

Part 3 Works on Roads

2003 Edition

First Issue 1st August, 2003

Second Issue 2nd April, 2007

Third Issue 22nd February 2010 (electronic copy only)

Fourth Issue 30th April, 2010



(Blank)

PREFACE

This part of the Manual of Uniform Traffic Control Devices (Queensland) has been based on Australian Standards AS1742.3 - 2009, Traffic control for works on roads.

It updates the specification of traffic control devices for roadworks previously given in 2003 Manual of Uniform Traffic Control Devices and Departmental document Works on Roads. It deals with the principles of signing at roadworks, describes the signs and devices used to effect traffic guidance and provides typical layout diagrams for deployment of signs and devices for various work site configurations. It is intended as both an office reference document for the planning and design of traffic guidance schemes, and a field guide for the installation, operation and removal of traffic guidance schemes.

This document should now be used for all roadworks. However, this document shall be used for all roadworks after 30 June 2010, excluding Clause 3.2.2.

The minimum class of retroreflective material should be Class 1 until 30th June 2012 when the requirements in Clause 3.2.2 of this document shall apply.

Principal variations from the previous issue are as follows:

Third Issue (Electronic copy only)

- (a) Major revision of provisions for short-term low-impact works in open road areas and for works on unsealed roads.
- (b) New material on short-term low-impact works in built-up areas.
- (c) Revision of detail on mobile works.
- (d) Introduction of the concept of mobile speed limits with special reference to protection of workers on foot during mobile works.
- (e) Provision for lowering temporary speed limits at hazardous sites.
- (f) Expansion of material on maintaining a safe workplace including detail on hierarchy of control.
- (g) Enhanced detail on determining advance distances for advance warning signs.
- (h) Review of sign sizes in the T Series and their assessment for adequacy of legibility.
- (i) Assignment of specific values where the earlier edition referred to 'high' and 'low' speeds and traffic volumes.
- (j) Introduction of the following new signs:
 - (i) SIDE ROAD CLOSED.
 - (ii) Speed Limit AHEAD.
 - (iii) T Series Advisory Speed Signs.
 - (iv) 'Mobile phones' included in Blasting Area signs.
 - (v) FOOTPATH CLOSED.
- (k) Safety management of traffic and pedestrians on roadways temporarily converted from one-way to two-way traffic.

Fourth Issue

Fourth Issue principle variations from the previous issue are as follows:

- (a) Revised definition of 'should'
- (b) Traffic speed defined as posted speed limit
- (c) Minimum requirement for retroreflective material used on roadworks signs is Class 1W
- (d) New material on the spacing of delineators on barriers
- (e) Clarification of the use of vehicle-mounted warning devices and illuminated flashing arrow signs
- (f) Revision of mowing operations and other work off roadways
- (g) Revision of minimum lane widths and clearances from edge traffic lane to road safety barrier systems
- (h) Review of speed limit repeater sign spacing
- (i) Addition of further multi-message signs in Table D1

(Blank)

CONTENTS

SECTION 1. SCOPE AND GENERAL	3-11
1.1 SCOPE	3-11
1.2 OBJECTIVE	3-11
1.3 REFERENCED DOCUMENTS	3-11
1.4 DEFINITIONS	3-12
1.5 RESPONSIBILITY FOR SAFETY AT WORK SITES.....	3-14
1.6 LEGAL AUTHORITY	3-14
1.7 LEVELS OF TRAINING.....	3-14
SECTION 2. PRINCIPLES FOR THE DEVELOPMENT, INSTALLATION AND OPERATION OF A TRAFFIC GUIDANCE SCHEME	3-15
2.1 PRINCIPLES.....	3-15
2.2 PLANNING	3-15
2.2.1 Traffic guidance schemes	3-15
2.2.2 Traffic management plans.....	3-16
2.2.3 Risk management.....	3-16
2.3 TRAFFIC MANAGEMENT	3-17
2.3.1 General	3-17
2.3.2 Safety and convenience	3-17
2.3.3 Traffic through the work area	3-17
2.3.4 Traffic past the work area	3-18
2.3.5 Traffic around the work area (side-tracks and detours).....	3-18
2.3.6 Night conditions	3-18
2.3.7 Provision for pedestrians and bicycles	3-19
2.3.8 Temporary footpaths and pedestrian crossing	3-19
2.4 DEVICE REQUIREMENTS	3-19
2.4.1 Selection and use.....	3-19
2.4.2 Delineation.....	3-20
2.4.3 Night conditions	3-20
2.4.4 Adjustment to existing devices	3-20
2.4.5 Safety barriers	3-20
2.4.6 Vehicle size and load restrictions.....	3-21
2.5 INSTALLATION AND REMOVAL	3-21
2.5.1 Condition of devices.....	3-21
2.5.2 Positioning of devices	3-21
2.5.3 Setting out and recovery of devices	3-22
2.5.4 Orientation of sign	3-22
2.5.5 Inspection	3-22
2.5.6 Publicity	3-23
2.5.7 Removal.....	3-23
2.6 OPERATION	3-23
2.6.1 Daily routine and worksite records	3-23
2.6.2 Layout variation	3-23
2.6.3 Maintenance of devices.....	3-23
2.6.4 Use of high visibility clothing.....	3-23
2.6.5 Hazard avoidance	3-23
2.6.6 Closures and delays.....	3-23
2.6.7 Safety audit.....	3-24
2.7 EMERGENCY AND UNPLANNED WORKS	3-24

SECTION 3. DESCRIPTION AND USE OF SIGNS AND DEVICES	3-25
3.1 FUNCTIONS OF DEVICES	3-25
3.2 FORMAT AND SIZE OF SIGNS	3-25
3.2.1 Format of signs.....	3-25
3.2.2 Retroreflective material.....	3-25
3.2.3 Sign sizes in the T Series	3-25
3.3 SIGN MOUNTINGS.....	3-26
3.3.1 General	3-26
3.3.2 Multiple sign displays.....	3-26
3.3.3 Multiple-message sign displays.....	3-26
3.4 SIGNS AND DEVICES FOR WORK SITE APPROACHES AND DEPARTURES	3-27
3.4.1 General	3-27
3.4.2 Roadwork ahead (T1-1, T1-31), Roadwork X km ahead (T1-16), Roadwork 500 m ahead (TC1825)	3-27
3.4.3 Bridgework ahead (T1-2), Bridgework X km ahead (T1-29).....	3-28
3.4.4 Workers (symbolic) (T1-5).....	3-28
3.4.5 Road plant ahead (T1-3), Grader ahead (T1-4)	3-28
3.4.6 Roadwork next X km (T1-24), Roadwork on side road (T1-25), Road plant on side road (T1-27), Side road closed (T1-32).....	3-29
3.4.7 Next 2 km (T1-28).....	3-29
3.4.8 End roadwork (T2-16, T2-17, T2-Q03)	3-29
3.5 SIGNS AND DEVICES FOR REGULATORY CONTROL OF TRAFFIC	3-30
3.5.1 General	3-30
3.5.2 Manual control.....	3-31
3.5.3 Sign control	3-31
3.5.4 Traffic signal control	3-32
3.5.5 Temporary speed limits	3-33
3.6 DETOUR SIGNS.....	3-34
3.6.1 General	3-34
3.6.2 Detour ahead (T1-6)	3-35
3.6.3 End detour (T2-23)	3-35
3.6.4 Detour (left or right) (T5-1)	3-35
3.6.5 Detour marker (T5-6)	3-35
3.6.6 Low bridge ahead ... m, high vehicles detour (G9-3) Load limit on bridge ... t gross, heavy vehicles detour (G9-4).....	3-36
3.6.7 Detour for vehicles (G9-5)	3-36
3.6.8 Two-way traffic (W4-11), Two-way traffic (T2-24)	3-36
3.6.9 All traffic turn (R2-14).....	3-37
3.6.10 Local traffic only (G9-40-2)	3-37
3.7 ROAD CONDITION SIGNS	3-37
3.7.1 General	3-37
3.7.2 Slippery (T3-3), Soft edges (T3-6), Rough surface (T3-7), Gravel road (T3-13), Loose stones (T3-9), Loose surface (T3-14).....	3-38
3.7.3 Advisory Speed signs (T3-16).....	3-38
3.7.4 New work, no lines marked (T3-11), No lines do not overtake unless safe (T3-12)	3-39
3.8 SIGNS AND DEVICES FOR LANE AND ROAD CLOSURES	3-39
3.8.1 General	3-39
3.8.2 Signs.....	3-39
3.8.3 Barricades.....	3-40
3.9 DEVICES FOR DELINEATING AND INDICATING THE TRAVELLED PATH	3-41

