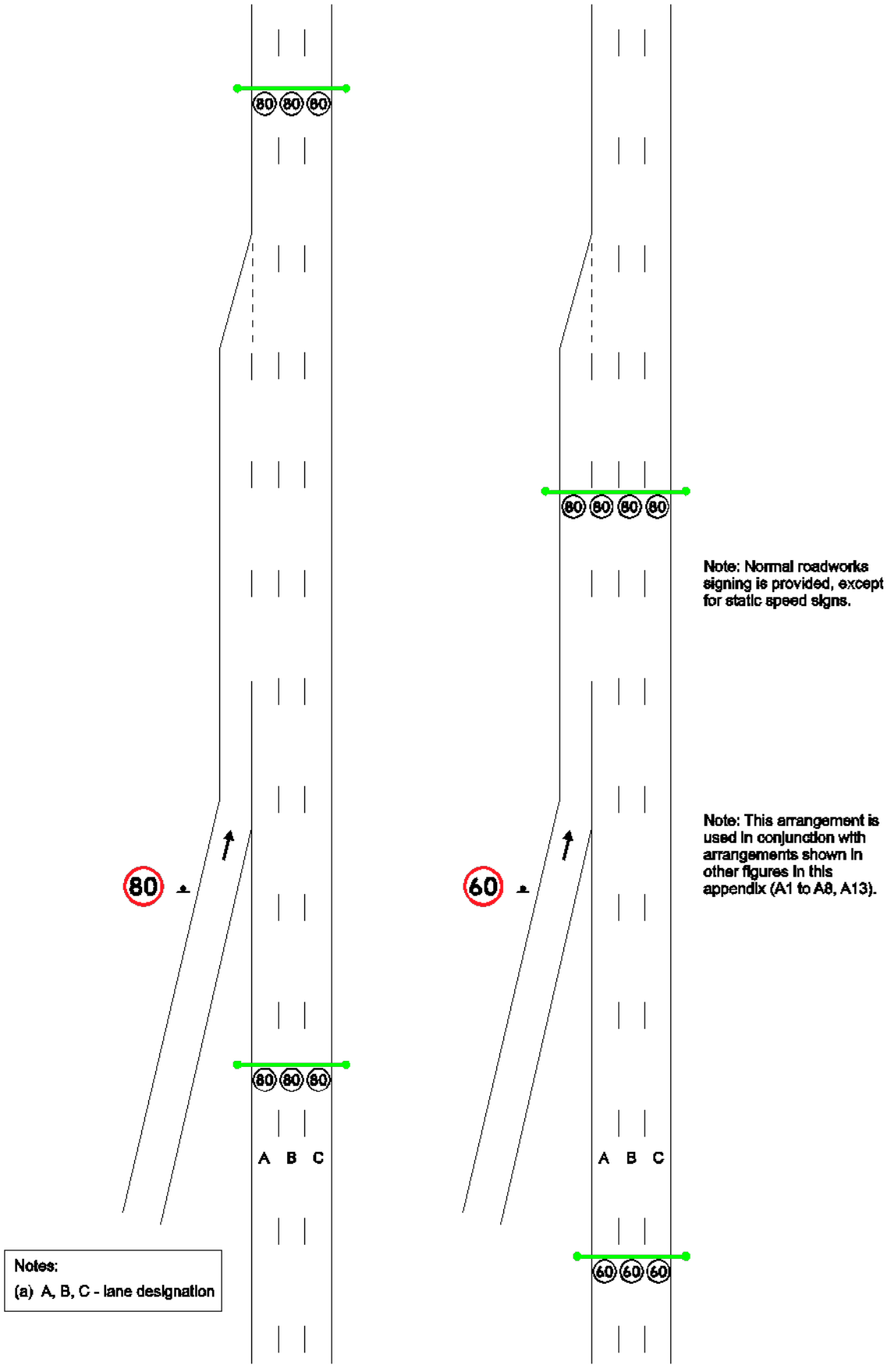


Figure 2.6(n) – Work in one lane – pole mounted VSL signs

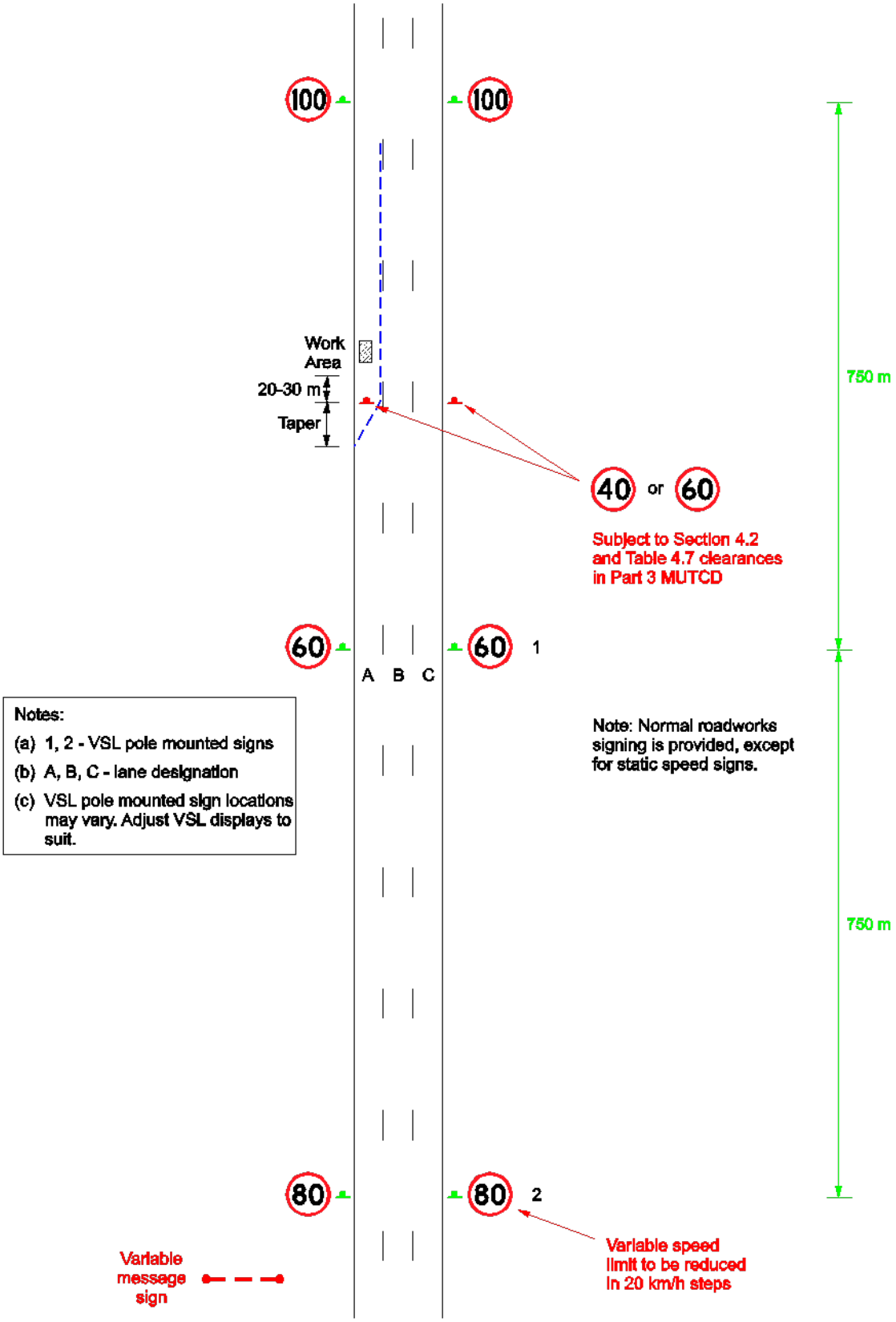
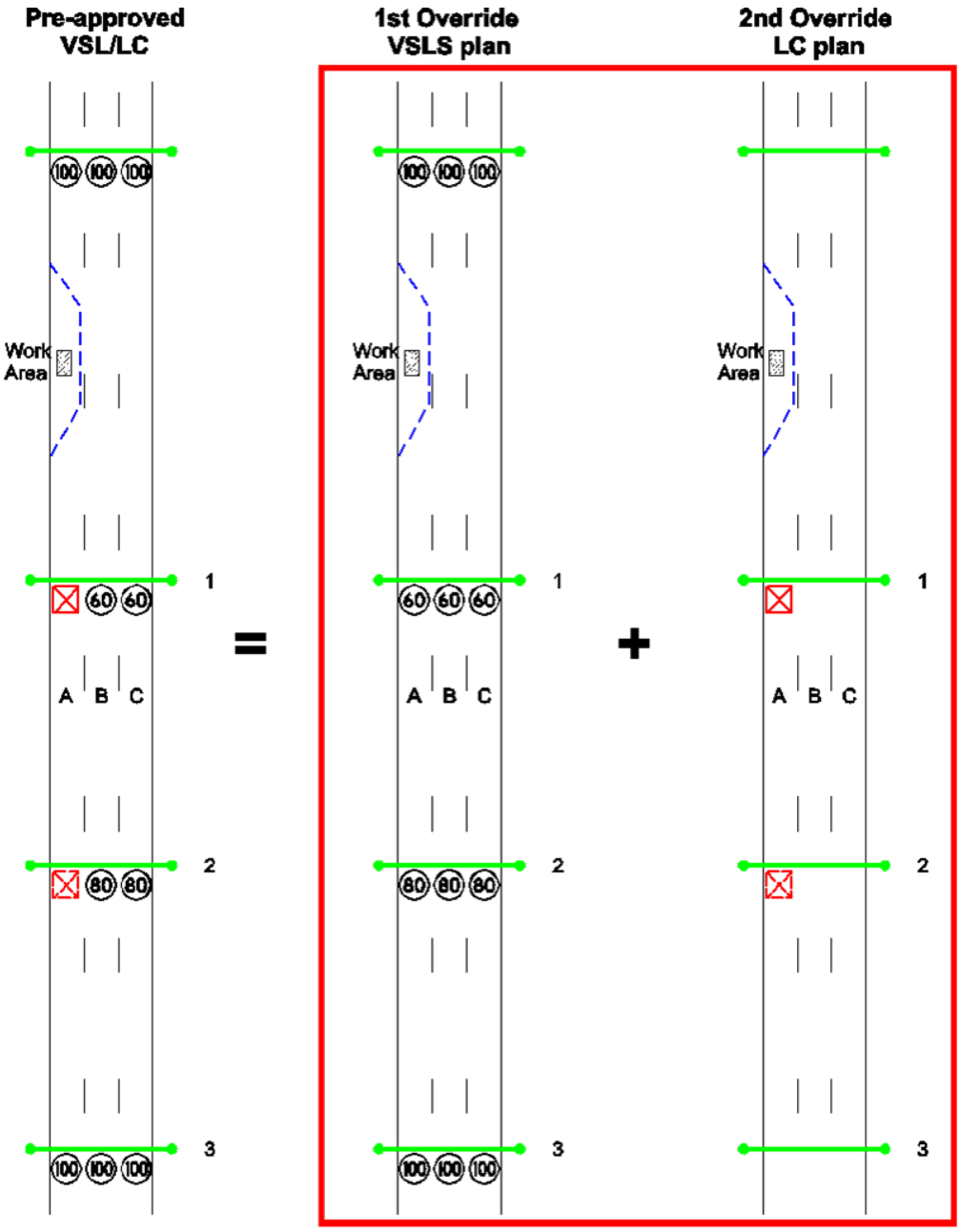


Figure 2.6(o) – Staged implementation of pre-approved VSL / LC plan



3 Traffic operations level of service for roadworks sites

3.1 Purpose

This section provides guidance for determining the appropriate traffic operations Level of Service (LOS) to be maintained through roadworks sites. LOS is defined in Austroads *Guide to Traffic Management Part 3* This guidance is to be applied in the assessment of alternative construction and traffic management schemes on traffic operations.

3.2 Background

Most roadworks schemes invariably require a degree of interruption to the normal flow of traffic on a road. The acceptable level of impact is dependent on a range of factors including the urgency of the works, the scale of the works, the advance notice provided to the community and the availability of alternative routes or modes of transport.

In developing a Traffic Guidance Scheme, the primary objective is to ensure the safety of road workers and road users. The secondary objective is to balance the:

- safe and convenient movement of traffic (community costs), and
- construction and traffic management costs (project costs).

These elements must be carefully assessed to ensure that the most appropriate balance is found to ensure that cost effective solutions are being applied.

Examples of the inefficient application of a Traffic Guidance Scheme can include:

- The traffic operations principles behind a Traffic Guidance Scheme are based purely on maintaining traffic flow. In these cases, the minimum number of lanes to be retained in each direction on each road is usually defined. This can result in constraints on the construction process which may lead to the inefficient sequencing and conduct of the works which can potentially increase the project costs.
- A minimum Level of Service is specified based on maintaining existing traffic conditions. This can severely affect the times at which construction activity can be undertaken, which can result in an associated increase in project costs.