3.9.1	Traffic cones and temporary bollards	3-41
3.9.2	Roadworks delineators.....	3-42
3.9.3	Temporary hazard markers (T5-4, T5-5, T5-Q02)	3-43
3.9.4	Pavement markings.....	3-43
3.9.5	Raised retroreflective pavement markers	3-44
3.9.6	Temporary kerbing	3-44
3.10	CONTAINMENT FENCES AND ROAD SAFETY BARRIER SYSTEMS	3-44
3.10.1	Containment fences	3-44
3.10.2	Longitudinal channelising barricades	3-44
3.10.3	Road safety barrier systems.....	3-45
3.10.4	Temporary crash attenuators	3-45
3.11	LAMPS.....	3-46
3.12	VEHICLE-MOUNTED SIGNS AND DEVICES	3-46
3.12.1	Vehicle-mounted warning device	3-46
3.12.2	Illuminated flashing arrow sign	3-46
3.12.3	Supplementary vehicle-mounted signs	3-47
3.12.4	Painting of vehicles and machinery	3-48
3.12.5	Truck-mounted crash attenuator	3-48
3.13	BLASTING WORK SIGNS	3-48
3.13.1	General	3-48
3.13.2	Blasting area switch off radio transmitters (T4-7)	3-49
3.13.3	End blasting area (T4-3).....	3-49
3.14	SIGNS AND DEVICES FOR PEDESTRIAN CONTROL	3-49
3.14.1	General	3-49
3.14.2	Pedestrians watch your step (T8-1)	3-49
3.14.3	Pedestrians (arrow) (T8-2).....	3-49
3.14.4	Use other footpath (T8-3), Footpath closed (T8-4)	3-50
3.14.5	Look both ways, two-way traffic (T8-5)	3-50
3.14.6	Pedestrian containment	3-50
3.15	SIGNS AND DEVICES FOR VEHICLE HEIGHT AND MASS RESTRICTIONS	3-50
3.15.1	General	3-50
3.15.2	Bridge load limit ... t gross (R6-3)	3-50
3.15.3	Low clearance ... m (R6-11)	3-51
3.15.4	Clearance ... m (R6-12)	3-51
3.15.5	Low clearance ... m (W4-8)	3-51
3.15.6	Low clearance warning gauge	3-51
3.16	OTHER SIGNS AND DEVICES	3-52
3.16.1	General	3-52
3.16.2	Trucks (T2-25), Trucks (W5-22)	3-52
3.16.3	Power line works in progress (T4-5)	3-52
3.16.4	High-visibility clothing for work personnel	3-52
3.16.5	Traffic hazard (T1-10)	3-53
3.16.6	Variable message signs	3-53
3.16.7	Antiglare screen.....	3-53
3.16.8	Miscellaneous signs	3-53
SECTION 4. PROCEDURES FOR THE INSTALLATION AND OPERATION OF TRAFFIC CONTROL DEVICES		3-55
4.1	GENERAL.....	3-55
4.1.1	Scope of section.....	3-55
4.1.2	Maintaining a safe workplace.....	3-55

4.1.3	Works protection methods	3-55
4.1.4	Components of a typical work site	3-56
4.1.5	Dimension D	3-56
4.1.6	Tolerances on positioning	3-57
4.2	STATIC WORK SITES	3-57
4.3	SHORT-TERM LOW IMPACT WORKS - OPEN ROAD AREAS	3-59
4.3.1	General	3-59
4.3.2	Work between gaps in traffic	3-59
4.3.3	Short term work in traffic	3-60
4.3.4	Frequently changing work area	3-60
4.3.5	Shoulder grading on sealed roads in open road areas	3-60
4.3.6	Mobile inspections	3-61
4.3.7	Work off-roadway	3-61
4.3.8	Work protected by specialist vehicles	3-61
4.3.9	Survey work	3-61
4.3.10	Traffic investigations	3-62
4.4	SHORT-TERM LOW IMPACT WORKS - BUILT-UP AREAS	3-62
4.4.1	General	3-62
4.4.2	Frequently changing work area - Work not within traffic lane	3-62
4.4.3	Frequently changing work area - Work within a traffic lane	3-63
4.4.4	Road lighting works	3-63
4.4.5	Works on medians, verges and footpaths	3-64
4.4.6	Street sweeping and garbage collection	3-64
4.4.7	Work between gaps in traffic	3-64
4.4.8	Work protected by specialist vehicles	3-65
4.4.9	Survey work	3-65
4.4.10	Traffic investigations	3-65
4.5	WORKS ON UNSEALED ROADS	3-65
4.5.1	General	3-65
4.5.2	Maintenance grading and resheeting	3-65
4.5.3	Short term partial road closures	3-66
4.6	MOBILE WORKS	3-67
4.6.1	General	3-67
4.6.2	Work convoy arrangements	3-70
4.6.3	Operating principles	3-70
4.6.4	Signs	3-74
4.6.5	Mobile temporary speed zones	3-74
4.7	ADVANCE AND TERMINATION WARNING SIGNS	3-76
4.7.1	General	3-76
4.7.2	Advance sign selection	3-76
4.7.3	Intermediate advance signs	3-78
4.7.4	Advance warning distances	3-78
4.7.5	Sign display	3-78
4.7.6	Frequently changing work area	3-78
4.7.7	Mobile works	3-78
4.7.8	Avoiding end-of-queue collisions	3-78
4.7.9	Termination signs	3-79
4.8	APPROACH TAPERS	3-79
4.8.1	General	3-79
4.8.2	Lane closures	3-79

4.8.3	Devices	3-82
4.9	CREATING A TEMPORARY SPEED ZONE AT WORKS ON ROADS	3-82
4.9.1	General	3-82
4.9.2	Speed zones for workplace safety purposes.....	3-83
4.9.3	Speed zones for traffic safety purposes	3-83
4.9.4	Duration	3-84
4.9.5	Advance warning of temporary speed zones (buffer zones).....	3-85
4.9.6	Start of zone	3-85
4.9.7	End of zone	3-85
4.9.8	Repeater signs.....	3-86
4.9.9	Offset speed zones.....	3-86
4.10	TRAFFIC CONTROLLERS	3-90
4.10.1	Application.....	3-90
4.10.2	Equipment	3-90
4.10.3	Sight distance.....	3-90
4.10.4	Control of approach speed	3-90
4.10.5	Period of duty	3-90
4.10.6	Traffic controller competency.....	3-90
4.11	PORTABLE TRAFFIC SIGNALS	3-91
4.11.1	General	3-91
4.11.2	Operation.....	3-91
4.11.3	Approach conditions and speed.....	3-91
4.11.4	Performance monitoring.....	3-91
4.12	PILOT VEHICLE.....	3-92
4.13	MAINTAINING TRAFFIC FLOW.....	3-92
4.13.1	Length of single-lane operation under reversible flow.....	3-92
4.13.2	Number of lanes for each direction of flow	3-93
4.13.3	Lane widths	3-93
4.13.4	Edge clearances.....	3-94
4.13.5	Work in residential streets	3-94
4.14	DETOURS, SIDE-TRACKS AND CROSSOVERS.....	3-95
4.14.1	General	3-95
4.14.2	Surface condition	3-95
4.14.3	Alignment, width and capacity	3-95
4.14.4	Provision for pedestrians, bicycles, wheelchairs and public transport	3-98
4.14.5	Access for local traffic	3-98
4.14.6	Delineation.....	3-98
4.14.7	Continuity of signing at a detour	3-99
4.14.8	Reversed traffic direction.....	3-99
4.14.9	Freeway exit closures	3-100
4.14.10	Detours for high and heavy vehicles.....	3-100
4.15	EXCAVATION WORKS	3-101
SECTION 5. ARRANGEMENT DIAGRAMS FOR TRAFFIC GUIDANCE SCHEMES		3-103
5.1	SCOPE	3-103
5.2	APPLICATION	3-103
5.3	DIAGRAM SELECTION	3-103
5.4	DIAGRAM SYMBOLS	3-104
5.5	DIAGRAMS.....	3-104

APPENDICES

A	DAILY ROUTINE TASKS AND RECORD KEEPING	3-184
B	ERECTION AND REMOVAL OF REGULATORY TRAFFIC CONTROL DEVICES FOR WORKS ON ROADS	3-186
C	PROTECTIVE EQUIPMENT AND CLOTHING	3-187
D	MULTI-MESSAGE SIGN SYSTEM	3-188
E	PROTECTION AND DELINEATION AT EXCAVATION WORKS.....	3-194
F	ROADWORKS AT INTERSECTIONS	3-195
G	SUPPLEMENTARY LIST OF TEMPORARY ROADWORKS SIGNS	3-196
H	EMERGENCY AND UNPLANNED WORKS	3-198
INDEX.....		3-200

**DEPARTMENT OF TRANSPORT AND MAIN ROADS
Queensland**

Manual of Uniform Traffic Control Devices

PART 3 – TRAFFIC CONTROL DEVICES FOR WORKS ON ROADS

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE

This Part of the Manual specifies the traffic control measures and devices to be used to warn, instruct and guide road users in the safe negotiation of work sites on roads including unsealed roads together with footpaths, shared paths and bicycle paths adjacent to the roadway. It is applicable to traffic guidance schemes for road and bridge construction and maintenance sites, works associated with other public utilities and services or any other works which cause interference or obstruction to the normal use of a road by any road user. It also provides guidance for the planning, design, installation and operation of such traffic guidance schemes together with requirements for maintaining a safe workplace for workers on site. Instructions for carrying out daily routine checks of the traffic guidance scheme are given in appendices.

NOTE: Detailed specifications for the design and manufacture of the signs used are given in AS 1743.

1.2 OBJECTIVE

The objective of this Part of the Manual is to provide organisations carrying out works on roads with a set of uniform practices for the signing and delineation of construction and maintenance works which will promote the safety of both workers and road users at the work site.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Part:

1.3.1 Australian Standards

AS

- 1158 The lighting of urban roads and other public thoroughfares
- 1158.4 Part 4: Supplementary lighting at pedestrian crossings
- 1348 Road and traffic engineering - Glossary of terms
- 1743 Road signs - Specifications
- 1906 Retroreflective materials and devices for road traffic control purposes
- 2187 Explosives - Storage and use
- 2187.2 Part 2: Use of explosives
- 1906.3 Part 3: Raised pavement markers (retroreflective and non-retroreflective)
- 4191 Portable traffic signal systems

AS/NZS

- 1906 Retroreflective materials and devices for road traffic control purposes
- 1906.1 Part 1: Retroreflective materials
- 1906.2 Part 2: Retroreflective devices (non-pavement application)
- 3845 Road safety barrier systems
- 4192 Illuminated flashing arrow signs
- 4360 Risk Management
- 4602 High visibility safety garments

HB

43 Road safety audit (Austroads publication no. AP-630/02)

1.3.2 International Standards

Transportation Research Board, National Cooperative Highway Research Program

NCHRP Report No. 350. Washington DC 1993. Recommended Procedures for the Safety Performance Evaluation of Highway Features

NCHRP Report No. 358. Washington DC 1994. Recommended Practices for Use of Traffic Barrier and Control Treatments for Restricted Work Zones

1.3.3 Department of Transport and Main Roads Manuals

Road Planning and Design Manual

Traffic and Road Use Management Manual

1.4 DEFINITIONS

For the purpose of this Manual, the definitions in AS 1348 and those below apply.