Alternatively, the most effective construction practice may result in extensive delays / detours to traffic with substantial community impact. In these cases, delays at roadworks sites can be a source of frustration for drivers which may potentially lead to an increased risk for road users and road workers

This note, therefore, provides some guidance on determining the appropriate balance between traffic operations and construction process.

3.3 Discussion

The following principles for roadworks LOS shall apply:

1. In the following cases, the community cost will be considered to be NIL and the most efficient construction process which complies with these LOS parameters should be applied:
    a. If the existing LOS on the road is A, B or C, then a traffic management treatment which delivers no worse than LOS D.
    b. If the existing LOS on the road is D, then a traffic management treatment which delivers no worse than LOS E.

   c. If the existing LOS on the road is E or F, then a traffic management treatment which maintains the existing traffic operational performance.

2. An assessment of the community cost against the construction cost will be undertaken in all other circumstances
3. Travel time costs:
   a. Travel time costs are to be determined using the approach documented within Clause 3.2 of the Austroads *Guide to Project Evaluation Part 4: Project Evaluation Data*, 2012.
   b. Private travel time cost is adopted for a single occupant (A$13.17/hour) which, as per the Austroads Guide, was assumed to be 40% of average hourly earnings (A$32.93, as per quarter ending 31st May 2010).
   c. Business travel time for cars is assumed to be the average hourly earnings.
   d. These figures need to be increased by CPI to current day figures.
4. Traffic management costs and project costs should be provided by the contractor undertaking the works

Chapter 3: Risk management

This chapter provides guidance to practitioners for conducting risk assessments associated with the preparation, implementation and review of Traffic Management Plans and Traffic Guidance Schemes prepared in accordance with the principles of the Queensland MUTCD Part 3 and the QGTTM. It also provides guidance on the processes to be followed when developing and accessing exceptions to the requirements of the Queensland MUTCD Part 3 and the QGTTM.

1 Risk management and exception process for traffic control at road work sites

1.1 Background

Variations in traffic management practices at work sites in Queensland and in the application of traffic control devices occur when those preparing Traffic Management Plans design the Traffic Guidance Scheme outside the parameters set in the Queensland MUTCD Part 3 and related documents.

The department's current culture is to encourage innovation in the design of Traffic Management Plans and Traffic Guidance Schemes where that innovation leads to an improvement in the value for money solutions which may involve impacts outside the specified requirements, without compromising safety.

Such treatments may include:

- planning for greater network impacts through reducing the level of service (LOS) for the road user which typically enables works to be undertaken in a more time efficient manner –Chapter 2 Section 3 of this document provides guidance on assessing acceptable LOS for roadworks sites: this may include changes to the scheduling / programming of the work to occur during periods of lower traffic demand
- treatments for the deployment of devices, and
- alternative device layouts using new / improved devices.

It is also recognised that, in some cases, conditions specific to the site and proposed traffic management layout may result in it not being possible to implement the requirements as outlined in the Queensland MUTCD Part 3 and related documents.

Traffic Guidance Schemes which provide a lesser level of protection and guidance may lead to additional safety risks to road workers and an increased risk of driver error. Schemes which do not meet the optimal requirements of the Queensland MUTCD Part 3 and QGTTM can be considered but must be accompanied with a risk assessment and appropriate measures to ensure that the safety of workers and road users is not compromised.

Traffic Guidance Schemes with traffic management treatments in excess of that included in the Queensland MUTCD Part 3 and QGTTM are also considered as Exceptions and may potentially appear unnecessary to drivers and / or lead to increased driver frustration and reduced compliance with the regulatory requirements of the scheme. Traffic Guidance Schemes should not be developed with treatments in excess of that documented unless the risk assessment process identifies a clear need.

Where any alternative traffic management treatment or departure from standards is proposed, a risk assessment should be undertaken in accordance with this supplement. Both the risk assessment and Traffic Guidance Scheme shall be certified by a Registered Professional Engineer of Queensland (RPEQ).

1.2 Risk management

Risk Management shall generally be undertaken as per *Section 2 – Risk Management for TTM*, of Austroads *Guide to Temporary Traffic Management Part 10: Supporting Guidance*.

The following additional provisions shall apply:

Use of standard and site-specific Traffic Management Plans

While the application of standard diagrams may be appropriate, they can be inappropriate if they are implemented without considering specific site conditions or the other requirements and options for deviation contained within the Queensland MUTCD Part 3 and QGTTM.

When considering the application of standard diagrams, practitioners should consider:

- the notes accompanying the diagrams
- the need for a risk assessment
- the hierarchy of control to assess whether the highest practical level of protection or separation is being applied, and
- site specific circumstances (for example, traffic characteristics, pedestrian facilities, public transport, vulnerable road users, road furniture, property access, crash history, probable weather conditions, site distance and so on) and adaptions of the plan as necessary to appropriately address these conditions.

Roles and responsibilities

Exceptions to requirements of the Queensland MUTCD Part 3 and QGTTM must be certified by a Registered Professional Engineer of Queensland (RPEQ), who must ensure that the use of the design Exception is appropriate, compliant with reasonable engineering principles and that departmental processes have been followed, including Clause 1.9 of Queensland MUTCD Part 3.

1.3 Exceptions process

This process for Exceptions to traffic control standards is adapted from the department's design Exception process included within the *Road Planning and Design Manual 2nd Edition*, *Volume 3 Supplements to Austroads Guide to Road Design, Parts 1, 3 and 4A*.

1.3.1 General

Traffic management officers must consider the following when contemplating Exceptions to traffic control standards:

- What is the safety performance of the standard arrangement?
- What is the expected safety performance of the arrangement that incorporates the Exception?
- What should the safety performance of the temporary traffic arrangement be?
- Is the difference acceptable?

The Exception process for traffic control standards is shown in Figure 1.4.3 of this chapter. The amount of work required to be put into each phase in the process will depend on the works and the extent of the proposed variations from the standards.

1.3.2 Development and evaluation of alternatives

An evaluation of the impacts of both the standard arrangement/s and that which incorporates the Exception/s must be undertaken. The evaluation should consider (and document) at least the following for all options:

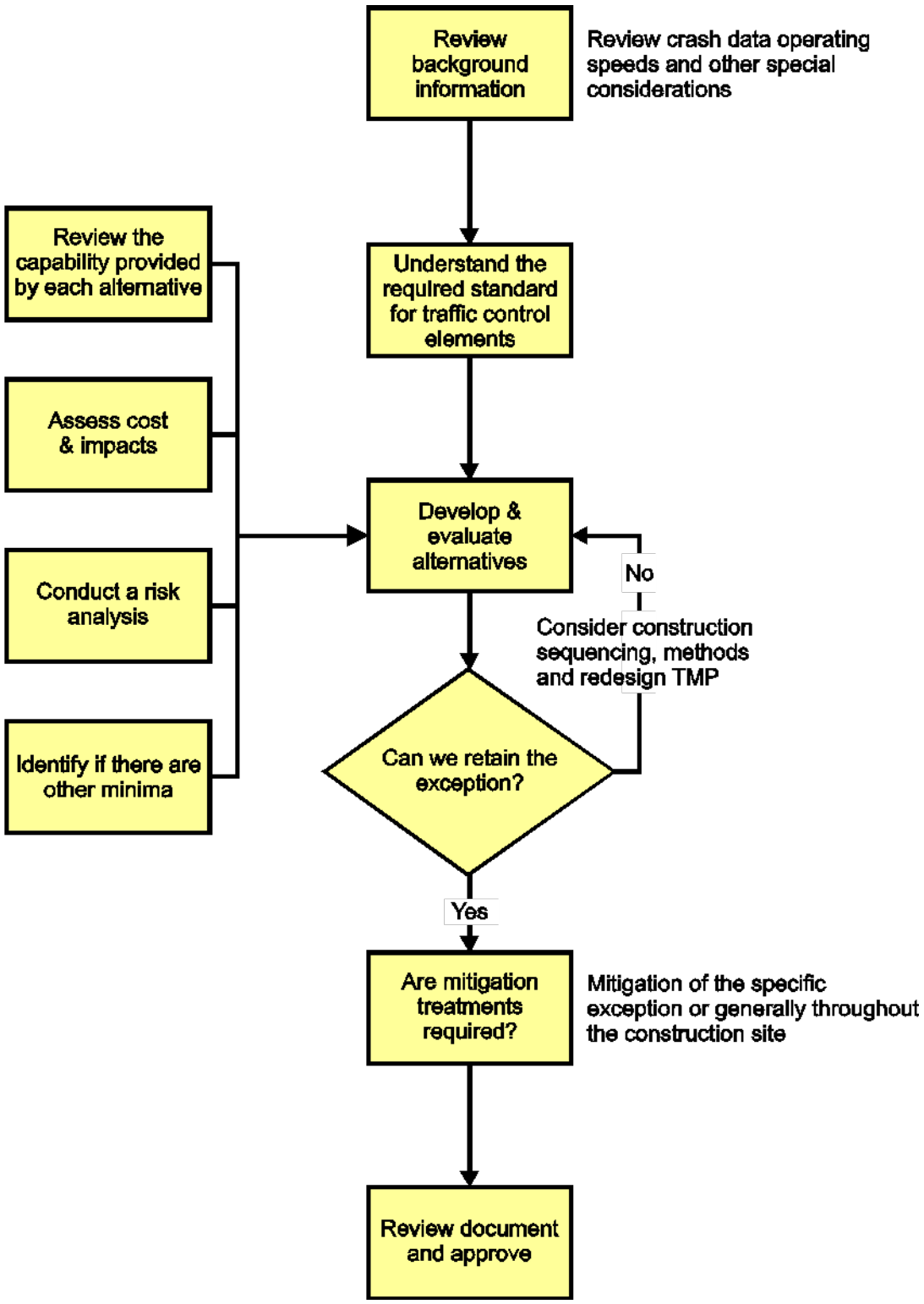
- safety impact
- environmental impact
- community impact
- network impact (traffic operation and level of service), and
- value for money.

Other factors may also be considered depending on the particular circumstances of the site / project.

1.3.3 Mitigation

Specific treatments to mitigate identified risks associated with a proposed Exception must be considered and assessed on a case-by-case basis. An understanding of a site's crash history and crash reducing treatments will assist in the development of risk mitigation strategies.

Figure 1.4.3 – Process for exceptions to the Queensland MUTCD Part 3 and QGTTM



1.3.4 Documentation

Elements of the Exception report may include:

- the location of the works
- the site characteristics such as sign posted speed limit, traffic volume and composition
- the standard to which the Exception applies, including full details of the document it is contained within
- the proposed Exception and the reasons for its proposal including site constraints
- the costs and impacts of both the standard solution and the Exception (including impacts to the environment, community, traffic network, safety and so on)
- other alternatives considered
- the risk assessment and control measures considered
- any safety and other performance information of similar Exceptions applied at other work sites, and
- all reference material used in the evaluation of the Exception.

Example:

The following road conditions are assumed for the following example. This information would be contained in the Traffic Management Plan / Guidance Scheme to which this Exception is attached.

- The road is a four lane, two-way urban arterial with 1 m wide central median. Only one direction of traffic will be affected.
- The existing lane width is 3.3 m with a 0.5 m shoulder.
- The sign posted speed limit is 60 km/h.
- The AADT is 28,000 vehicles per day with 4.9% heavy vehicles.
- There have been no recorded crashes at the site in the last five years.

Note: This is an example only. The level of risk associated with the Exception will determine the amount of documentation required to justify and support the Exception.

Figure 1.3.4 – Example Exception decision record

Work Site Traffic Management Practice Exception Decision				
Location and Scheduled Dates				
Location	This Exception related to work site traffic management activities at Ch. Xxx on xxx Road	Dates	From: To:	dd / mm / yyyy dd / mm / yyyy
What is the standard that is to be departed from?				
QGTTM Part 3 Section 2.5.8, Table 2.5 requires a minimum lane width of 3 m for road works speed zones of 60 km/h or less.				