1.4.1 Arterial road

A general term for a main road carrying mostly long distance traffic, as distinct from local traffic.

1.4.2 Built-up area

Roadside development comprising property accesses at spacings averaging less than 100 m over distances of at least 500 m.

1.4.3 Competent person

A person who has, through a combination of training, qualification and experience, acquired knowledge and skills enabling that person to correctly perform a specified task.

NOTE: Levels of training currently provided are:

Level 1 for new entrants to industry;

Level 2 for persons required to implement Traffic Management Plans;

Level 3 for persons required to design/develop Traffic Management Plans; and

Level 4 for persons required to conduct inspections and prepare reports in relation to Traffic Management Plans and/or worksites.

1.4.4 Expressway type road

A divided highway for through traffic with full or partial control of access and generally with grade separation at intersections. The term includes expressways, freeways, tollways and motorways (as defined in AS 1348).

1.4.5 Long-term

The description which applies when a traffic guidance scheme is required to operate both day and night and may be left unattended.

1.4.6 May

A permissive condition. Where the word “may” is used, it indicates that usage of the device is conditional, or optional. Usually, no specific requirement for design or application is intended.

1.4.7 Multilane

Two or more traffic lanes in one direction.

1.4.8 Open road area

Roadside development less frequent than that specified for a built-up area. (See Clause 1.4.2.)

1.4.9 Regulatory traffic control device

A sign, signal, marking or installation indicating an obligation to comply with a legally enforceable instruction.

1.4.10 Residential street

A residential street is a local street as defined in Part 4 of this Manual i.e. a road or street that serves primarily to provide for direct property access and/or for limited neighbourhood movement.

1.4.11 Road safety barrier system

A physical barrier separating the work area and the travelled path, designed to resist penetration by an out-of-control vehicle and as far as reasonably practicable, to redirect out of control vehicles back into the travelled path (see Clause 3.10.3).

1.4.12 Road user

Any driver, rider, passenger or pedestrian using the road.

1.4.13 Roadway

That portion of the road devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes.

1.4.14 Running lane

A portion of the roadway allotted for a single line of moving vehicles.

1.4.15 Shall

A mandatory condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory that when an installation is made, these requirements be met.

1.4.16 Should

Indicates a recommendation. Where the word "should" is used, it is considered to be recommended usage, but not mandatory. Any recommendation that is not applied must be based on sound traffic engineering judgement and documented.

1.4.17 Short-term

The description which applies when a traffic guidance scheme is required only while work personnel are in attendance and 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.

1.4.18 Speed of traffic (traffic speed)

The posted speed limit or an estimate (see Note 1) of the speed of the majority of vehicles in the stream if considered to be significantly different from the speed limit (see Note 2), either above or below.

NOTES:

- 1 This estimate can be made by travelling in the stream when there is a sufficient volume of traffic to match and observe the speed of the majority of vehicles. Occasional vehicles clearly travelling faster than the majority are ignored.
If the 85th percentile speed measured in accordance with Part 2 of the Manual is known at the location, this should be used in lieu.
- 2 A variation from the speed limit of ± 10 km/h or more is considered significant.

1.4.19 Traffic

All vehicles, persons or animals travelling on a road.

1.4.20 Traffic controller

A person who is competent to control traffic at a work site (see Clause 4.10.6).

1.4.21 Traffic guidance scheme

An arrangement of temporary signs and devices to warn traffic and guide it through or past a work area or temporary hazard.

1.4.22 Two-way roadway

A roadway having a single traffic lane allotted for use by traffic in opposing directions.

1.4.23 Travelled path

That part of the roadway which is made available to vehicles and which may comprise of one or more traffic lanes.

1.4.24 Work area

The specific area where work is being done.

1.4.25 Work site

An area which includes the work area(s) and any additional length of road required for advance signing, tapers, side-tracks or other areas needed for associated purposes.

1.5 RESPONSIBILITY FOR SAFETY AT WORK SITES

Organisations and individuals responsible for works in accordance with this Part of MUTCD need to be aware of their responsibilities for any injury to road users or damage to property as a result of such operations. There is an equally important obligation to provide a safe workplace environment that minimises, as far as practicable, the likelihood of injury to workers by traffic within or adjacent to the work area. Principals and contractors need to be aware of the requirements of OHS legislation and implement them as they apply to this obligation.

Steps should be taken to warn the public of prevailing conditions and to guard, delineate, and, where necessary, illuminate work which may pose a hazard to road users. Care should also be taken to avoid, wherever possible, long delays or detours which may cause unnecessary inconvenience to road users (see Clause 2.6.6).

Supervisory personnel carrying out construction, maintenance or other works that require the use of a traffic guidance scheme shall give attention to the following:

- (a) Be mindful of their responsibility to provide, as far as practicable, a safe workplace for personnel and plant under their control, and safe and convenient travelling conditions for road users.
- (b) Ensure that personnel under their control are at all times courteous to road users. Personnel should not allow themselves to become distracted by provocation from members of the public.
- (c) Ensure that personnel are competent to perform the roadwork signing task (see Clause 1.4.3).
- (d) Ensure that all personnel at a work site are aware of their responsibilities.
- (e) Ensure that traffic controllers are appropriately trained and informed of their duties and that they are regularly relieved from their duty (see Clause 4.10.5).
- (f) Be familiar with, and act, as far as is practicable, in accordance with the provisions of this Part of the Manual.

1.6 LEGAL AUTHORITY

The Transport Operations Road Use Management Act provides that Official Traffic Signs shall be installed only by the authority of the Director-General of Transport and Main Roads or a local government. The Act also provides that any such sign shall be installed in accordance with the methods, standards and procedures prescribed in this Manual, or other duly approved documents.

1.7 LEVELS OF TRAINING

Details of the levels of training currently provided by the Department of Transport and Main Roads may be obtained on the departmental website (www.tmr.qld.gov.au).

SECTION 2. PRINCIPLES FOR THE DEVELOPMENT, INSTALLATION AND OPERATION OF A TRAFFIC GUIDANCE SCHEME

2.1 PRINCIPLES

Careful consideration should be given to the signing of the work site, no matter how brief the occupation of the site may be. This should include:

- (a) protection of workers;
- (b) provision of adequate warning of changes in surface condition and the presence of personnel or plant engaged in work on the road; and
- (c) adequate instruction of road users and their guidance safely through, around or past the work site.

Important basic principles to be observed are as follows:

- (i) Signs and devices shall be installed by a competent person.
- (ii) Signs and devices shall be appropriate to the conditions at the work site and shall be used in accordance with this Standard unless a risk assessment by a competent person indicates that an alternative arrangement is satisfactory.
- (iii) Signs and devices shall be erected and displayed before work commences at a work site.
- (iv) Signs and devices shall be regularly checked and maintained in a satisfactory condition.
- (v) Signs and devices shall be removed from a work site as soon as practicable. However, appropriate signs should remain in place until all work (including loose stone removal and line marking following bituminous surfacing) has been completed.
- (vi) Records shall be kept of all works signing and delineation at roadway or part-roadway closures.
- (vii) Where works require the relocation of regulatory traffic control items, they shall be relocated or reinstalled promptly in positions where they are visible and can perform their regulatory function.

2.2 PLANNING

2.2.1 Traffic guidance schemes

Planning for all road works requires the preparation of traffic guidance schemes by a competent person. It will normally take place at one of three levels, as follows:

- (a) *Short-term and mobile works not involving road closure*

The scheme in these cases shall comprise procedures together with details of signs and devices needed to cover all of the routine tasks the workers will encounter. The procedures should be documented by means of work methods statements supported if necessary by standard plans showing, for example, the processional order and separation distances of items in a mobile works gang.

- (b) *Works involving relatively simple part-roadway closures*

The scheme in these cases shall comprise as a minimum a sketch of the protective devices and delineation required on a road construction or similar plan, and a list of devices required for the job. A reference to a diagram or figure or similar standardised illustration may be substituted for the sketch or plan provided it matches adequately the situation.

- (c) *Works involving complex traffic arrangements or staging, or both*

The scheme in these cases shall comprise a fully documented traffic guidance scheme providing the following:

- (i) Plans showing temporary traffic paths, their delineation and the position of traffic control or warning devices.
- (ii) On multi-stage works, a separate set of plans for each stage.
- (iii) Details of after-hours traffic arrangements, on separate plans if they cannot be adequately incorporated into the above.
- (iv) All necessary instructions for the installation, operation, between-stage rearrangement and ultimate removal of devices at the conclusion of the job.

It is essential to prepare such plans well before the job starts or before the start of the stage to which they apply, so that there is enough time to obtain any special devices or approvals needed.