What is the proposed departure?
Only one lane will remain open in the affected direction while works are being undertaken. The proposed departure reduces the width of this lane to 2.9 m to allow a 1.2 m lateral clearance and avoid the use of barrier separation.
What alternatives have been considered?
Maintain the existing lane widths and install temporary barriers.
What are the costs and impacts of the standard arrangement and Exception (including environmental, community, network and safety impacts along with any other relevant factors and constraints)?
Due to the day-time traffic demand, the works will be carried out between 9 pm and 5 am. A lane closure during day-time peak period would result in considerable traffic congestion and the time and cost required to implement a full detour is not considered justifiable due to the short duration of the works. The set-up and removal of barriers will add several hours to the duration of the works and prevent it from being completed in one nightshift. This will result in additional night-time noise for surrounding residence, additional traffic impacts, and considerable additional costs in the supply and installation of barrier as well as additional traffic management and construction worker labour. While a reduction in lane width is generally considered to be associated with reduced capacity and safety, this will be managed through the undertaking of works at night when volumes are low and adequate advance warning and speed restrictions at the work site. A 2.9 m lane provides adequate width for all heavy vehicles that have general access to the road. The road is not an over-dimension route.
What mitigation treatments were identified in the risk assessment in relation to this Exception?
The following mitigation measures have been identified in relation to this Exception: • Ensure advance signage is in accordance with Queensland MUTCD Part 3 and the QGTTM and correct for the works taking place. • Delineate with suitable bollards/hats to clearly identify locations. • Reduce the posted speed to 40 km/hr to reduce the likelihood, impact and severity of crashes and further ensure the safety of road workers. • Ensure speed signage arrangements are correct so police enforcement can be undertaken. • Monitor road user behaviour to determine if drivers are observing and responding to signs and devices. If not, review treatments. • Maintain acceptable minimal lateral separation from the trafficable path of 1.2 m. • Advise appropriate authorities of width reduction so over dimension vehicles can be diverted. • Provide warning of diversion at closest decision point.
What is the safety performance of the standard arrangement?
The safety performance of the standard lane width applied in conjunction with Queensland MUTCD and QGTTM compliant signs and devices is considered to be very good.
What is the expected safety performance of the arrangement that incorporates the Exception (including performance information from other sites where the Exception has been applied)?
All other arrangements are in accordance with the relevant standards. The 2.9 m lane has a 1 m concrete median providing clearance to opposing traffic on one side and a 1.2 m clearance to workers on the other side. For this reason, the safety performance of the arrangement incorporating the Exception is considered to be comparable to the standard arrangement incorporating a 3 m lane.
Is the difference acceptable?
Yes.

<table>
<tr><td colspan="5">Will monitoring, and evaluation be carried out? Provide details.</td></tr>
<tr><td colspan="5">Road user behaviour will be monitored to determine if drivers are observing and responding to signs and devices – if not, the treatments will be reviewed. Any incidents or near misses will be evaluated to determine if the Exception was a contributing factor.</td></tr>
<tr><td colspan="5">References / attachments</td></tr>
<tr><td colspan="5">References: Queensland MUTCD Part 3 and QGTTM
Attachments: Location Map and Risk Assessment attached to Traffic Guidance Scheme.</td></tr>
<tr><td colspan="5">Is the Exception considered to be acceptable (appropriate and compliant with reasonable engineering principles and departmental processes)?</td></tr>
<tr><td colspan="5">Yes.</td></tr>
<tr><td colspan="5">Certification</td></tr>
<tr><td rowspan="2">On behalf of</td><td colspan="4"></td></tr>
<tr><td colspan="4">Contractor name</td></tr>
<tr><td rowspan="4">Signed by</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Name</td><td>Position</td><td>RPEQ</td><td>Expiry Date</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Signature</td><td colspan="2">Date</td></tr>
</table>

1.4 Roles and responsibilities

Exceptions to temporary traffic management standards must be certified by a Registered Professional Engineer of Queensland (RPEQ), who must verify that the Traffic Guidance Scheme is compliant with reasonable engineering principles and that the departmental Exception processes have been followed.

1.5 Monitoring and evaluation

Monitoring of road works sites where Exceptions have been implemented must be carried out for the duration of the works to ensure they are performing safely, effectively and with an acceptable level of service. This monitoring can be incorporated into the daily routine checks required by the Queensland MUTCD and QGTTM. Clear and complete records of the monitoring undertaken, analysis of results and any changes made to the TGS as a result must be kept.

Details of any incidents that occur at the site, whether the Exception contributed to the incident and the actions taken, are also essential.

Chapter 4: Application and use of truck and trailer mounted attenuators (TMAs) at roadworks

The purpose of this chapter is to provide a set of technical specifications, operational procedures and the minimum training qualifications required by persons responsible for supervising and operating Truck Mounted Attenuators (TMAs) at road work sites in Queensland.

1 Objectives

The primary objective of this chapter is to improve the safety of road workers through providing physical protection via TMAs when road closures or temporary safety barriers are not reasonably practical. TMAs also protect the occupants of errant vehicles through attenuating an impact.

The secondary objective is to provide guidance for training of TMA Operators, in order to achieve a consistent approach in the use of TMAs in Queensland.

2 Terminology

This section provides abbreviations and definitions of terms used throughout the chapter.

Table 2(a) – Acronyms

Acronym	Expansion
AASHTO	American Association of State Highway and Transportation Officials
ADR	Australian Design Rule
AIB	Automatic Impact Braking
AS	Australian Standard
GVM	Gross Vehicle Mass
MASH	Manual for Assessing Safety Hardware
MUTCD Part 3	Queensland *Manual of Uniform Traffic Control Devices* Part 3: Traffic control for works on roads
NCHRP	National Cooperative Highway Research Program
NHVR	National Heavy Vehicle Regulator
TGS	Traffic Guidance Scheme
TL	Test Level
TMA	Truck of Trailer Mounted Impact Attenuator (see definition)

Table 2(b) – Definitions

Term	Expansion
AIB	A system that, in the event of an impact with the rear of the Impact Attenuator Unit, will apply the brakes of the TMA host vehicle automatically; the system must apply brakes on all wheels of the rear axle/s of the host vehicle
Competent person	A person who has acquired through training, qualification and/or experience, knowledge and skills to carry out a particular task
GVM	Means the maximum loaded mass of a vehicle: • stated on the vehicle's compliance plate, or • stated in a way prescribed under a regulation.

Term	Expansion
Host vehicle	A host vehicle is a vehicle that has an impact attenuator unit attached to it permanently or to which a trailer mounted impact attenuator unit can be attached
Impact	In mechanics, an impact is a high force or shock applied over a short time period when two or more bodies collide (such a force or acceleration usually has a greater effect than a lower force applied over a proportionally longer time period) / an impact that may affect the integrity or operation of the vehicle and / or Impact Attenuator Unit
Impact Attenuator Unit	(Also known as a 'crash cushion' or 'crash attenuator') A device intended to reduce the damage done to structures, vehicles and motorists resulting from a motor vehicle collision, designed to absorb the vehicles' kinetic energy and / or redirect the vehicles away from the hazard, and from roadwork machinery or workers
TGS	A diagram that illustrates the layout, signs, devices and general arrangement to warn and guide traffic around, past, or, when necessary, through a work site or temporary hazard
TL2	Applies to Impact Attenuator Units that meet MASH Test Level 2 (basic) requirements (TL2) 70 km/h
TL3	Applies to Impact Attenuator Units that meet MASH Test Level 3 (basic) requirements (TL3) 100 km/h
TMA	A combination of Host Vehicle and Impact Attenuator Unit, either mounted to the Host Vehicle or towed by the Host Vehicle; the combination must meet the requirements of this document
TMA Operator	A person meeting the requirements of Section 7 of this chapter

3 Reference and applicable documents

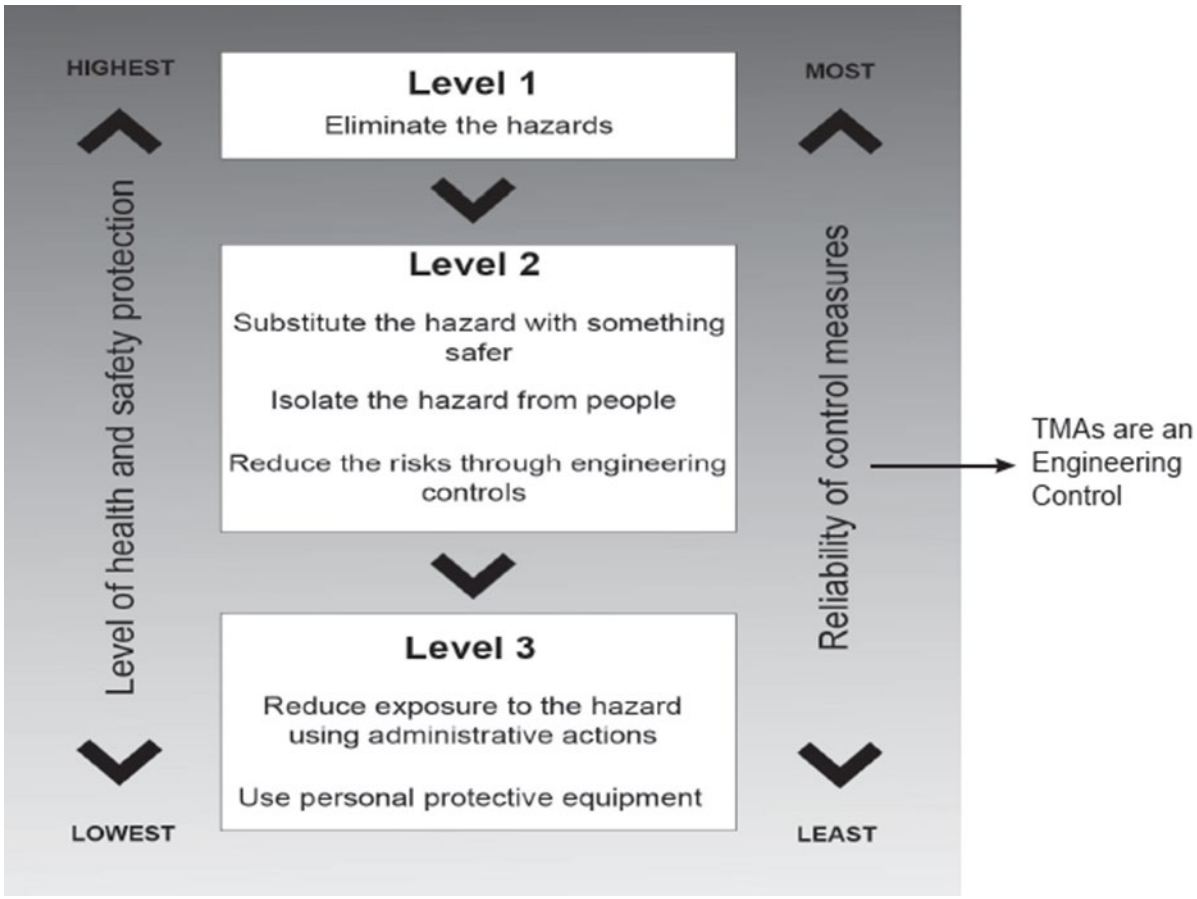
- Queensland *Manual of Uniform Traffic Control Devices* Part 3: Traffic control for works on roads.
- *The Traffic Signs Manual*, Chapter 8: 'Traffic Safety Measures and Signs for Road Works and Temporary Situations' United Kingdom (2006).
- BS EN 1317 1 *Road Restraint Systems – Part 1: Terminology and General Criteria for Test Methods.*
- BS EN 1317 2 *Road Restraint Systems – Part 2: Performance classes, acceptance criteria and test methods for safety barriers.*
- ISO 6487 *Road vehicles – Measurement techniques in impact tests – Instrumentation.*
- AS 4192 2006 *Illuminated flashing arrow signs.*
- *AASHTO Manual for Assessing Safety Hardware.*
- AS/NZS ISO 31000 *Risk Management*.
- ASBAP.

4 Risk management

The Queensland Work Health and Safety Regulation 2011 classifies work on or adjacent to roads that is used by traffic other than pedestrians as high-risk work and prescribes the need to identify hazards and control risks.

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest. This ranking is known as the 'hierarchy of risk control'. The WHS Regulation requires duty holders to work through this hierarchy when managing risk under the WHS Regulation.

Figure 4 – Hierarchy of risk control



The Queensland *Manual of Uniform Traffic Control Devices* Part 3: Traffic control for works on roads provides guidance in relation to hazard identification and risk control as it relates to all applications of road works. This supplement embraces these requirements together with the principles as contained in AS/NZS ISO 31000 *Risk Management*.

5 Technical specifications

This section provides technical specifications in the following areas:

1. Host vehicle.
2. Impact Attenuator Unit certification.
3. Truck Mounted Impact Attenuator unit.
4. Trailer Mounted Impact Attenuator unit.
5. TMA repairs, modifications and inspections.
6. Traffic control devices.

5.1 Host vehicle

This section provides standard functional specifications for the host vehicle. This includes areas such as seating, seatbelt harnesses, masts, visibility of the host vehicle and standard control panel arrangement.

Individual state or territory authorities may have different or specific registration requirements; therefore, it is advisable that the relevant authorities be contacted prior to modifications being made to any vehicles.

The host vehicle shall conform to the following requirements:

a) Must comply with the applicable regulatory requirements, such as Australian Design Rules, registration requirements and applicable legislation, including the Transport Operations (Road Use Management – Vehicle Standards and Safety) Regulation 2010. In some cases, a full engineering analysis by a suitable qualified person, supported by testing where applicable, will be necessary before the modified vehicle is accepted. This testing may include determination of front axle loading when the impact attenuator unit is deployed.

b) Be approved for on road use.

c) Be a minimum of 15 tonnes GVM (refer to Appendix A of this chapter and use of truck and trailer mounted attenuators (TMAs) at roadworks).

d) Be a single cab truck with an automatic transmission.

e) The mounting of any fixtures is to be engineered to 20 times the weight of the fixture.

f) Be fitted with an Automatic Impact Brake (AIB) system that, in the event of an impact with the rear of the Impact Attenuator Unit, will apply the brakes of the TMA host vehicle automatically. In the event of such incidents, it is critical to have an isolation switch or system which will allow the AIB system to be deactivated: this will allow for the impacted TMA vehicle to be removed from positions or locations that could cause an unnecessary obstruction or blockage to the roadway.