2.2.2 Traffic management plans

Preparation of a traffic management plan requires a procedure to be followed whereby all essential aspects of the plan are considered in an ordered way. The following matters should be considered in turn and incorporated into the plan if relevant:

(a) *Traffic demand*

Determination of the capacity required to accommodate traffic demand at an acceptable level of service and convenience to road users. From this is determined the amount of road space which must remain open and where applicable, the times of day during which greater amounts of road space are needed to handle higher traffic volumes, e.g. peak periods in built-up areas (see Clause 4.13).

(b) *Traffic routing*

Selection of the appropriate means of routing traffic at the site, i.e. through, around or past the site or a combination of these (see Clause 4.13), and ensuring that all required traffic movements are provided for.

(c) *Traffic control*

Determination of the need for traffic control, i.e. by traffic controller, traffic signals (portable or permanent), police or other means.

(d) *Other road users*

Determination of the need to make provisions for road users other than vehicular traffic, including:

- (i) Pedestrians, including people with disabilities where appropriate.
- (ii) Bicycles.
- (iii) School children.
- (iv) Local residents.
- (v) Emergency vehicles.

(e) *Special vehicle requirements*

Determination of the need to provide for vehicles such as:

- (i) Buses, including stops and terminals.
- (ii) Over-dimensional vehicles, i.e. vehicles which, together with their load, are wider or longer than a legal limit vehicle.
- (iii) Restricted vehicles, i.e. vehicles which, although within legal limits, are permitted to use only specified routes.

2.2.3 Risk management

Risk management entails the identification and analysis of all safety risks likely to arise during works on road including the setting up, operating, changing and ultimate dismantling of a traffic guidance scheme, followed by the determination of appropriate measures to mitigate those risks. The process is appropriate at all levels of planning and operation including the following:

- (a) When preparing standardised plans and work method statements for the conduct of minor routine and mobile works.
- (b) When preparing traffic guidance schemes for more extensive or complex works where site specific risks will assume importance.

In each case the process should be carried out by first identifying all the hazards likely to arise, evaluating them in terms of likelihood of occurrence and adverse consequences using historical data, experience or other means. The proposed procedural statement or traffic guidance scheme should then be checked in detail to ensure that adequate means of controlling or reducing those risks found to be significant, are in place.

This Part of the Manual sets out guidance and minimum requirements. Variations below these minima shall only be made on the basis of a documented risk assessment prepared by a competent person in consultation with affected parties as appropriate. Where superior hazard controls are identified through this process they should be adopted in preference to minimum requirements.

More detail on the management of risk is given in AS/NZS 4360.

2.3 TRAFFIC MANAGEMENT

2.3.1 General

Depending on circumstances, movement of traffic may be achieved in one of the following ways:

- (a) Movement through the work area under closely controlled conditions, see Clause 2.3.3.
- (b) Movement past the work area by means of a delineated path alongside but clear of the work area, see Clause 2.3.4.
- (c) Movement around the work area by a detour, which may be via a side track or an existing road, see Clause 2.3.5.
- (d) Closure of the road for short periods while work is carried out.

Figure 4.1 illustrates the various components of a typical work site. A summary of the requirements for signing and delineation of each component is given in Clause 4.1.4. It is essential that at any work site, all of these components which are relevant in a particular case, are identified and the appropriate treatment applied.

2.3.2 Safety and convenience

The safety of workers through adequate protection from traffic and the safety and convenience of traffic at a work site are achieved as follows:

(a) *Safety of workers*

Worker protection from traffic at a static work site is achieved by either the provision of a safety barrier between the work area and moving traffic or in the absence of a such a barrier by maintaining a relationship between-

- (i) the lateral clearance between the edge of the work area and the nearest traffic path or lane; and
- (ii) the speed of traffic past the site, controlled either by temporary speed zoning or other effective means.

Corresponding requirements including requirements for associated signs and delineating devices are specified in detail in Clause 4.2.

Worker safety at short term and mobile works not requiring a static work site to be set up shall be achieved by adherence to the work methods specified in Clauses 4.3, 4.4, 4.5 and 4.6 respectively.

(b) *Safety and convenience of road users*

In addition to providing adequate traffic control and guidance at a static work site the safety of road users will be enhanced by ensuring that the work site is managed in such a way as to cause the minimum amount of inconvenience to traffic movement.

Works should be arranged to minimise-

- (i) disruption of established traffic movements and patterns;
- (ii) interference with traffic at peak movement periods;
- (iii) interference with public transport services; and
- (iv) the amount of road closed to traffic at any one time.

When they are not applicable during the works period, regulatory signs shall be removed or covered. Regulatory pavement markings likewise shall be either obliterated or traffic control measures employed to direct traffic along paths which might otherwise infringe the regulatory requirements of the markings.

Consideration needs also to be given to maintaining traffic flow through or past a work site, see Clause 4.13.

2.3.3 Traffic through the work area

Except as provided below for short term and low impact works, passage of traffic through a work area shall only be permitted where both the traffic and the work can be adequately controlled. Traffic controllers or traffic signals shall be employed as necessary to slow traffic on the immediate approach to an active work area, to stop traffic for short periods when required for the movement of plant or other operations, or to control single line shuttle working. A pilot vehicle may be required to lead traffic along the desired path and to control its speed. For short term and low impact works, the works methods set out in Clauses 4.3, 4.4 and 4.5, and for work in residential streets (see Clause 4.13.5),

underpinned as necessary by risk assessment in particular cases, takes the place of more positive traffic control measures.

Controllers shall also be provided if necessary to control the movement of plant within the trafficable area.

2.3.4 Traffic past the work area

This will be the normal method of traffic management at sites where complete elimination of traffic from the site is not required. Traffic paths past the work area shall be clearly delineated. At long-term works, if the travel path substantially deviates from normal, as far as practicable, original pre-works delineation including pavement markings and raised pavement markers (RPMs) shall be obliterated if they are likely to misdirect drivers negotiating the site. Single line shuttle working may be required if available trafficable roadway width is restricted.

2.3.5 Traffic around the work area (side-tracks and detours)

When it is not practicable to allow traffic through or past the work area, it may be catered for by means of either a detour using existing roads or a specially constructed side-track. Requirements and recommendations for the operation of side-tracks, detours and temporary crossovers on divided roads, are given in Clause 4.14.

2.3.6 Night conditions

Where work at a site extends for more than a single day or is to be performed at night the following requirements and recommendations for operating or securing the site at night apply:

(a) General

The following requirements and recommendations apply to all night-time road closures whether or not workers or plant are on site:

- (i) Wherever practicable, any part of the normal roadway which is closed during the day and can be opened at night, should be opened if, by so doing, either travel conditions or safety, or both for night traffic, can be improved.
- (ii) Temporary traffic route lighting through a work site may be required in open road areas if there is a substantial deviation of the travel path from normal, the posted speed limit is greater than 70 km/h and the traffic volume exceeds 10 000 vpd. Temporary lighting may also be required to supplement existing lighting on arterial roads in built-up areas where the path through the site could be difficult to follow. Lighting from other sources, especially glare sources, should be taken into account when assessing the need for temporary traffic route lighting. Lighting for pedestrians shall be provided as specified in Clause 2.3.8(c).
- (iii) Uncontrolled single lane operation shall not be permitted except for very short lengths under the conditions described in Clause 4.13.1(i), e.g. in residential streets. The need for lighting should be considered. If single lane operation is required at night, the preferred method is to use portable or temporary fixed traffic signals. Traffic controllers should only be used as a last resort.
- (iv) Signs and devices shall be provided in accordance with Clause 2.4.3.
- (v) Illuminated flashing arrow signs and similar devices having light emitting elements should be dimmed for night use where necessary to avoid glare.

(b) Work in progress at night

The following requirements and recommendations applicable to works being carried out at night are additional to those given in Item (a):

- (i) Lighting at a work site shall, as a minimum requirement, illuminate the following areas:
 - (A) Any locations where workers or plant might encroach on traffic lanes.
 - (B) Intersections in which works are taking place.

Wherever practicable, it is recommended that the entire work area and immediate approach be lit.

- (ii) Workers shall wear high visibility garments (see Clause 3.16.4).
- (iii) Floodlighting is recommended as traffic route lighting levels will not normally be adequate for an active work site.

- (iv) Steps should be taken to ensure that floodlighting does not produce glare sources for approaching drivers.
- (v) The adverse environmental effects of high lighting levels close to residential property should be considered.
- (vi) Dimming controls on illuminated flashing arrow signs and matrix type variable message signs should be checked for correct operation.

2.3.7 Provision for pedestrians and bicycles

Where pedestrians, including people with disabilities or visual impairment, have to move through, past or around a work site or to cross the road within a work site, they shall be provided with and directed to suitably constructed and protected temporary footpaths and crossing points, or formal pedestrian crossings, or refuges if warranted. Such facilities shall meet the requirements of Clause 2.3.8.

Pedestrian and bicycle paths should be provided on the same scale and to the same width as any facilities for pedestrian or bicycle traffic that were existing prior to the works.

2.3.8 Temporary footpaths and pedestrian crossing

Where footpaths or pedestrian crossings have been partially closed or temporarily relocated, requirements and recommendations for the temporary facilities are as follows:

- (a) Where pedestrian traffic has been diverted onto an existing roadway the pedestrian path shall be separated from vehicular traffic. A mesh fence may be used provided that-
 - (i) the clearance to the delineated edge of the traffic lane is at least 1.2 m and the speed limit is 60 km/h or less; or
 - (ii) the clearance to the delineated edge of the traffic lane is less than 1.2 m and the speed limit is 40 km/h or less.

Where traffic speeds (see Clause 1.4.18) are more than 10 km/h above the top end of the ranges given in Items (i) and (ii), a road safety barrier system (see Clause 3.10.3) shall be provided.

NOTE: The channelling of pedestrians and bicycle traffic using lightweight modules is subject to the requirements of Clause 3.10.2.

- (b) Surfacing should provide for prams, strollers and wheelchairs, and other mobility aids.
- (c) Except as below, lighting shall be not less than the level provided on the original footpath or crossing, or to AS 1158.4, whichever is the lesser level. Lighting to AS 1158.4 should be provided if the associated works reduce either the sight distance to, or the prominence of, the crossing.
- (d) Crossings shall be located as near as practicable to established pedestrian routes, and shall have the same level of function as the crossings they replace, including provisions for the people with a vision impairment.
- (e) Crossings should be signalised if the crossings they replace were signalised.
- (f) The management of pedestrians at crossings on roadways temporarily converted from one-way to two-way is given in Clause 4.14.8.

2.4 DEVICE REQUIREMENTS

2.4.1 Selection and use

This Manual specifies the minimum number of signs and devices required-

- (a) to provide advance warning;
- (b) to guide traffic through, around or past the work area; and
- (c) to minimise the possibility of confusion and misinterpretation of the intended instructions.

Advance warning signs and devices should allow adequate time for correct response under the anticipated worst conditions (see Clause 4.7.1). All approaches to the work area, including any side roads, shall be considered.

Approval for erection or removal of regulatory traffic control devices shall be obtained from the Department of Transport and Main Roads or appropriate road authority.

Authorities shall use standard signs wherever a suitable sign for the purpose exists. However, there will be instances where there is no suitable standard sign. In such cases, the sign developed shall comply with the format requirements specified in Clause 3.2, and approval of the Director-General, Transport and Main Roads, shall be obtained for such non-standard signs prior to erection.

2.4.2 Delineation

The travelled path on the approaches and past the work area shall be delineated so as to properly define which part of the roadway is available to road users, or the path that traffic is required to follow, under all reasonably expected weather and atmospheric conditions, day or night as applicable.

Delineation should be considered for both long and short range purposes. The former should provide drivers approaching the work site with an advance view of the site indicating the general location and direction of the trafficable path, whilst the latter should guide drivers through the works once they have entered the work area or side track. Long range delineation should begin to provide advance guidance at the start of the work site. Short range delineation should indicate a continuous path for at least D (see Table 4.2) metres in front of the vehicle.

Long-range delineation will be mostly achieved by post mounted devices. Short range will usually rely on a combination of retroreflective line marking, other pavement based devices, and traffic cones or bollards.

2.4.3 Night conditions

Signs shall be floodlit if outside the headlight beams. Delineating devices shall comprise or incorporate retroreflectors. Flashing lamps may be used to draw attention to certain advance signs (see Clause 3.11). Flashing lamps shall not be used for delineation.

Pavement markings through the work site shall be retroreflective. This may be achieved by means such as reflectorising paint using drop-on beads, retroreflective preformed materials or raised retroreflective pavement markers.

NOTE: The use of steady or ripple lamps has been deleted from this Part of the Manual.

Hazards or barriers may require floodlighting to make them more conspicuous. Care should be taken that floodlighting, undimmed illuminated flashing arrow signs, matrix type variable message signs and other similar devices do not cause disability glare for approaching drivers. Except in an emergency, floodlighting should not be provided by use of vehicle headlights.

Signs required to be fluorescent by day and retroreflective at night, e.g. the Workers (symbolic) sign, shall have a sign face background comprising combination fluorescent/retroreflective material. Signs and equipment e.g. Workers (symbolic) sign and high visibility clothing worn by traffic controllers, which comprise combination fluorescent/retroreflective material do not require illumination i.e. floodlighting.

Further requirements for the use of temporary delineators are given in Clause 3.9.2.

2.4.4 Adjustment to existing devices

Existing signs and traffic control devices which are inappropriate to, or conflict with, the temporary work site situation shall be covered or removed.

2.4.5 Safety barriers

Safety barriers may be required for situations where any of the following are cause for concern:

- (a) Inadequate safe clearance between moving traffic and workers and plant on site (see Clause 4.2).
- (b) Hazardous traffic conflicts (e.g. head-on collisions).
- (c) Collisions with hazardous fixed objects, construction works or falls into excavations close to the travelled path.
- (d) Inadequate separation of temporary footpaths, shared paths or bicycle paths from vehicular traffic paths (see Clause 2.3.8).

Requirements and recommendations for the selection, positioning and end treatment of safety barriers are given in Clause 3.10.3.

2.4.6 Vehicle size and load restrictions

Where the width, height or load-carrying capacity of the roadway or structure is to be temporarily reduced during works, the appropriate authority should be informed in advance so that arrangements may be made to divert traffic which would exceed the temporary limitations. The authority should also be advised when the restriction is removed so that all traffic can resume use of the roadway or structure.

Possible ground clearance problems for long, low vehicles should also be made known.

Low clearance warning gauges may be required in advance of false work structures (see Clause 3.15.6 and Figure 4.23).

2.5 INSTALLATION AND REMOVAL

2.5.1 Condition of devices

Individual signs and devices should be examined before installation to ensure that they are in good condition and their performance is not impaired. The following checks are required:

(a) *Mechanical condition*

Items that are bent, broken or have surface damage, should not be used.

(b) *Cleanliness*

Items should be free from accumulated dirt, road grime or other contamination.

(c) *Colour of fluorescent signs*

Fluorescent signs whose colour has faded to a point where they have lost their daylight impact should be replaced.

(d) *Night-time visibility*

Signs required to be effective at night shall be checked for retroreflectivity as soon as possible after installation. Those whose retroreflectivity is degraded either from long use or surface damage shall be replaced. Night-time effectiveness can best be checked by viewing the signs by vehicle headlights in dark conditions.

Functional inspections are also required, see Clause 2.5.5.

2.5.2 Positioning of devices

Signs and devices should be positioned and erected so that-

- (a) they are properly displayed and securely mounted (see Clause 3.3);
- (b) they are within the line of sight of the intended road user;
- (c) they cannot be obscured from view (e.g. by vegetation or parked cars);
- (d) they do not obscure other devices from the line of sight of the intended road user;
- (e) they do not become a possible hazard to workers, pedestrians or vehicles; and
- (f) they do not deflect traffic into an undesirable path.
- (g) they do not restrict sight distance for drivers entering from side roads or streets, or private driveways; and
- (h) they are not installed using supports that could be a hazard if struck by a vehicle.

Delineating devices (e.g. traffic cones, bollards, post mounted delineators) should generally be placed 1 m clear of the travelled path.

In open road areas and on unkerbed roads in built-up areas where signs are to be mounted on posts, they should normally be placed clear of the outer edge of shoulder and at least 2 m clear of the travelled path, whichever is the greater clearance. They should be erected 1 to 1.5 m above the level of the nearest edge of the travelled path to the underside of the sign.

On kerbed roads in built-up areas where signs are mounted on posts adjacent to a footpath, or where vehicle parking may occur, they should be erected a minimum of 2.2 m above the level of the kerb or footpath to the underside of the sign, to reduce interference from parked vehicles. Where neither pedestrians nor parked vehicles have to be considered, e.g. on a traffic island or median, a mounting height of 1.5 m may be more appropriate.

Signs mounted on portable supports used for short-term operation (see Clause 3.3) should generally be located and erected as follows:

(i) *In open road areas*

On the road shoulder a minimum of 1 m clear of the travelled path.

(ii) *In built-up areas*

Behind the kerb if visible to oncoming traffic and not obstructing pedestrians, otherwise on the pavement as near as practicable to the kerb without the sign becoming obscured and without obstructing moving traffic.

Where an instruction sign (e.g. see Clauses 3.5 and 3.6) and a road condition sign (see Clause 3.7) would normally be required at the same location, the former shall take precedence and the latter should be positioned at the best alternative location.

Where practicable, signs shall be erected on both sides of the roadway on multilane divided or one-way roads where the volume is 10 000 vpd or greater. This treatment should also be considered for all other roads, especially those with curved alignments.

The visibility of a sign can be affected by deep shade, the direction of the sunlight, background conditions (including lighting) and oncoming headlights. These factors should be considered when signs and devices are erected to ensure that they can be clearly seen at all times.

2.5.3 Setting out and recovery of devices

Before work commences, signs and devices at the approaches to and within the work area should be set out in accordance with the traffic guidance scheme in the following sequence:

- (a) Advance warning and regulatory signs.
- (b) All intermediate advance warning and regulatory signs and devices required in advance of the taper or start of the work area.
- (c) All delineating devices required to form the taper including the illuminated flashing arrow sign at the end of the taper where required.
- (d) Delineation of the work area or side track.
- (e) All other required warning and regulatory signs including termination and end of temporary speed zone signs.

This operation shall be carried out, where practicable, as a frequently changing work area in accordance with Clause 4.3.4 for locations in open road areas and Clause 4.4.2 or 4.4.3 for locations in built-up areas. A mobile works method (see Clause 4.6) shall be used if the above method is not practicable due to the volume or speed, or both, of approaching and passing traffic.

Recovery of devices at the conclusion of the work shall be done in the reverse order using the same work method as for setting out.

Signs and devices that are erected before they are required should be fully covered by a suitable material. The cover should be removed immediately prior to the commencement of work.

NOTE: These signs should be covered with opaque materials. Open weave materials such as hessian are not suitable as the retroreflective performance of the sign is not sufficiently inhibited when viewed at night using vehicle headlights. Covering signs with black or dark coloured plastic materials can result in excessive temperature and moisture cycling which may damage the sign. Best results are obtained by using a dense fabric that allows entrapped moisture, e.g. condensation, to dissipate in a natural manner. Covered signs should be inspected at night to ensure that they are not visible and hence do not provide conflicting messages to drivers. Signs should also be checked in unusual weather conditions including high winds for loss or disturbance of the covering.