   As a minimum, the AIB System must apply the brakes on all wheels of the rear axle/s of the host vehicle. The AIB system must only be activated when the Impact Attenuator Unit is fully deployed, and the host vehicle speed is no greater than 40 km/h.

   It is recommended that the AIB system be fitted so activation of the system is automatic when the Impact Attenuator Unit is fully deployed, and the host vehicle is travelling at a speed no greater than 40 km/h.

   Note: Modification of the braking system may affect ADR compliance and require approval through the NHVR Code of Practice for the Approval of Heavy Vehicle Modifications.

g) Be fitted with an AS/NZS 4192 Illuminated flashing arrow signs approved size ‘C’ arrow board. The arrow board assembly shall be positioned on the truck in accordance with the requirements of the Queensland MUTCD Part 3 and QGTTM.

h) The arrow board and its mountings shall be engineered to a standard:

   i. that will allow for them to withstand the forces applied during forward travel motion based on maximum speed environment for heavy vehicles when travelling to site; that is, 100 km/h, and

ii. to withstand a force of 20 times the total mass of the arrow board and its mountings, and

iii. if the arrow board assembly is designed to lift and lower, it must lift or lower within 15 seconds.

i) Have an 'in cabin' control panel placed in close proximity to the operator and illuminated at night. The panel shall include methods of control for, but not limited to, the following:

i. activation of communication equipment

ii. activation of warning lights

iii. activation of arrow board

iv. raising and lowering of arrow board if applicable

v. activation of rear-view camera

vi. raising and lowering of the Impact Attenuator Unit.

j) Be fitted with an approved four-point harness seat belts and mountings (a four-point harness seat belt is also required in the passenger seat if the vehicle is used for training or assessment purposes).

k) Prevention of rearward seat collapse.

To reduce the likelihood of rearward seat collapse in the event of a substantial rear impact:

The driver's seat and seat mountings must be of sufficient strength to prevent rearward seat collapse when subjected to a loading of 740 ± 20 daN (daN – decanewton, a metric unit of force equal to 10 newtons), supplemented by a force equal to 6.6 times the mass of the complete seat, or

Note: This loading must be applied horizontally rearward through the centre of mass of the seat / occupant combination and must be sustained for at least one second.

An engineered and certified device designed to restrict rearward seat collapse when the driver's seat and seat mountings are subjected to the loading described in this point l) must be installed behind the driver's seat.

Note: The device should not increase the likelihood of injury to the seat occupant.

Reference Appendix B of this chapter for further information on rearward seat collapse.

l) Be fitted with high strength headboards to prevent debris from crashing through the cabin in the event of an impact. The backs of these headboards are to be blacked out, so as to contrast / highlight the arrow board and other detailing of the vehicle when viewed from the rear.

m) Be fitted with a minimum of two flashing yellow lamps, positioned on the vehicle in accordance with the requirements of the Queensland MUTCD Part 3 and QGTTM.

n) Have mounting facilities for signs to be mounted to the tailgate or headboard as required by relevant state / territory road authority technical publications.

o) As a minimum, be fitted with communication equipment that will enable simultaneous and independent communication to all relevant personnel, for example, two 5-watt 41 channel UHF radios, operating on separate channels.

p) Be equipped with a warning device of sufficient intensity and volume to be easily heard by workers carrying out their normal duties at least 30 metres from the TMA.

q) Have an independent power back up system installed that will adequately cater for all auxiliary equipment associated with use of the host vehicle as a TMA; for example, this may include the installation of auxiliary batteries or power packs.

r) Be fitted with a camera to allow the TMA Operator to observe traffic approaching from the rear.

Note: Consideration should be given to the use of cameras suitable for both day and night operations, and installation of an associated data recording device to record vehicles approaching from potential impact areas.

s) Must have rear marker plates fitted to the rear of the vehicle.

5.2 Impact attenuator unit testing requirements

Impact attenuators units shall meet all mandatory testing requirements of the following:

- AASHTO Manual for Assessing Safety Hardware for all other Impact Attenuator Units (MASH).

Typical form of evidence for compliance would be or may include test specification report of that particular make and model.

5.3 Impact attenuator unit test level ratings

The following table indicates impact attenuator unit ratings.

Table 5.3 – Impact attenuator unit ratings

Rating	Speed
TL2	70 km/h
TL3	100 km/h

Impact attenuators units shall have their test level rating clearly displayed on both side panels of the unit. The display shall be made up of a panel with black lettering (for example, TL3) on a white 210 mm x 300 mm background.

5.4 Truck mounted impact attenuator unit

Host vehicle shall be as detailed in Section 6.1 of this chapter:

a) Impact attenuator units shall be assembled and fitted to the host vehicle in accordance with the manufacturer's specifications.

b) Flashing yellow light/s shall be fitted to the rear of the impact attenuator unit.

c) The rear surface of the impact attenuator unit when deployed shall consist of Class 400 retroreflective red diagonal striping at least 100 mm wide on a white non retroreflective background.

5.4.1 Truck mounted impact attenuator unit configuration

In addition to these requirements, the following shall apply:

a) dedicated yellow flashing light to automatically provide notice of the impact attenuator unit being raised or lowered

b) automatic impact brake micro switch is to be fitted to the rear of the impact attenuator unit to activate the host vehicle brakes in the event of an impact

c) in-cabin and external audible alarms to automatically provide notice of the impact attenuator unit being raised or lowered

d) travel lock system installed that prevents inadvertent deployment of the impact attenuator unit, and

e) when not deployed, an adhesive type (black on yellow) warning sign stating: 'Caution: keep clear this unit may lower at any time' must be visible from the rear of the impact attenuator unit.

5.5 Trailer mounted impact attenuator unit

Trailer mounted impact attenuator units must be equipped with anti-rotational damper systems (designed to restrict gating of the unit into adjacent traffic lanes). Breakaway cables shall also be used to ensure that the electronic braking system is activated, should the anti-rotational damper system fail.

The minimum recommended weight for the tow or host truck is 4536 kg gross vehicle weight (GVM).

It is important to note that, as the weight of the support or host truck is increased, the 'roll ahead distance' upon impact is reduced.

5.6 Truck mounted attenuator repairs, modifications and inspections

a) All repairs and/or modifications to TMAs and attachments shall be carried out by a competent person.

b) Following repair or modification, TMAs and attachments must be inspected and have certification documentation prepared by a competent person.

c) TMAs and attachments must be inspected at least once each year and have certification documentation prepared by a competent person.

5.7 Traffic control devices

All traffic control devices are to conform to the requirements of and installed in accordance with the Queensland MUTCD Part 3 and QGTTM.

5.7.1 Vehicle mounted signs and devices

All vehicle mounted warning devices shall be in accordance with the requirements contained in the Queensland MUTCD Part 3 and QGTTM. This includes all signs, illuminated flashing arrow sign and flashing yellow lamps:

- illuminated flashing arrow sign
- flashing yellow lamps may be used in conjunction with this sign, provided that the lamps are either appropriately shielded or laterally or vertically displaced from the edge of the sign to avoid visually corrupting the arrow shape or its directional effect
- variable message sign
- all variable message sign boards shown in the Traffic Guidance Schemes and used in conjunction with attenuator operations as a minimum shall:
  - meet AS 4852.2
  - have a display of 1600 mm wide x 1150 mm high as a minimum, and
  - display no more than two messages.

5.7.2 Advance warning vehicles

Advance warning vehicles warn and inform of changes to traffic conditions ahead and give motorists time to adjust their driving patterns.

Advance warning vehicles shall have ‘B’ size arrow board or variable message board.

6 Qualification criteria for operators

This section provides guidance in TMA driver training requirements.

Mandatory requirements for TMA operators:

1. Hold a current and valid Heavy Vehicle licence of a suitable class to operate the TMA.
2. Hold a General Construction Induction Card – CPCCOHS1001A (White Card).
3. Traffic control qualifications. TMA operators must be able to produce evidence that they have completed and maintained currency in traffic control training equivalent to RIIWHS302E ‘Implement Traffic Management Plan’.
4. Completed training and be deemed competent in the operation of a TMA equivalent to RIIRTM301E ‘Operate a Truck or Trailer Mounted Attenuator’.

In addition to the above mandatory requirements, TMA operators also require Traffic Management Implement Training.

For more information on Traffic Management Implement Training, refer to https://www.tmr.qld.gov.au/business-industry/Business-with-us/Traffic-Management/Traffic-management-training.

6.1 Truck mounted attenuator operator training – gained qualifications and experience through competency-based assessment

All TMA operators must successfully complete TMA operator training before operating the TMA. When training has been successfully completed, a statement that clearly identifies the trainee’s name, when the training occurred (date of training), training content and trainer’s details must be provided.

The following elements of competency need to be covered and assessed for training of TMA operators.

6.1.1 Plan and prepare

- Access, interpret and apply compliance documentation relevant to work activity.
- Obtain and discuss safety requirements for the site; for example, Traffic Guidance Scheme (TGS) and Vehicle Management Plan (VMP).
- Set up TMA signage as required by TGS.
- Select vehicles, plant and equipment consistent with requirements for the job.

6.1.2 Conduct truck and attenuator pre-operational checks

Check truck and attenuator (including TMA pre-start check and TMA features and functions).

6.1.3 Check truck mounted attenuator devices and identify positioning of truck mounted attenuator

- Position and check TMA signs and devices.
- Check TMA vehicle warning lights and displays.

- Identify TMA position according to TGS.

6.1.4 Use radio communication

- Check radio.
- Test and verify radio contact between all vehicles and hand-held.
- Check radio contact periodically.
- Use radio communication between vehicles to confirm correct positioning of vehicle.

6.1.5 Operate truck mounted attenuator

- Identify site hazards associated with TMA operations.
- Identify and apply safe operating techniques for TMA.
- Operate TMA to work instructions, including closing lanes and working in a mobile/progressively moving work situation.
- Move TMA safely between work sites.

6.1.6 Carry out operator maintenance

Conduct inspection and fault finding.

In addition, all support staff working with a TMA must be inducted into the TMA, including the communication processes.

7 Operational procedures

This section provides guidance in the operation of TMAs.

7.1 Operational requirements

The following shall be observed when operating a TMA:

a) At all times, the host vehicle's seat belts shall be used.

b) After an impact or crash that may affect the integrity of the host vehicle and / or impact attenuator unit, TMAs and attachments must be inspected (see Section 6.6 of this chapter)

c) No items to be carried in the back of a host vehicle while it is performing the duties of a TMA.

d) The mounting of any fixtures or equipment to the TMA shall be engineered to 20 times the weight of the fixture.

e) Only the operator shall be in the vehicle when the TMA is in use, except if the operator is undergoing training or assessment, in which case the trainer or assessor must occupy a seating position that has the same level of occupant protection as the driver's seat (see Section 6.1 of this chapter – Host Vehicle clauses 'l' and 'm').

f) On request, operators shall produce evidence of successful completion of an approved competency-based TMA training course.

g) When the impact attenuator unit is in the deployed / lowered position, the vehicle may only travel within its own lane or carry out lane changing manoeuvres in the same direction. The impact attenuator unit must be raised when carrying out all other manoeuvres.

h) The impact attenuator unit may only be in the deployed / lowered position when the TMA is engaged at an approved road work site. This may include the preparation and disassembly of an approved TGS.

i) The TMA operator shall remain in the vehicle while it is in operation which includes mobile works, progressively moving works, or setting up a static closure. Once a static closure is in place, the TMA operator should leave the vehicle and may assist with works being undertaken.

7.2 Use of truck mounted attenuators

TMAs shall be used as prescribed in the Queensland MUTCD Part 3 and QGTTM.

7.3 Truck mounted attenuator work instructions

Work instructions shall be produced for the safe operation of TMAs.

Typically, these instructions should include information relating to the following:

- Using TMAs to undertake a static lane closure.
- Using TMAs in a mobile convoy situation or progressively moving work situation.

Appendix A – 15-tonne gross vehicle mass rationale

15-tonne gross vehicle mass (GVM) requirement for truck mounted attenuator host vehicle

Critical to the development of a TMA that affords protection to the public, the road workers and the TMA Operator, is the selection of the host vehicle. The vehicle must be appropriate for the use intended and also comply with all legislative requirements.

There are a number of requirements that affect the selection of the host vehicle. A discussion of critical requirements follows.

Minimum tare mass

For acceptable impact performance, minimum tare mass requirements for host vehicles are set by the manufacturers of Impact Attenuator Units. The two currently available Impact Attenuator Units have minimum host vehicle tare mass requirements of 7.3 tonnes (Safe Stop) and approximately 9.07 tonnes (20 000 lbs) (Scorpion).

The host vehicle tare mass is the mass of the truck with all the components necessary for operation as a TMA.

Weight distribution

To enhance the effectiveness of the automatic impact braking (AIB) system, the rear axle/s should carry a significant proportion of the total TMA mass.