2.5.4 Orientation of sign

Signs should face towards approaching traffic approximately at right angles to the line of sight from the driver to the sign.

At curved alignments, the sign should be placed approximately at right angles to the line of sight of a motorist 50 m in advance of the sign.

2.5.5 Inspection

At a static work site, when the erection of the signs and devices is completed and the condition of devices has been checked in accordance with Clause 2.5.1, supervisory personnel should carry out a functional inspection before and after opening to traffic. This inspection should be carried out along the travelled path, and past all of the signs and devices. The same inspection should be carried out at night with dipped headlights. If the arrangement is considered confusing or unsatisfactory, it should be adjusted and reinspected. A similar functional inspection should be carried out after any change is made to the arrangement.

2.5.6 Publicity

Depending on the complexity of the traffic guidance scheme and the length of time it is to operate, it may be necessary to erect special signs to inform the public of the traffic guidance scheme.

NOTE: It may also be advisable to implement a publicity campaign using printed material and local media, particularly the radio.

2.5.7 Removal

It is most important that the relevant signs and devices be removed or concealed from view as soon as any activity is completed or a hazard ceases to exist.

When all work is complete, signs and devices should be dismantled in the reverse order to that specified in Clause 2.5.3.

2.6 OPERATION

2.6.1 Daily routine and worksite records

A daily routine for the operation of a work site, including the keeping of daily records of the sign and delineation arrangement or traffic guidance scheme, and records of any incidents which might have ongoing consequences, shall be put into effect and maintained.

NOTE: Recommended procedures and guidelines are given in Appendix A.

2.6.2 Layout variation

It is most important that signs and devices for which the temporary or permanent need no longer exists, be covered (see Note to Clause 2.5.3) or removed. Additional appropriate signs and devices should be introduced as changed circumstances or road conditions dictate and any changes should be noted on daily work sheets or in a diary (see Paragraph A2(a) Appendix A).

Long-term work sites shall, in addition to the signs and devices required to protect the work area on a continuing basis, have the Workers (symbolic) sign (see Clause 3.4.4) erected at each location within the site at which workers are actually on site. The latter signs shall be removed at the end of the shift (except where multiple shifts are involved) or when the workers leave the site. A change of speed limit may also be required in conjunction with the placement or removal of the Workers (symbolic) sign (see Clause 2.5.3).

2.6.3 Maintenance of devices

Ineffective signs and devices shall be replaced by similar items in good condition, if they cannot be made effective by cleaning or repairing.

Signs and devices which are damaged or otherwise no longer in good condition should be either refurbished to new condition or replaced. Non-repairable signs should be destroyed so that they are not inadvertently reused.

Water in water-filled safety barrier elements shall be maintained at the required level.

2.6.4 Use of high visibility clothing

All personnel shall wear high visibility clothing while on or adjacent to the travelled path, or in other potentially hazardous areas, e.g. on or adjacent to construction haul roads (see Clause 3.16.4).

2.6.5 Hazard avoidance

Machinery should not be parked, materials stored, or buildings erected in positions where they may create a hazard, obscure signs, or block approaching drivers' lines of sight.

2.6.6 Closures and delays

There may be occasions when there is no alternative to the complete closure of a road. Delays to traffic should be minimised with a desirable maximum delay of about 15 min. If the delay is expected to be longer, the method of working should be altered or a detour or side track provided.

If the delay is longer than 15 min because of an unexpected event, e.g. plant breakdown, the supervisor should inform the traffic controllers of the delay and should give an estimated time to be relayed to the public. If traffic queues become too long, consideration should be given to either finding a suitable detour or otherwise re-routing traffic. Advice should also be given to emergency services.

2.6.7 Safety audit

The conduct of a construction phase road safety audit as recommended in HB 43 should be considered for works involving complex traffic arrangements or staged works, or both, see Clause 2.2.1(c). This is especially desirable where site-specific risks will assume importance.

2.7 EMERGENCY AND UNPLANNED WORKS

Traffic control requirements and recommendations for emergency and unplanned works are given in Appendix H.

SECTION 3. DESCRIPTION AND USE OF SIGNS AND DEVICES

3.1 FUNCTIONS OF DEVICES

The functions of the various traffic control devices are as follows:

- (a) To warn, guide and instruct road users, e.g. signs.
- (b) To draw attention to the work area, personnel and equipment.
- (c) To control the speed or the passage of traffic within and adjacent to the work area, e.g. the Stop/Slow bat, signals and speed limit signs.
- (d) To indicate the direction and width of the available travelled path, e.g. delineators.
- (e) To discourage access to the whole or portion of the work area, e.g. barrier boards and mesh fence.
- (f) To provide physical protection for the work area and its occupants, e.g. safety barriers.

3.2 FORMAT AND SIZE OF SIGNS

3.2.1 Format of signs

The format of signs used at roadworks shall be as follows:

- (a) *Signs warning of works personnel*
These shall have a black legend on a retroreflective fluorescent orange background. Such signs shall be displayed only when personnel are working at the site.
- (b) *PREPARE TO STOP signs and signs associated with blasting operations*
These shall be rectangular with a white legend on a red background, both retroreflective.
- (c) *Other roadworks signs*
All other roadworks signs shall be rectangular with a black legend on a yellow retroreflective background.
NOTE: Retroreflective fluorescent yellow may be used.
- (d) *Direction signs*
Temporary direction signs shall be rectangular with a white legend on a green retroreflective background. Any patches e.g. street name, service symbol, etc. shall use standard colours.
NOTE: Substrates and mounting arrangements may need to be altered to suit temporary mounting.
- (e) *Regulatory and warning signs used for roadworks purposes*
Signs in the R, W and G series shall be the same format as their permanent counterparts.

3.2.2 Retroreflective material

Retroreflective material used on signs for works on roads shall meet at least the requirement for Class 1W sheeting as specified in AS/NZS 1906.1.

3.2.3 Sign sizes in the T Series

The application of the sign size designations A and B in the T Series in this Section are as follows:

- (a) *A size*
Applicable to all signs in T Series. This size will be suitable for -
 - (i) posted speed limits up to 110 km/h; or
 - (ii) signs directed at pedestrians.

NOTE: Signs and devices for works on roads shall be positioned in accordance with Clause 2.5.2.

- (b) *B size*
Applicable where an oversize sign may be required-
 - (i) on expressway type roads for added emphasis of the onset of works, detours or closures; or
 - (ii) for other critical safety messages.

NOTE: B size signs should also be considered for all T1 Series signs where the A size signboard is less than 1 m² in area and traffic speeds exceed 70 km/h.

3.3 SIGN MOUNTINGS

3.3.1 General

Mountings for signs at works on roads are required to suit a variety of maintenance and construction situations.

Both signs and mountings used for short-term operations including where staging of works requires their frequent relocation, should be portable, easily erected and stored. The mountings should-

- (a) be quick and easy to install;
- (b) provide secure sign attachment;
- (c) be stable in windy conditions and from the effects of moving traffic;
- (d) provide for installation on all types of road, shoulder or verge surface;
- (e) have the flexibility to handle the sizes of signs involved;
- (f) be easily handled, transported and stored; and
- (g) not be a hazard to road users if struck in their normal upright position or after being knocked over.

Mountings for short-term operations should be arranged so that the signs are prominently displayed to traffic and will command attention. The sign should be mounted so that is clear of the ground and free of obstruction. The minimum height from the shoulder surface to the bottom edge of the sign is 200 mm.

Signs for long-term work should be mounted on normal fixed supports so that they are not likely to be disturbed by the weather, vandals or traffic (see Clause 2.5.2).

3.3.2 Multiple sign displays

In cases where this Part of the Manual requires two signs to be displayed together at the one position (e.g. the Workers (symbolic) and Speed restriction signs) they may be displayed on the same mounting either side by side or one above the other. The sign sizes may be reduced to suit the mounting provided that the size of legend, size of symbol or area occupied by the legend is unchanged from the corresponding sign specified in this Part of the Manual.

3.3.3 Multiple-message sign displays

Multiple sign displays (see Clause 3.3.2) may be displayed as a multi-message sign. Multiple message signing entails the combination of multiple roadwork warning, regulatory signing and traffic instruction messages within a single sign. Appendix D sets out the requirements for the approved panel configuration, size of sign and typical arrangement diagrams.

3.4 SIGNS AND DEVICES FOR WORK SITE APPROACHES AND DEPARTURES

3.4.1 General

Signs used for work site approaches and departures are listed in Table 3.1.

Table 3.1 SIGNS FOR WORK SITE APPROACHES AND DEPARTURES - SIZE TABLE

Sign	Sign Number	Size mm *
ROADWORK AHEAD	T1-1A	1800 x 600
	T1-1B	2400 x 900
BRIDGEWORK AHEAD	T1-2A	1800 x 600
ROAD PLANT AHEAD	T1-3-1A	900 x 600
	T1-3-1B	1800 x 600
GRADER AHEAD	T1-4	900 x 600
Workers (symbolic)	T1-5A	900 x 600
	T1-5B	1200 x 900
ROADWORK X km AHEAD	T1-16A	1800 x 600
	T1-16B	2400 x 900
ROADWORK 500 m AHEAD	TC1825A TC1825B	1800 x 600 2400 x 900
ROADWORK NEXT X km	T1-24A	1800 x 600
	T1-24B	2400 x 900
ROADWORK ON SIDE ROAD	T1-25A	1800 x 600
ROAD PLANT ON SIDE ROAD	T1-27A	1800 x 600
NEXT 2 km	T1-28A	600 x 600
	T1-28B	900 x 900
BRIDGEWORK X km AHEAD	T1-29A	1800 x 600
ROAD WORK AHEAD (narrow format)	T1-31A	900 x 1200
SIDE ROAD CLOSED	T1-32A	1500 x 600
END ROAD WORK	T2-16A	1800 x 600
	T2-17A	900 x 1200
	T2-Q03	900 x 600

* Guidance on sign size selection is given in Clause 3.2.3.