Use of ballasting

The use of ballasting is discouraged. The mounting points of all attachments to a TMA host vehicle are required to withstand a force of 20 times the mass of the attachment. While the attachment of the ballasting to the truck body may meet this requirement, the attachment of the body with ballast to the chassis is unlikely to meet the 20 times mass requirement without significant modification to the mounting points on both the body and to the truck chassis.

Chassis size and strength for impact attenuator unit mounting

Under impact, the loads imposed on an impact attenuator unit are transferred through the mounting assembly into the chassis of the truck. The truck chassis shall be of a size that allows mounting of the impact attenuator unit in accordance with the manufacturer’s specifications. The truck chassis shall also be of sufficient strength to absorb applied loads without significant failure or distortion.

Conclusion

It is recommended that TMA host vehicles with a manufacturer’s GVM rating of at least 15 tonnes will meet these critical requirements.

Vehicles with a lesser GVM rating are unlikely to meet all or possibly any of these critical requirements.

Appendix B – Rearward seat collapse

Prevention of rearward seat collapse

Background

The Queensland Department of Transport and Main Roads experienced a TMA incident where the driver's seat failed in a rearward direction. The driver's head hit the rear of the cabin and the driver also suffered back injuries, which have permanently prevented his return to work.

Rearward seat collapse

The purpose of this requirement is to reduce the likelihood of rearward seat collapse in the event of a substantial impact to the rear of a TMA. This will reduce the likelihood of injury to a TMA occupant.

The purpose of this requirement may be achieved by either of two methods:

1. By design or testing, determine that the seat and mountings are of sufficient strength to withstand, in the rearward direction, similar loading to that applied to the seat and seat mountings in a forward direction for ADR compliance.
2. By fitting a device behind the seat to restrict rearward seat collapse when the same loadings are applied in a rearward direction.

The rearward loading requirements are based on ADR 5/05 requirements.

ADR 5/05 relates to seat belt anchorage strength required to restrain an occupant in a frontal impact. In a rear impact, the seat belt has no effect and rearward movement of the occupant is restrained by the seat structure and seat mountings only.

The TMA requirement is intended to afford a seat occupant a similar level of protection in the event of a rear impact that the ADRs provide in a frontal impact.

ADR 5/05 requires that, for heavy goods vehicles (GVM >12 t) with lap belt anchorages located wholly within the seat structure, the seat and the belt anchorages must withstand the following loading in the forward direction:

> A test load of 740 ± 20 daN supplemented by a force equal to 6.6 times the mass of the complete seat.

The TMA requirement imposes the same loading in a rearward direction to simulate the effects of a rear impact.

Evidence of compliance with these rearward loading requirements can be either by design verification or by representative test results. This evidence would give blanket cover (type approval) to that seat / vehicle combination and the vehicle / seat supplier or verifying engineer would supply certification of same.

If evidence of compliance with additional rearward loading requirements is not available, a device to prevent rearward seat collapse would be fitted.

Note: ADRs require that, to test seat and seat anchorage strength, a rearward longitudinal deceleration of 20 G is applied to the whole shell of the vehicle, without an occupant.

Given this requirement, and that the seat assembly is certified to withstand applied loads in a forward direction, the original equipment seats may meet the TMA requirements.

Appendix C – Traffic Guidance Schemes

The design, selection and implementation of traffic control measures should be based on the Queensland MUTCD Part 3 and QGTTM.

It is of paramount importance in ensuring the safety of all persons, including members of the public at work sites, that there is a high standard of traffic control around, past or through those work sites. This can only be undertaken with a systematic consideration of conditions to be encountered at each site and selecting or designing a specific plan for the control of traffic.

Chapter 5: Methods for controlling traffic and lookout persons

This chapter provides procedures and guidance on the various methods of controlling traffic. Methods for controlling traffic discussed following include manual control via a STOP / SLOW bat; control using portable traffic signal systems, type 1 and 2; and boom barriers.

1 Manual traffic control with a STOP / SLOW bat

1.1 Controlling traffic with STOP / SLOW bat

In addition to the sight distance requirements in the QGTTM Part 7, the Traffic Controller is to stand clear of the travel path on the road shoulder and operate in accordance with the provisions specified in the Tra*ffic Controller Accreditation Scheme Approved Procedure*.

A single traffic controller, when using a STOP / SLOW bat, shall only control a single lane of traffic from one direction.

1.2 Signals or boom barrier failure or malfunction

In the event of a signal system or boom barrier failure, the recommended traffic management response by the Traffic Controller operating these devices would entail:

1. The Traffic Controller who is operating the signals on the closed side of the road stops all traffic in this direction, using a STOP / SLOW bat (this is the critical approach which needs to be managed). It is recognised that this would entail the TC displaying a STOP sign without the use of the required Traffic Controller / PREPARE TO STOP sign being installed for a short period of time.
2. The signals of boom barrier should be switched off or rotated away from traffic to remove any conflicting message.
3. The advance signs for this approach should be changed from ‘signals’ (or boom barrier) to the Traffic Controller sign as soon as possible.
4. Traffic at the other end of the works may be managed in a similar way; however, it is not as critical in terms of response time, as traffic from this direction may continue to flow along the open lane while the other direction is stopped. This approach should be treated as soon as possible after the other end and so that normal STOP / SLOW activities with bats may then proceed.
5. Following the commencement of STOP / SLOW bat control, the faulty devices may then be removed or fixed.

2 Portable traffic control device (PTCD)

2.1 General

PTCDs increase the safety and protection of road users and road workers at the worksite. Portable traffic control devices may include portable traffic signals systems (PTSS) or boom barriers. PTCDs are a traffic control device that either operates without the need for a traffic controller or when operated in manual mode by a traffic controller, shall be operated by using a handheld remote control (wireless or wired) and the traffic controller shall be located a safe distance from traffic.

2.2 Application

Warrants for the use of PTCDs are found in Clause 5.10.1 of the QGTTM Part 3. Any decisions not to use PTCDs in these situations, will need to be supported by a risk assessment (the risk assessment must address why it is considered that the use of a Traffic Controller with a STOP / SLOW bat is safer than using a PTCD at that site and the measures that will be implemented to reduce the potential risks to the Traffic Controller).

Commentary

Transport and Main Roads' vision is that 'there should never be an incident in which a Traffic Controller is killed or seriously injured at work'.

This chapter was developed to facilitate the deployment of PTCD's such as light weight PTSS and boom barriers that allow either a single Traffic Controller (or in some cases, two or more Traffic Controllers) to monitor and control PTCDs deployed at roadworks from a safe location. The benefits of the technology are:

- significant workplace health and safety improvement (as well as being out of harm's way, Traffic Controllers can locate themselves in the shade, where it is cooler, and they have reduced sun exposure)
- ability to manage traffic with one fewer Traffic Controller, in many cases, which will encourage rapid uptake as a result of labour cost savings and largely obviate the need to mandate circumstances in which portable traffic signals be deployed (the Supplement does however elevate Transport and Main Roads expectation that portable signals be used in high-risk locations), and
- ease of installation and operation, when compared with current trailer mounted traffic signal systems that comply with AS 4191.

2.3 Location

Traffic Controllers (TCs) operating PTCDs must do so from a safe location, and as such, the department encourages practitioners to adopt the following recommendations.

The key considerations in determining a safe location for TCs include site geometry, traffic control device position, sight distance, roadside terrain / vegetation, the type of PTCD used, vehicle mix and their approach speeds. Environmental factors (for example, fog, rain, dust or smoke) and time of day/night also need to be considered.

TCs should occupy a position which:

- is clear of the travel path (the risk of being struck by passing vehicles is significantly reduced as the offset distance is increased).
- has an escape path.
- has sight distance from the traffic control station, and also the location the TC will be occupying during PTCD operation, to approaching traffic.
- aims to ensure that drivers focus on the PTCD, and not take cues directly from the TC.

- enables effective communication to both site workers and other TC (if applicable). If a single TC is operating two PTCDs, an added consideration is to ensure the operating range of the hand-held remote controller is not exceeded.
- enables the TC to identify the last vehicle before changing to STOP.
- is close enough to the PTCD to allow the TC to commence STOP / SLOW bat duties in the event of a system failure. In the case of a single TC operating two PTCDs, the TC should be located at the end which is on approach to the closed section of road (as this is the critical approach to control in the event of a failure).
- has visibility of the PTCD (either the front face or rear indicator light) and traffic queues. In the case of a single TC operating two PTCDs, the TC should be located to have visibility of both devices and traffic queues for each approach.

In addition to these recommendations, other considerations include:

- Planning the site arrangements so that, where possible, one hand-held remote controller can be used to operate the PTCDs.
- Using an elevated location (to maximise sight distance).
- Positioning the TC behind safety barrier (clear of deflection zone).
- Parking vehicles clear of the traffic control station.
- Using shade to reduce sun exposure and heat stress wherever appropriate.
- Managing fatigue; for example, if a suitable position is available, the TC may be seated while performing TC duties.

2.4 Boom barrier

Generally, a boom barrier can be used at any location in lieu of STOP / SLOW control or where a PTSU is suitable.

While a single traffic controller using a STOP / SLOW bat shall only control traffic in one lane from one direction, under certain conditions it may be appropriate for a single traffic controller to control up to two boom barriers, subject to the requirements in Section 2 of this chapter above.

Where this occurs, the traffic controller shall use a single hand-held remote controller (HRC) to control up to two boom barriers to manage traffic as follows:

- Shuttle flow: a single traffic controller controlling a single lane approach from both sides of the work area, using one boom barrier per approach, and permitting traffic to flow alternately from each end through a single lane section past the work area.
- Plant crossing: traffic from both approaches is stopped to allow works to occur or plant to cross while the road is closed for a short period of time. A single traffic controller controlling a single lane approach from both sides of the work area or crossing point by using one boom barrier per approach, or
- Gating control: road closure on a single or multilane, divided, or one-way road for a short period of time where up to two lanes may be closed by the one traffic controller controlling up to two boom barriers, one for each lane at the closure point.
- For more information on shuttle flow, plant crossings and gating control see Section 2.5 below.

Commentary

There may be times where traffic control, using a boom barrier, at a three or four-leg intersection with a prominent traffic flow path may be managed using a two boom barriers with a single HRC under manual control for the prominent traffic flow path (normally the through leg movements under shuttle flow arrangements). Either a TC with a STOP / SLOW bat or a PTCD with an individual HRC may be used to control traffic on the terminating or each minor approach legs.

2.5 Portable traffic signals

2.5.1 Introduction

This section outlines the operational requirements for two different portable traffic signal systems (PTSS) that are approved for use in Queensland.

The requirements ensure that:

- PTSS are operated effectively and consistently by accredited Traffic Controllers trained and competent in their use, and
- the risk to road workers, Traffic Controllers and road users is minimised.

PTSS can be used for three types of traffic control:

- shuttle control
- plant-crossing control, or
- gating control.

There are four user selectable modes of operation:

- flashing yellow
- manual
- vehicle-actuated, or
- fixed time.

2.5.2 Definitions

Table 2.5.2 – Definitions

Expression	Definition
actuation	The electrical action produced by a vehicle (on a vehicle detector) to enable the controller to recognise its presence.
All-red time	A period of time during which only red aspects are illuminated for all movements.
approach	That section of road, consisting of one or more lanes, used by vehicles approaching an intersection or mid-block site.
aspect	A single optical system (circular, arrow or symbolic) on a single face capable of being illuminated at any given time. Red, yellow and green aspects are used for vehicle movements.
controller	The equipment (including the housing) that switches power to signal lanterns and controls the duration and sequence of signal displays.

Expression	Definition
Cycle length (cycle time)	Time required for one complete sequence of signal displays. For a given movement, cycle time is the sum of the durations of red, yellow and green signal displays.
flow rate	Number of vehicles per unit time (normally per hour) passing (arriving or departing) a given reference point.
Green time	Duration of the green display for a phase or movement.
Hand-held Remote Controller (HRC)	A hand-held remote/device which can control and set the PTSS lanterns. This allows the Traffic Controller to control operations without being physically located at a PTS.
Long-term	The description which applies when a Traffic Guidance Scheme is required to operate both day and night and may be left unattended.
Maximum green time	The maximum duration of the green display that can continue to be illuminated after a demand for another phase had occurred.
phase	That part of a signal cycle during which one or more movements receive right-of-way subject to resolution of any vehicle conflicts by priority rules. A phase is identified by at least one movement gaining right-of-way at the start of it and at least one movement losing right-of-way at the end of it.
Portable Traffic Control Devices (PTCD)	A traffic control device that either operates without the need for a traffic controller or when operated in manual mode by a traffic controller, shall be operated by using a handheld remote control (wireless or wired) and the traffic controller shall be located a safe distance from traffic.
Portable Traffic Signal Unit(s) (PTSU)	An individual portable traffic signal that consists of the traffic signal lantern, battery, communications equipment, mounting assembly and base.
Portable Traffic Signal System(s) (PTSS)	Traffic light signals and associated equipment that provides signalling for temporary control of traffic at work sites.
Red time	Duration of the red signal for a phase or movement.
Short-term	The description which applies when a Traffic Guidance Scheme is required only while work personnel are in attendance. The time is generally limited to the duration of a single work shift or lesser period where road conditions are returned to normal when the shift or lesser period ends.
Signal lantern	A signal assembly of optical components (one or more aspects), together with the means of connecting them to power supply and facilities for mounting the complete assembly.
Stop line	A single continuous line marked across all or part of a road, behind which vehicles should stand when required to stop by traffic light signals or regulatory signs.
Temporary traffic signal system	An electrically operated signalling system that provides traffic signals for the temporary control of vehicular traffic at road works, bridge works or similar applications. The system is installed temporarily to the road using the same standard traffic signal equipment used at permanent sites.
Traffic Controller / flag person	A person who holds an appointment as an accredited person under section 21 of the Transport Operations (Road Use Management) Act 1995 to perform the functions of a Traffic Controller as prescribed by the Transport Operations (Road Use Management - Accreditation and Other Provisions) Regulation.
Unattended operation	Vehicle actuated operation and fixed time operation.
Yellow time	Duration of the yellow display for a phase or a movement.