3.4.2 Roadwork ahead (T1-1, T1-31), Roadwork X km ahead (T1-16), Roadwork 500 m ahead (TC1825)



T1-1

The sign ROADWORK AHEAD shall be used to give advance warning of all long-term work sites other than bridgeworks (see Clause 4.7.2).



T1-31

The T1-1 sign is preferred wherever space available at the area allows it to be used.

The ROADWORK X km AHEAD sign is used X km in advance of the taper at a work area, where additional advance warning on arterial roads is necessary, e.g. approach speeds higher than 80 km/h and sight distance less than 150 m.



T1-16

Consider use of ROADWORK 1 km AHEAD and ROADWORK 500 m AHEAD signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more, see Clause 4.7.2.



TC1825

3.4.3 Bridgework ahead (T1-2), Bridgework X km ahead (T1-29)



T1-2

The sign BRIDGEWORK AHEAD is used to give advance warning of long-term works on bridges (see Clause 4.7.2(c)).



T1-29

The sign BRIDGEWORK X km AHEAD is used on the approach to a bridgework site under the same conditions as specified for the ROADWORKS X km AHEAD (T1-16) in Clause 3.4.2.

3.4.4 Workers (symbolic) (T1-5)



T1-5

The Workers (symbolic) sign is used to give warning of personnel engaged in works on or adjacent to the travelled path as specified in Clause 4.7.2(a). It shall comprise a black symbol on a retroreflective fluorescent orange background.

Use of this sign is further dealt with in the following Clauses:

- (a) At static worksites - Clause 4.2.
- (b) At short-term works, open road areas - Clause 4.3.
- (c) At short-term works, built-up areas - Clause 4.4.
- (d) With mobile works - Clauses 3.12.3 and 4.6.4.

As this sign is used to warn of the presence of personnel, it shall only be displayed when they are actually working, or are visible to traffic, or both, and shall be removed or covered when workers have left the work area or are no longer visible to traffic.

The sign NEXT 2 km (T1-28) (see Clause 3.4.7) is used in conjunction with this sign when it is used for frequently changing work areas (see Clause 4.3.4).

3.4.5 Road plant ahead (T1-3), Grader ahead (T1-4)



T1-3-1

The sign ROAD PLANT AHEAD is used at work sites where machinery is working on the roadway and no form of traffic control, barrier or delineation is present to separate traffic from the work area. Where a grader alone is engaged in pavement, shoulder or roadside maintenance, the alternative sign GRADER AHEAD (T1-4) may be used.



T1-3-2

The smaller ROAD PLANT AHEAD (T1-3-1) sign or the GRADER AHEAD sign should be used in conjunction with the NEXT 2 km (T1-28) sign at a frequently changing work area involving maintenance work carried out on the shoulder or verge by a grader or other machine (see Clause 4.3.4). At a frequently changing work area where there are workers on foot the Workers (symbolic) (T1-5) sign is used instead of these signs.



T1-4

The sign should only be displayed when machinery is actually working.

3.4.6 Roadwork next X km (T1-24), Roadwork on side road (T1-25), Road plant on side road (T1-27), Side road closed (T1-32)



T1-24



T1-25



T1-27



T1-32

The ROADWORK NEXT X km sign may be used to supplement other advance signs wherever, over a distance of 2 km or more, there are a series of two or more work areas within the one work site separated such that road users may not be aware that they are still within the work site. Advance signing shall be provided in advance of each individual work area.

The ROADWORK ON SIDE ROAD and ROAD PLANT ON SIDE ROAD shall be used in advance of an intersection to warn of the relevant activities on the side road where there is insufficient distance from the through road intersection to the start of the works for turning traffic to be given adequate warning. Where practicable, all warning and delineation of the works should be confined to the side road. These signs shall not be used on a side road to warn of works on a through road about to be entered from the side road. The ROADWORK AHEAD (T1-1) or ROAD PLANT AHEAD (T1-3) may be appropriate in this case. A Speed Restriction sign shall not be used in conjunction with these signs.

The SIDE ROAD CLOSED sign shall be used in advance of an intersection where the side road is closed to all traffic.

3.4.7 Next 2 km (T1-28)



T1-28

The NEXT 2 km sign may be used in conjunction with either the Workers (symbolic) (T1-5), the ROAD PLANT AHEAD (T1-3-1) or the GRADER AHEAD (T1-4) signs where they are used to warn of a frequently changing work area (see Clause 4.3.4).

For shoulder grading and verge mowing on sealed roads in open road areas (see Clause 4.3.5) and for maintenance grading on unsealed roads (see Clause 4.5.2) the distance may be increased up to 10 km.

3.4.8 End roadwork (T2-16, T2-17, T2-Q03)



T2-16



T2-17



T2-Q03

The END ROADWORK sign shall be used at the departure end of a work site where a temporary speed zone has been implemented. The sign may not be necessary at the departure end of a work site where a temporary speed zone has not been implemented, on mobile works or where an END DETOUR sign (T2-23) is used (see Clause 3.6.3). The T2-16 sign is preferred wherever space available at the site allows it to be used. The smaller sized signs may be used in conjunction with ROAD PLANT AHEAD (T1-3-1), GRADER AHEAD (T1-4) and Workers (symbolic) (T1-5) signs.

3.5 SIGNS AND DEVICES FOR REGULATORY CONTROL OF TRAFFIC

3.5.1 General

Signs used for regulatory control of traffic at work sites are listed in Table 3.2. Other regulatory signs specified in Part 2 of this Manual may be used, where appropriate, if the usage specified in Part 2 applies.

TABLE 3.2 SIGNS FOR REGULATORY CONTROL OF TRAFFIC - SIZE TABLE

Sign	Sign Number	Size mm *
GIVE WAY	R1-2A	750 ht
	R1-2B	900 ht
Speed Restriction	R4-1A	450 x 600
	R4-1B	600 x 800
	R4-1C	900 x 1200
	R4-1D	1200 x 1600
ROAD WORK	R4-3A	450 x 300
	R4-3B	600 x 400
	R4-3C	900 x 600
END Speed Limit	R4-12B	600 x 1000
NO OVERTAKING OR PASSING	R6-1A	750 x 900
STOP HERE ON RED SIGNAL	R6-6A	450 x 750
STOP/SLOW bat: STOP face	R6-8A R6-8B	450 dia 600 dia
SLOW face	T7-1A T7-1B	450 dia 600 dia
ONE LANE	R9-9A	600 x 400
	R9-9B	750 x 500
Signals Ahead	W3-3B	750 x 750
	W3-3C	900 x 900
Speed limit AHEAD	G9-79B	600 x 1000
Traffic Controller Ahead/ PREPARE TO STOP	T1-Q05A	900 x 1000
	T1-Q05B	1200 x 900
Signals Ahead (Rectangle)	T1-30A	900 x 600
Next ... m (Rectangle)	R9-6A	750 x 150
	R9-6B	1000 x 200

* Except as noted in Clauses 3.5.5(a) and (b), guidance on sign size selection is given in Clause 3.2.3.

3.5.2 Manual control

The following are used for the manual control of traffic:

- (a) Traffic controller ahead/Prepare to stop (T1-Q05)



T1-Q05A

T1-Q05B

The Traffic Controller Ahead/PREPARE TO STOP sign shall be used to give advance warning where traffic may be required to stop in compliance with the directions of a traffic controller.

The sign shall not be displayed when the traffic controller is not actually in attendance controlling traffic.

- (b) Stop/slow bat (R6-8,T7-1)



R6-8



T7-1

The STOP/SLOW bat shall be used by a traffic controller to control traffic at any temporary obstruction or hazard (see Clause 4.10). Retroreflective material used on the STOP/SLOW bat shall be Class 1W material. The bat shall have a handle a minimum of 1.8 m long to the underside of the sign. For night-time operations, an illuminated wand should be used in conjunction with the bat.

3.5.3 Sign control

The following signs are used for controlling traffic by signs only:

- (a) Give way (R1-2), One lane (R9-9)



R1-2



R9-9

The GIVE WAY, ONE LANE sign assembly may be used to assign priority to one direction of travel past the work area when the travelled path is reduced to less than that required for two lanes of traffic. This technique is appropriate for road or bridgeworks when-

- (a) the traffic volume is 150 vpd or less and the posted speed limit during roadworks is 70 km/h or less;
- (b) each entry to the work area is visible from the other;
- (c) the work area is less than 100 m in length; and
- (d) there is sight distance to opposing traffic of desirably 200 m or more beyond the far end of the work area for traffic facing the GIVE WAY, ONE LANE sign assembly.

If advance warning of this sign is needed, the Give Way Sign Ahead sign (W3-2) (see Part 2 of this Manual) may be used.

- (b) No overtaking or passing (R6-1)



R6-1



R9-6

Where traffic at a single lane section is controlled by a GIVE WAY, ONE LANE sign assembly at one end in accordance with Item (a) above, the NO OVERTAKING OR PASSING sign should be erected at the start of the single lane for traffic in the opposite direction.

The NEXT ... m sign shall be used beneath the NO OVERTAKING OR PASSING sign to indicate the length of the no overtaking or passing zone. The sign is not required when the NO OVERTAKING OR PASSING zone applies to a bridge.