2.5.3 Types of portable traffic signal systems

2.5.3.1 General

The technical requirements of Type-1 PTSS are defined in MRTS264 *Type 1 Portable Traffic Signals* and the requirements of Type-2 PTSS are defined in MRTS265 *Type 2 Portable Traffic Signals*. The Type-1 PTSS provides a simpler, easy to deploy system with reduced functionality compared to the Type-2 PTSS. The Type-1 units only work in manual mode and are used for shuttle flow, plant crossing and gating control.

A PTSS operating under manual mode may be used to control traffic at the approach legs to an intersection (signalised or unsignalised) under the same procedures as Traffic Controllers using STOP / SLOW bats. If all approaches are controlled by PTSUs, each approach may be independently controlled by a Traffic Controller (one TC with one HRC controlling a PTSU).

There may be times where traffic control at a three or four leg intersection with a prominent traffic flow path may be managed using two PTSUs paired with a single HRC under manual control for the prominent traffic flow path (normally the through leg movements under shuttle flow arrangements). A TC with a STOP / SLOW bat or a PTSU with an individual HRC is required to control traffic on the terminating or each minor approach legs.

PTSUs, when not in use, shall face away from traffic or be covered and all signs for the device shall be removed or covered.

PTCDs other than PTSS that accomplish the same outcome of removing Traffic Controllers from the road (for example, boom barriers) may also be used in lieu of Traffic Controllers. These alternative systems shall be approved for use by the Department of Transport and Main Roads (Engineering and Technology) and may be supported by approvals from the ARRB Transport Infrastructure Product Evaluation Scheme.

2.5.3.2 Type-1 portable traffic signal systems

Where used Type-1 PTSS shall consist of either one PTSU, or two PTSUs if paired, with a single HRC operated by a Traffic Controller. When paired, control is limited to shuttle flow operations.

Where the PTSS consists of one HRC paired with two PTSUs:

- Visibility to the PTSUs and approaching traffic shall be assessed before confirming the number of controllers required, noting that visibility can vary with weather condition, day light, local lighting, road geometry and the presence of roadside objects. Where visibility to both PTSUs and approaching traffic from both directions is available, traffic may be controlled using a single Traffic Controller.
- Visibility to both PTSUs and approaching traffic from both directions by one Traffic Controller is restricted:
  - two Traffic Controllers (one per PTSU) are required
  - the operating procedure is as per standard stop / slow arrangements
  - only one of the two Traffic Controllers will operate the PTSS with a fully functional HRC: the other Traffic Controller monitors the other PTSU and associated traffic and provides information to the operator, and
  - each Traffic Controller shall be equipped with radio communication.

A PTSS consisting of two or more PTSUs (not paired) with each PTSU being controlled by a single HRC may be used under the following conditions:

- Where visibility to both PTSUs and approaching traffic from both directions by one traffic controller is restricted.
- Where a single HRC cannot communicate effectively with both PTSUs.
- Where traffic control is required at intersections or for plant crossing.

In any of these cases the following will apply:

- traffic controllers (one per PTSU) are required
- each traffic controller has an HRC controlling a single PTSU
- the operating procedure is as per standard stop / slow arrangements, and
- each traffic controller shall be equipped with radio communication.

2.5.3.3 Type-2 portable traffic signal systems

Type-2 PTSS comply with MRTS265 *Type-2 Portable Traffic Signals*.

A Type-2 PTSS has the following features:

- three modes of operation
  - manual
  - fixed time, and
  - vehicle actuated
- adjustable time settings, and
- minimum battery life of seven days without recharging.

During manual operation, the Traffic Controller controls the sequence and time for which the green signals are displayed. The Traffic Controller cannot override the configured minimum green time and all-red time after initial configuration and operation has commenced.

Two Type-2 PTSUs shall be used for gating control on a two-lane one-way road (refer to Section 2.5.5.3 of this chapter).

Vehicle-actuated mode shall be used when operating unattended shuttle control, except if the vehicle detectors fail.

A Type-2 PTSS can operate unattended. When operating unattended, a Type-2 PTSS shall be inspected at least once every 24 hours to confirm its correct operation or shall have remote error monitoring and reporting functionality.

When unattended, the contractor’s after hours contact details shall be displayed prominently on all PTSUs.

2.5.4 Application guideline

Table 2.5.4 – Application guideline of portable traffic signal systems

	MANUAL OPERATION			VEHICLE-ACTUATED / FIXED-TIME OPERATION
TYPE	shuttle control	plant crossing control	gating control	shuttle control
TYPE-1	✓	✓ (independently operated PTSUs only)	✓ (single lane only)	
TYPE-2	✓	✓	✓ (single and two lanes)	✓ (in vehicle-actuated mode, fixed-time mode as fall back mode only)

2.5.5 Control types

PTSS can be used in three forms of traffic control:

- shuttle control
- plant crossing, and
- gating control.

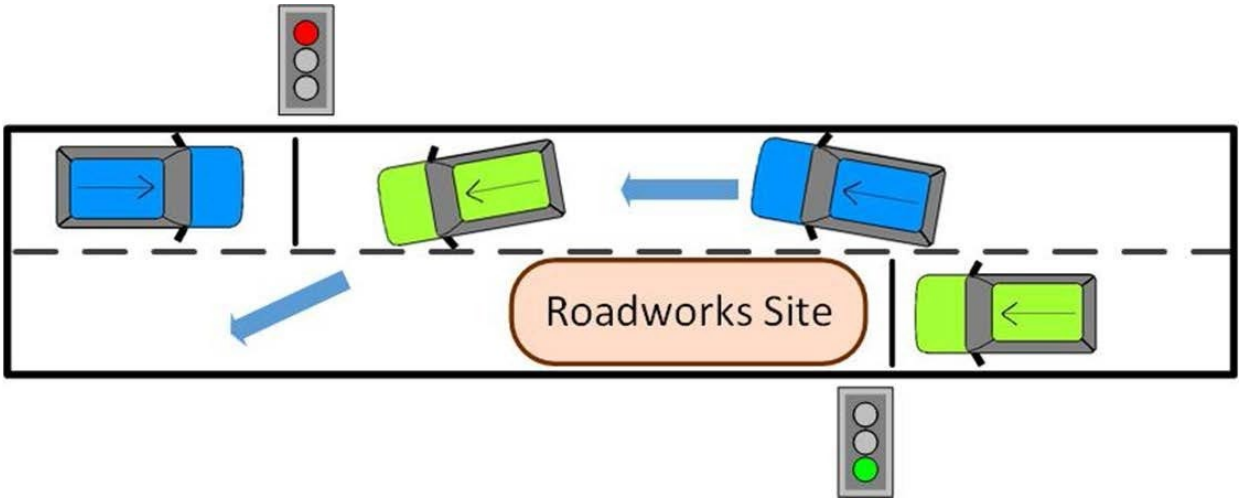
2.5.5.1 Shuttle control

PTSS may be used in lieu of Traffic Controllers for shuttle control operations. This type of control is generally used on a two-lane two-way road, where one lane is closed for maintenance and the other is shared by traffic from both approaches.

Shuttle control uses two PTSUs.

Each PTSU indicates which direction of the traffic flow may proceed past the roadworks site. A PTSU is used at each end of the work zone, and only one PTSU can be green at a time. When there is a need for complete access to the roadway for a short period, both PTSUs can be red.

Figure 2.5.5.1 – Shuttle control



2.5.5.2 Plant crossing control

One PTSU shall be used on each road approach to temporarily stop traffic at a road work site where plant needs to cross the roadway.

This control type allows the signals on both approaches to display the same signal (that is, green, yellow and red simultaneously).

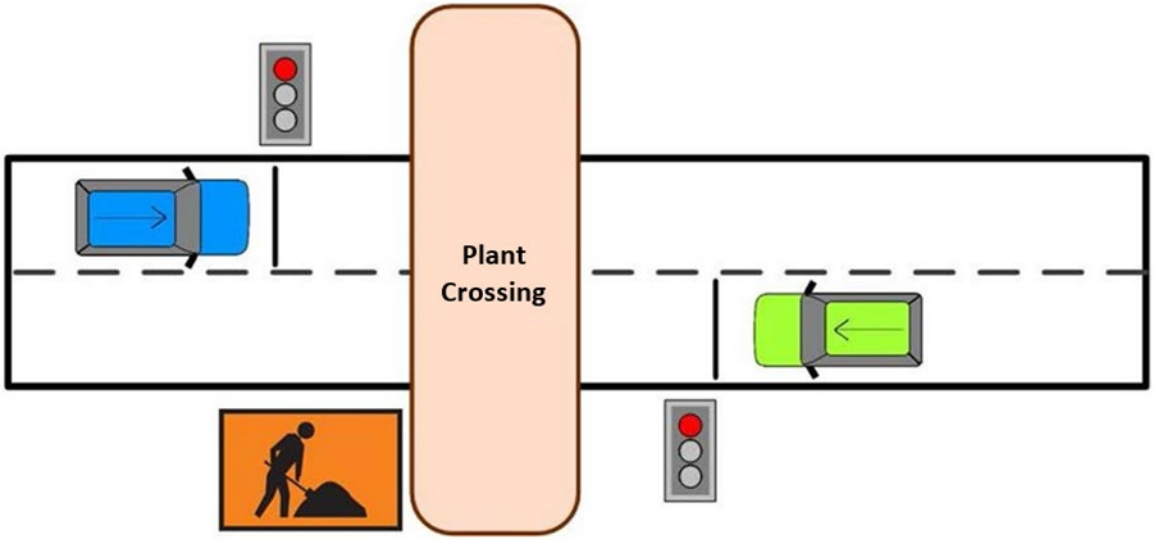
Appropriate measures to control traffic on the plant crossing shall be implemented.

Manual operation is safer and more effective in preventing delays to vehicles on both the road and plant crossing.

Plant crossing control may be undertaken with unattended vehicle actuated operation if the following conditions are met:

- A PTSU is used on each approach (both the road and the plant crossing).
- The PTSS used has the capability to hold a permanent call on the through road to allow the signals to dwell on green and the signals on the plant crossing are vehicle actuated as required.
- A site-specific risk assessment has been completed which addresses the operational details (for example, volumes of both the through road and plant crossing and vehicle types using the plant crossing).

Figure 2.5.5.2 – Plant crossing control



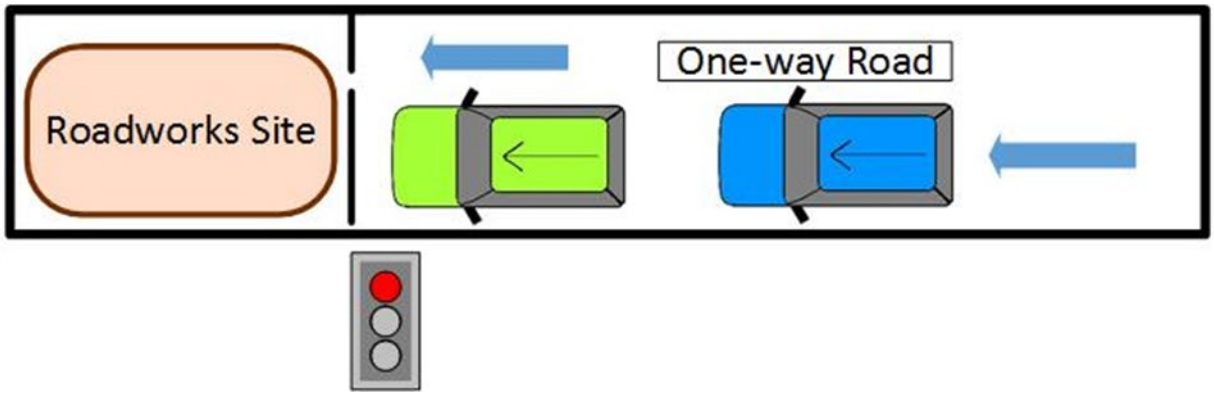
2.5.5.3 Gating control

Gating control is the control of traffic from a single approach. Gating control is permitted in accordance with Table 2.5.5.3.

Table 2.5.5.3 – Gating control on one-way roads

Approach	Type of PTSS	Number of PTSU
Single lane operation	Type-1 or 2	1
Two lane operation	Type-2	2

Figure 2.5.5.3 – Gating control



2.5.6 Modes of operation

The permitted modes of operation for PTSS are outlined in Table 2.5.6.

Table 2.5.6 – Permitted modes of operation and control types

	Shuttle control	Plant crossing control	Gating control
Manual operation	✓	✓	✓
Vehicle-actuated operation	✓	✓ (see Section 2.4.5.2)	
Fixed-time operation	Fall-back mode only		
Flashing yellow operations	See Section 2.4.6.1		

2.5.6.1 Flashing yellow operation

In flashing yellow mode of operation, the yellow aspects on all PTSUs continually flash.

This operation mode occurs in response to:

- start-up conditions
- faults or failure conditions, and / or
- manual selection of flashing yellow mode (Type-2 PTSS).

2.5.6.2 Manual operation

In manual mode, the lantern signals are manually controlled remotely from a safe location.

Manual operation should be used when:

- traffic is required to be kept out of the live lane for an extended period (for example, to accommodate work vehicle movements)
- a vehicle detector fails when using vehicle-actuated operation, and it is not appropriate to switch to fixed-time operation, and
- other situations where optimal traffic flow is not being achieved by vehicle actuated mode.

Where manual operation is used, the operator shall ensure that all-red times are sufficient to clear the control area of opposing traffic

2.5.6.3 Vehicle actuated operation

Vehicle-actuated operation allows a variable sequence and variable duration of signal displays. In this mode, a PTSS operates automatically. It responds to actuations from vehicle detectors installed on each PTSU. For details of sequence and timing of signal displays, refer to AS 4191 *Portable Traffic Signal Systems*.

Vehicle-actuated operation should be the normal mode of operation for Type-2 PTSS.

2.5.6.4 Fixed-time operation

In this mode, the duration of the greens and all-reds are fixed, and the PTSS cycles through a fixed sequence. The operator sets the green and all-red times at the PTSS controller. These time settings operate until the signals are switched off or the timer is reset.

Type-2 PTSS shall not be operated in fixed time operation unless the vehicle detectors have failed.

2.6 Equipment installation

2.6.1 Safety considerations

Only a nominated trained and competent Traffic Controller may operate PTSS in manual mode.

It is the responsibility of the Traffic Management Designer to determine the location, operation mode and operation parameters of the PTSS. Operation parameters (including any on site changes) shall be documented for record keeping purposes.

PTSS shall only be operated when all safety, operation and service instructions contained in the manufacturer's manuals are understood by the operator. Operators shall understand and comply with the manufacturer's instructions accompanying each PTSS (this supplement does not replace the field service manual and instructions accompanying each set of equipment).

PTSUs shall be located a safe distance from the traffic path, which would generally be not more than one metre from the travelled path; however, this may need to be increased in particular circumstances so that wide loads or turning vehicles will not impact the unit. PTSUs shall not be located within the taper and shall be installed so that their signal lanterns are approximately vertical (± 5 degrees).

The location of PTSUs should also consider the impact of work vehicles and plant (including the impact of vehicle mounted warning devices and other lights at night) on the visibility of the signals, especially when they are located or parked in the background.

For unattended operation, weather conditions shall be monitored to ensure they do not exceed manufacturer’s specifications (for example, wind speed).

PTSS using wireless communications are not to be used near blasting activities.

For shuttle control, the maximum operating distance should be based on the requirements in QGTTM.

The lantern faces, the vehicle detectors and solar panels (if used) shall be kept clean. PTSS batteries shall be fully charged before operating the unit.

2.6.2 Lanterns

Portable traffic signal lanterns shall be clearly visible to approaching traffic stopped behind the stop line or the STOP HERE ON RED SIGNAL sign.

Additional signal lanterns may be used on an approach, if appropriate for traffic or site conditions. A second signal lantern used on an approach provides redundancy – for example, one lantern may fail, or signals may be knocked or turned so that the signals are no longer facing traffic.

Before operating a PTSS, the visibility of each PTSU shall be assessed. To ensure visibility, these factors should be considered:

- deep shade
- the direction of the sunlight, and
- background conditions.

A PTSS with a target board may be required if visibility is compromised based on this assessment.

2.7 Time settings

2.7.1 General

The time settings listed following are set to the time settings determined by the Traffic Management Designer when the signals are installed on site.

Table 2.7.1 – Time settings

Time setting	Controlling factors
Yellow time	The speed limit, gradient and vehicle types on the approach to the signals.
All-red time	The distance between the stop lines and the speed limit (refer to Section 2.7.3 of this chapter)
Minimum green	Traffic volume (5 – 10 seconds)
Maximum green	Work zone length and traffic volume (refer to Section 2.7.4 of this chapter)

In fixed-time and vehicle-actuated modes of operation, the times are selected manually for each site. In manual operation, the timings are manually controlled in each cycle.

2.7.2 Yellow time

The length of yellow time shall be four seconds for Type-1 PTSS. The length of yellow time for Type-2 PTSS may be increased from four seconds with consideration to the controlling factors. For guidance, refer to Austroads *Guide to Traffic Management Part 9: Traffic Operations*.

2.7.3 All-red time

The all-red time is the time period after one approach changes to red, and before the opposite approach changes to green.

The all-red time shall be long enough to allow a vehicle to pass the stop line, and safely clear the work zone while travelling at the speed limit. The all-red time varies according to the work zone length and the posted speed limit. (The work zone length is measured as the distance between the stop lines at each traffic signal unit.)

All-red times for various speeds and work zone lengths are shown in Table 2.7.1. The relationship between the all-red interval and travel distance for a range of vehicle speeds is also illustrated in AS4191.

Table 2.7.3 – All-red time (to the nearest 0.5 second)

Distance between stop lines (m)	Work Zone Speed Limit (km/h)			
	20	**40**	**50**	**60**
50	9.0	4.5	3.5	3.0
100	18.0	9.0	7.0	6.0
150	27.0	13.5	11.0	9.0
200	36.0	18.0	14.5	12.0
250	45.0	22.5	18.0	15.0
300	54.0	27.0	21.5	18.0
350	63.0	31.5	25.0	21.0
400	72.0	36.0	29.0	24.0
450	81.0	40.5	32.5	27.0
500	90.0	45.0	36.0	30.0
550	99.0	49.5	39.5	33.0
600	108.0	54.0	43.0	36.0
650	117.0	58.5	47.0	39.0
700	126.0	63.0	50.0	42.0
750	135.0	67.5	54.0	45.0
800	144.0	72.0	57.5	48.0

For distances or speed limits other than those nominated in Table 2.7.3, the all-red time shall be calculated using the following formula:

$$t_{ar} = \frac{3.6L_c}{V_d}$$

where

$$t_{ar} = \ all\ red\ time - must\ be\ equal\ or\ greater\ than\ 1.0$$

$$L_c \ = \ distance\ between\ stop\ lines\ (m)$$

$$V_d = work\ zone\ speed\ limit$$

2.7.4 Maximum green time

The maximum green time varies with the two-way traffic flow and the work zone length.

Longer maximum green times may be used in vehicle-actuated operation, as the green time will only run to the maximum time where necessary. For fixed-time control, shorter green times are required. Unnecessary delays may occur if unsuitable green times are used.

Appropriate maximum green time values for both approaches may be selected from Table 2.7.4(a) (vehicle actuated operation) or Table 2.7.4(b) (fixed time operation).

Table 2.7.4(a) – Initial maximum green times for vehicle-actuated operation

Work Zone Length (m)	Two-way Traffic Flow (veh/h)						
	200	**300**	**400**	**500**	**600**	**700**	**800**
50	60	60	60	70	80	90	100
100	60	60	60	70	80	90	100
200	60	60	60	70	80	90	100
300	60	60	60	70	80	90	90
400	60	60	60	70	80	80	80
500	60	60	60	70	70	80	Work zone too long for traffic volume
600	50	50	50	60	70	Work zone too long for traffic volume	
700	40	40	40	50	Work zone too long for traffic volume		
800	30	30	30	Work zone too long for traffic volume			

The maximum green times for vehicle-actuated operation allows for some variation in traffic flow while ensuring a reasonable maximum cycle time. The actual cycle time for any cycle is dependent on the traffic demand, but the maximum cycle time shall always be less than 240 seconds.

Table 2.7.4(b) – Initial maximum green times for fixed-time operation

Work Zone Length (m)	Two way Traffic Flow (veh/h)						
	200	**300**	**400**	**500**	**600**	**700**	**800**
50	20	20	20	20	20	20	20
100	20	20	20	20	20	20	20
200	20	20	20	20	20	21	26
300	20	20	20	20	22	32	37
400	20	20	20	23	28	38	48
500	20	20	20	29	34	44	Work zones too long for traffic volume
600	20	20	25	30	40	Work zones too long for traffic volume	
700	20	21	26	36	Work zones too long for traffic volume		
800	20	22	32	Work zones too long for traffic volume			

The green times given in Table 2.7.4(b) were calculated (using aaSIDRA) to give the minimum practical cycle time with a degree of saturation less than 0.9. They assume traffic flows in each direction are equal. Allowance has been made for some peaking within the hourly volume and for 4% heavy vehicles. Inter-green times for each work zone length were calculated by adding four seconds yellow time to the 40 km/h all-red times from Table 2.7.3.

These values are given as a starting point only. They are appropriate if traffic flows are similar in both directions and the two-way flow is known. The initial settings may be adjusted in accordance with Section 2.8.3 of this chapter. If long queues are regularly occurring on one approach, the maximum green time should be increased for that approach only. Manual operation may be used to provide traffic control if vehicle-actuated operation is not sufficient to clear the traffic.

2.8 Operation

2.8.1 Monitoring portable traffic signal systems

The performance of the PTSS shall be monitored to ensure that the assumptions made for the system set-up are correct.

When monitoring and evaluating the operation of a site:

- Are traffic flows actually as predicted?
- Is traffic avoiding the signalised site, and creating congestion elsewhere?
- Is the equipment (controller) operating as designed?
- Are signal phasings and timings adequate?
- Are yellow times appropriate (in relation to vehicle stopping characteristics, and times provided between phases to clear traffic from the controlled area)?
- Is traffic being held for long periods of time at a red signal, when adequate gaps exist in a running movement?
- Are there delays to vehicles (and pedestrians) on each approach?
- Is the number of vehicles left in a queue at the termination of the green period, and the number of vehicles stopped more than once in each queue, at satisfactory levels?
- Are vehicle detectors appropriately located to detect traffic as intended, in both the passage and presence mode?
- Are unusual vehicles being missed by detectors, and are they in sufficient numbers to justify special detection techniques?

The following checks shall be made to ensure the correct operation of PTSS:

- When operating in unattended operation, Type-2 PTSS shall be inspected to confirm its correct operation at least once every 24 hours or shall have remote error monitoring and reporting functionality. Contact details of the relevant persons shall be available on the body of PTSS for reporting any fault with the PTSS.
- With Type-1 and Type-2 PTSS, an alternative control arrangement shall be available to be put in place if the PTSS fails.
- For Type-1 PTSS, Traffic Controllers and STOP / SLOW bats should be available in case of failure of the PTSS.

2.8.2 Trouble shooting vehicle actuated operation

Table 2.8.2 – Trouble shooting in vehicle actuated operation (Type-2 PTSS)

Problem	Cause	Remedy
Long queues	Green time too short	Increase maximum green time setting (do not exceed the value given in the Table 2.7.4(a))
	Vehicle detector fault	Call service, and operate as fixed-time or manual operation until fixed
	Capacity exceeded	Call supervisor
Signals do not change	Vehicle detector fault	Call service, and operate as fixed-time or manual operation until fixed
Green period is always the same length and longer than required	Vehicle detector fault	Call service, operate as fixed-time or manual operation until fixed
Traffic still in work zone at start of opposite green	All-red time too short	Increase all-red time setting
Long gap between last vehicle clearing and start of next green	All-red time too long	Decrease all-red time setting
	Vehicle detector fault	Call service, and operate as fixed-time or manual operation until fixed
Signals do not dwell on all-red time in absence of traffic	Vehicle detector fault	Call service, and operate as fixed-time or manual operation until fixed

2.8.3 Adjusting green time for fixed-time operation

If the green times of Type-2 PTSS are too short (that is, the queue does not clear in the first cycle), they should be increased gradually by:

- Switching the signals to manual mode for one or two cycles to clear the queue
- Switching back to fixed-time mode and count how many vehicles do not get through in the first cycle
- Adding two seconds of green time for each vehicle that does not clear the work site
- Observing the signals over three cycles and subtract green time if the queue clears before the end of the green time.

Vehicle-actuated operation shall be used if traffic volumes significantly change throughout the work shift (for example, if traffic volumes are considerably higher in the peak hour). If the signals are in fixed-time operation, the maximum green time shall be adjusted throughout the day to suit the prevailing traffic conditions.

3 Lookout protection method

3.1 Introduction

The use of the lookout protection method is discussed in the *Queensland Guide to Temporary Traffic Management* (QGTTM) *Part 5*. Lookouts are used as a safety protection measure to watch for approaching road traffic and alert workers to vacate the roadway before road traffic arrives.

Lookouts must keep a continuous watch for approaching road traffic for personnel carrying out work tasks. On sighting approaching road traffic, the lookout must be able to warn the workers in time to allow them to react to the warning and move themselves and their tools/materials to a safe position before the road traffic arrives. Please note that safety barriers or guardrails may block escape paths - a position of safety off the roadway must be available for both workers and the lookout.

As lookout protection relies solely on the lookout keeping watch for road traffic hazards, work on the roadway (high-risk zone) must only be done where sight distances can be met, and visibility allows. Daylight hours are recommended. Where lookouts are required to be used at night, the risk must be assessed, and precautions taken to ensure the lookout can identify the approach of vehicles accurately and clear workers from the road in a safe and timely manner.

Under lookout protection:

a) The roadway will not be made unsafe for road traffic movement or obstructed by plant or equipment.

b) Only tools and equipment that can be cleared quickly can be used by the worker/s under lookout protection. For example, survey rods, cameras, small hand tools.

c) A position of safety off the roadway must be available and accessible for workers and lookouts (no barriers or other obstacles that may impede access).

d) Minimum sight distance must be maintained at all times by the lookout and the distance confirmed through physical measurement for example, laser measure, car odometer or measuring wheel.

e) The time taken to clear the high-risk zone (roadway) must be tested before work starts at the site. This should be tested off the roadway with any equipment/materials the worker will be using or carrying.

f) Extra precautions must be taken when using lookouts at night (see Clause 2).

g) Lookouts cannot do any other work while performing lookout duties.

h) Lookouts must remain in close enough proximity to workers who require lookout protection to ensure warnings can be given effectively.

i) Lookouts must warn workers immediately of the approach of traffic and in ample time to make sure workers and/or equipment are moved to a position of safety.

j) Lookouts must use an appropriate warning method for the type of work being undertaken and the environment, for example, a verbal warning would not be suitable if the works are noisy, or the lookout is on the verge - a siren and/or vibrating device may be more appropriate.

k) Workers must remain in a position of safety until the lookout gives the all-clear and the traffic has moved past the work area.

3.2 Using lookouts at night

It is important to remember that:

a) Distances cannot be judged accurately in low light conditions.

b) It is harder to judge the speed of approaching vehicles in low light conditions.

c) Peripheral vision is severely compromised in low light.

d) Vehicles become difficult to see as contrast is low.

e) It is harder to identify the type of vehicle, for example a motorbike from a car, if only 1 headlight is working.

If lookouts are to be used at night, a risk assessment and other controls should be put in place to ensure the use of lookouts is appropriate for the site conditions, activities involved and the safety of workers (and lookouts).

Considerations for using lookout protection at night, should include the following:

a) Traffic volume – low volume recommended.

b) Traffic speed.

c) Sight distances.

d) Traffic noise (ability to hear approaching traffic).

e) Ability to see vehicles / vehicle lights approaching on side roads.

f) How will the lookout identify when vehicles have entered the danger zone for workers?

g) Lighting of path to position of safety for workers and lookouts.

3.3 Minimum warning time

Table 3.3 shows an example to calculate the minimum warning time that can be used for determining the required minimum sight distance in Table 3.4 (e.g., 15 seconds).

The required minimum sight distance (Table 3.4) will vary depending on the time required to clear the roadway to a position of safety and the speed of approaching traffic.

The time required for workers and equipment to move to a position of safety MUST be tested and confirmed prior to workers entering the roadway.

Table 3.3 – Minimum warning time calculation example

Example – Minimum warning time		
	7 seconds	Time required for workers and equipment (and lookouts) to move to position of safety. This time will vary depending on width of roadway, work being carried out, the equipment being used, and the location of the position of safety. This time must be tested (off the road) prior to works commencing.
	3 seconds	Reaction time (includes lookout and worker). 3 seconds is the minimum time allowance.
	5 seconds	Workers and lookouts reach a position of safety before traffic arrives. 5 seconds is the minimum time allowance.
=	**15 seconds**	**Total time required (minimum)**

It is important that the responsible person on site identifies the correct minimum warning time for workers to clear the roadway in conjunction with the lookout and tests this timeframe before lookout protection is endorsed for use and before workers move onto the roadway.

3.4 Minimum sight distance

The minimum sight distance required for the lookout and workers to react appropriately to the approach of traffic is identified in Table 3.4 below.

Various parts of the QGTTM include a table providing the minimum sight distance for a lookout person. However, the values provided within QGTTM are limited to situations where a worker travels up to a maximum of 3.5 m between their work location and a nearby shoulder or median.

As a worker's position of safety may not always be the nearest shoulder or median, nor the escape distance be limited to 3.5 m or less, the provisions of this technical note have been published for use in Queensland to provide additional guidance for the use of lookout protection.

Other requirements and considerations include the following:

a) A clear line of sight MUST always be able to be maintained.

b) A physical marker MUST be used to identify the sight distance.

c) Weather conditions or visual obstructions may affect the ability to maintain sight distance.

d) At night it is suggested a physical marker with working lights be used so lookouts can clearly see when a vehicle is within the required distance for the road to be cleared of workers.

Table 3.4 – Minimum sight distance (m)

Speed limit (km/hr)	**Minimum warning time (see Clause 3)**			
	15 seconds	**20 seconds**	**25 seconds**	**30 seconds**
	Minimum sight distance (m)			
40	185	245	310	370
50	230	310	385	460
60	275	370	460	550
70	325	430	535	645
80	370	490	615	735
90	415	550	690	825
100	460	615	765	920
110	505	675	840	1010

Source: Working in Proximity to Traffic Awareness Part 2 (Transport and Main Roads, 2018)

3.5 Lookout responsibilities

Lookouts must:

a) Keep watch for traffic approaching the worksite from any direction – maintaining continual vigilance by monitoring / looking at all relevant approaches (for example, each way on a two-way road).

b) If traffic approaches the worksite, warn workers immediately to get off the road to a position of safety.

c) Give the all-clear signal for workers to move back onto the roadway - all traffic must be safely past the worksite before this occurs.

Responsible person on site:

The responsible person on site, is accountable for:

a) Risk-assessing the use of lookouts.

b) Deciding how many lookouts are needed to protect the workers.

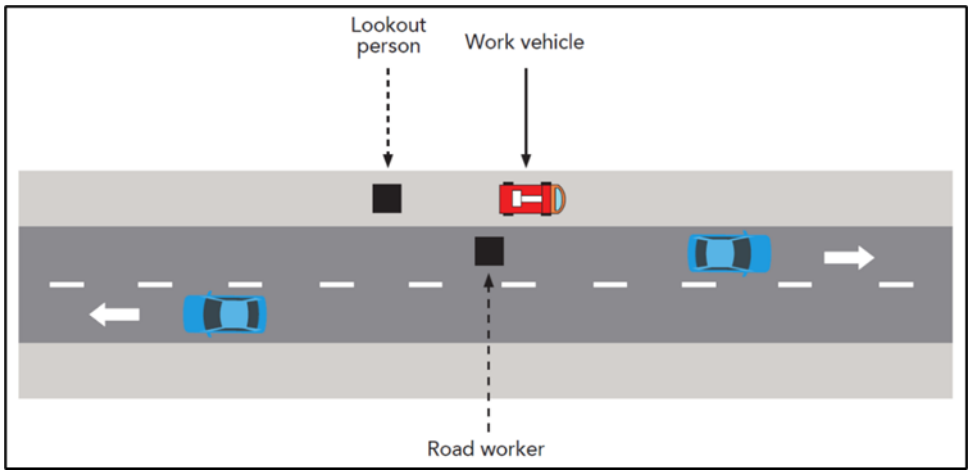
c) Assigning lookouts to the work site and advising workers of the lookouts who have been assigned.

d) Telling workers and lookouts about the location/s of position/s of safety.

e) Ensuring the time to clear the roadway is tested (in an off-road location) prior to implementation on the road.

f) Deciding how lookouts will warn workers by use of one or more of the following: whistles, sirens, other suitable means.

Figure 3.5 – Example worksite using lookout protection method



3.6 References and further information

a) *Queensland Guide to Temporary Traffic Management Part 5: Short Term Low Impact Worksites*.

b) *Working in Proximity to Traffic Awareness Part 2*.

Chapter 6: Traffic management administration

This chapter is a supplement to the Transport and Main Roads Specification MRTS02 *Provision for Traffic*, Queensland *Manual of Uniform Traffic Control Devices* (MUTCD) Part 3 – Works on Roads, and the *Queensland Guide to Temporary Traffic Management* (QGTTM). It provides guidelines to practitioners for keeping a video record of traffic guidance schemes.

1 Video record keeping of traffic management at roadworks

1.1 General

It is a requirement that supervisory personnel at roadworks sites collect and retain appropriate records in line with the requirements of the QGTTM, and where applicable the MRTS02 *Provision for Traffic*. Adequate record keeping is important for managing speed compliance where enforcement measures are being undertaken by the Queensland Police Service (QPS), and in the event of an incident and subsequent legal proceedings, if any.

To improve the capability of site staff in meeting their record keeping requirements, the QGTTM recognises that video record keeping is an acceptable alternative method for recording the details of the traffic control devices on site (Section 7.5 of AGTTM06-19).

This chapter has been developed to provide guidance for the collection of video records as part of the recordkeeping process of traffic guidance schemes at roadworks sites.

1.2 Purposes for which video records may be required

There are three purposes for which video records are to potentially be used:

1. Maintain a record of the presence, location and quality of the Traffic Guidance Scheme signs and devices as installed which can be used in the event that a claim is made due to a road traffic incident.
2. Maintain a record of the presence, location and quality of the installed speed limit signs in the event that a speeding infringement is challenged.
3. To allow post application review and auditing of the implementation of the traffic guidance scheme (TGS).

It must be noted that this video record could also validate an incident claim against the contractor, the principal contractor or the department, or invalidate a speeding infringement, in the event that they demonstrate the TGS installation is not in accordance with either the Queensland MUTCD, QGTTM or the TGS plan.

1.3 Application of this guidance

Reviews of suitable camera equipment by the department has revealed that appropriate cameras can be considered a relatively low-cost item. It is recognised that the primary implications, for those personnel undertaking a review and recording of the TGS installation in accordance with the QGTTM, is the filing and storage of video records.

The decision to enforce the use of video recording will be at the discretion of the Principal.

1.3.1 Video camera specification

Any video footage taken is required to be taken from the driver's perspective and to capture each of the following:

a) TGS signs and devices:
   i. Be able to correctly visually identify each sign and device.
   ii. View the sign / device location.
   iii. View the orientation of the sign / device, including whether it has been displaced or knocked.
   iv. View the condition – damage, dirt, colour etc.
b) Identify the visual presence or otherwise of permanent traffic control devices.

These outcomes represent the minimum requirements for any in-car video recording. To achieve this outcome the following represent the typical specifications required for a video camera.

a) Resolution – minimum 1080 Full HD Recording:
   i. Minimum 1920 × 1080 Pixels, and
   ii. Minimum 25 frames per second
b) Viewing Angle – Wide: minimum of 145 degrees, preferably 170 degrees.
c) GPS - coordinates shall be in decimal degrees format and in one of the following Datums:
   i. World Geodetic System 1984 (WGS84), or
   ii. Geocentric Datum of Australia 1994 (GDA94), or
   iii. Geocentric Datum of Australia 2020 (GDA2020), and
   iv. GPS data to be stored either directly onto the video image or recorded in the file metadata and must include the Datum.
d) Time and date stamping in Australian Eastern Standard Time (Coordinated Universal Time + 10 hours). Time and date stamping data to be stored either directly onto the video image or recorded in the file metadata.
e) Microphone with sufficient clarity to allow the recording officer to verbally record observations at the time of the video capture.
f) Data file format to be suitable for reading by standard media players. Camera specific formats which require specific non-standard software to playback shall not be used.

1.3.2 Video recording practice

The following describes the preferred practice for video recording. This practice provides a strong level of legal support in defence of any action arising from alleged deficiencies in the TGS:

i. Prior to starting the run the officer undertaking the recording should visually identify themselves and confirm and the required details listed in the Part 6 of QGTTM.
ii. The inclusion of a recognisable landmark or feature that visually confirms the location is also required. This may include a particular unique guidance sign, route maintenance marker, landmark or infrastructure (e.g. a unique bridge design).

iii. With the camera correctly mounted, the driver should then proceed through the site in the same manner as a typical driver behaving legally.

iv. The recording officer should make a verbal note of all of the observations and features that are observed. This may include reading off each of the signs on the TGS for confirmation of their presence on site.

1.3.3 Record keeping

All video records shall be retained by the Contractor in accordance with the *Limitations of Actions Act* 1974, for actions associated with personal injury (including the duration required for any claims to be resolved).

Records shall be provided to the Contract Administrator at the end of each month or upon request. All records should be provided at the completion of the contract.