3.5.4 Traffic signal control

The following traffic signals and signs are used to control traffic:

- (a) *Portable traffic signal* - A portable traffic signal usually consists of two signal heads each comprising a three-aspect signal face, red, yellow and green; two vehicle detectors, a signal control unit and a portable power source. The signal control unit is usually designed to permit vehicle-actuated, fixed-time or manual operation (see Note). Requirements for portable traffic signals are specified in AS 4191. A typical signal unit is shown in Figure 3.1.

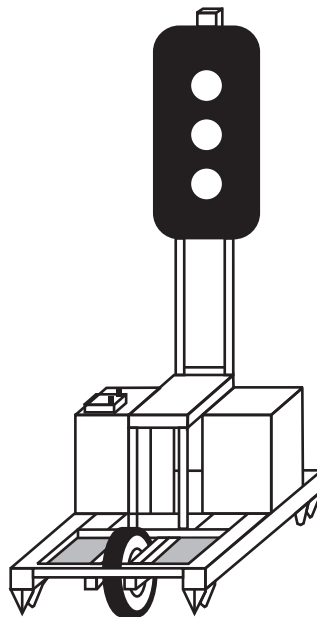


FIGURE 3.1 TYPICAL PORTABLE TRAFFIC SIGNAL

A portable traffic signal may be used to control traffic where the direction of flow in a one lane section of road is to be alternated or where all traffic is to be stopped, e.g. at a machinery or haul road crossing.

The procedures for operating portable traffic signals are given in Clause 4.11.

NOTE: All traffic and signal control equipment shall meet the applicable standards and specifications prescribed in Part 14 of this Manual, the requirements of relevant Statutory Authorities and current Queensland Department of Transport and Main Roads or local government specifications.

- (b) *Temporary fixed traffic signal* - The design and installation of a temporary fixed traffic signal shall comply with the relevant requirements of Part 14 of this Manual.

The use of temporary fixed traffic signals instead of portable signals should be considered on safety grounds. The additional signal lanterns provide a more reliable control indication to traffic.

It will usually be found preferable to install fixed temporary signals for service periods in excess of one to two weeks. Temporary signals will require a power supply for continuous use.

- (c) Signals ahead (W3-3),
Signals ahead (T1-30)



W3-3



T1-30

If portable or temporary fixed traffic signals are used to control traffic, the Signals Ahead sign (W3-3) shall be used to give advance warning. The PREPARE TO STOP (T1-18) sign shall be used in conjunction with this sign.

For short-term use with portable signals the rectangular version of this sign (T1-30) may be substituted.

Long distance warning of the existence of unexpected traffic signals, e.g. in open road areas, may be required. The sign assembly Signals Ahead (W3-3) and 1 km (TC1826) supplementary distance plate should be used in this case.

- (d) Stop here on red signal (R6-6)



R6-6

The STOP HERE ON RED SIGNAL sign shall be used to indicate where traffic must stop when there is no stop line on the pavement. It is also recommended to supplement the stop line where one is provided.

- (e) Prepare to stop (T1-18)



T1-18

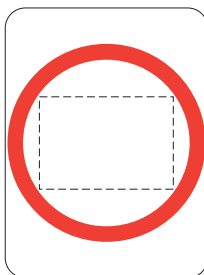
Sign Number	Size mm
T1-18A	Not used
T1-18B	750 x 500
T1-18C	900 x 600

The PREPARE TO STOP sign shall be used in conjunction with the SIGNALS AHEAD sign (W3-3). The matching size sign should be used.

3.5.5 Temporary speed limits

The following signs are used to impose temporary speed limits:

- (a) Speed restriction (R4-1)



R4-1

The Speed Restriction sign shall be used to create a temporary speed zone in accordance with the requirements and recommendations set out in Clause 4.9. It indicates the speed limit which applies between the sign and the next speed control sign ahead.

A variable speed limit sign in accordance with Part 4 of the Manual may be used.

Repeater Speed Restriction signs may be erected at intermediate locations within the zone. The sign R4-1B should be considered the minimum size.

The end of a temporary speed zone shall be indicated by a Speed Restriction sign (R4-1) displaying the appropriate speed limit for the road continuing beyond the works or the END Speed Limit (R4-12) sign where the conditions described in Item (c) apply. The END ROADWORK sign shall be used together with the Speed restriction sign.

It is a legal requirement that a speed zone be terminated either by another regulatory speed control sign, or other means as specified in traffic regulations.

These signs shall not be used without other appropriate warning signs. Where workers are present at the site, the Workers (symbolic) (T1-5) sign (see Clause 3.4.4) shall be used together with the Speed

Restriction sign. Speed Restriction signs continuously required for works which will be in progress for periods longer than 2 weeks shall be erected 1 to 1.5 m above the level of the nearest edge of the travelled path to the underside of the sign.

(b) Road work (R4-3)



R4-3

The ROAD WORK supplementary plate may be used with Speed Restriction sign (R4-1) to indicate the start of a temporary speed zone.

The A, B and C size signs are for use with the Speed Restriction sign sizes A and B respectively.

(c) End speed limit (R4-12)



R4-12

This sign may be used to terminate a temporary speed zone where it is not practicable or desirable to display the speed limit applying beyond the zone by means of the R4-1 sign. This case could typically occur where although the continuing speed limit (general limit or zoned limit) is 100 km/h, road surface, alignment or other conditions will not allow traffic to travel safely at that speed.

(d) Speed Limit AHEAD (G9-79)



G9-79

This sign shall be used to provide advance warning of the start of a temporary speed zone in accordance with Clause 4.9.5(a) where a speed zone of intermediate value is not proposed.

3.6 DETOUR SIGNS

3.6.1 General

Signs used for the guidance of traffic in advance of and through detours, are listed in Table 3.3.

Table 3.3 SIGNS FOR DETOURS - SIZE TABLE

Sign	Sign Number	Size mm *
NO ENTRY	R2-4B R2-4C	600 x 600 750 x 750
No Left Turn	R2-6B (L) R2-6C (L)	600 x 600 750 x 750
No Right Turn	R2-6B (R) R2-6C (R)	600 x 600 750 x 750
All Traffic Turn	R2-14B (L or R)	900 x 1200
LOW BRIDGE AHEAD ... m, HIGH VEHICLES DETOUR	G9-3A (L or R)	1700 x 900
LOAD LIMIT ... t ON BRIDGE, HEAVY VEHICLES DETOUR	G9-4A (L or R)	1700 x 900
DETOUR FOR HIGH VEHICLES	G9-5-1 (L or R)	1300 x 350
DETOUR FOR HEAVY VEHICLES	G9-5-2 (L or R)	1400 x 350

Table 3.3 SIGNS FOR DETOURS - SIZE TABLE (cont.)

Sign	Sign Number	Size mm *
Two-way traffic (Rectangular - regulatory)	R2-11A R2-11B	450 x 750 600 x 1000
LOCAL TRAFFIC ONLY	G9-40-2A G9-40-2B	900 x 600 1200 x 900
Two-way traffic (Diamond)	W4-11B W4-11C W4-11D	750 x 750 900 x 900 1200 x 1200
DETOUR AHEAD	T1-6A T1-6B	1200 x 600 1800 x 900
END DETOUR	T2-23	1200 x 600
Two-way traffic (Rectangular)	T2-24A	900 x 600
DETOUR (Arrow)	T5-1A (L or R) T5-1B (L or R)	1200 x 300 1800 x 450
Detour marker	T5-6A	450 x 450

* Application of the sign size designations in the T Series is given in Clause 3.2.3.

3.6.2 Detour ahead (T1-6)



T1-6

The DETOUR AHEAD sign shall be used to give advance warning of a detour bypassing a section of the normal roadway which is not trafficable or on which work is being carried out. The detour may be either via other roads or streets, or via a side track constructed for that purpose (see Clause 4.14).

3.6.3 End detour (T2-23)



T2-23

The END DETOUR sign should be used to indicate that a detour has ended wherever road users need to be advised that it has returned to the original route.

3.6.4 Detour (left or right) (T5-1)



T5-1 (L)



T5-1 (R)

The DETOUR sign (T5-1B) shall be used to indicate the direction and location for traffic to leave the normal roadway to detour via existing roads or streets or via a side track bypassing an obstruction (see Clause 4.14). It will usually be necessary to use the advance sign DETOUR AHEAD (T1-6) in conjunction with this sign.

DETOUR signs (T5-1A) should be used, if necessary, to reassure and guide traffic along the route of the detour.

3.6.5 Detour marker (T5-6)

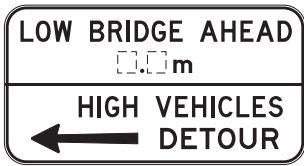


T5-6

The Detour Marker may be used in lieu of the DETOUR (T5-1) sign to guide and reassure road users along the route of a detour if the DETOUR sign is likely to misdirect road users other than those following the detour. It is typically used in built-up areas where traffic is detoured via side streets.

The signboard shall be designed to be mounted with the arrow either vertically upwards, or to the left or right.

**3.6.6 Low bridge ahead ... m, high vehicles detour (G9-3)
Load limit on bridge ... t gross, heavy vehicles detour (G9-4)**



G9-3 (L)



G9-4 (L)

The signs LOW BRIDGE AHEAD ... m, HIGH VEHICLES DETOUR and LOAD LIMIT ON BRIDGE ... t GROSS, HEAVY VEHICLES DETOUR shall be erected at locations where it is essential that high or heavy vehicles detour to avoid structures which have a low clearance or a load limitation (see Clause 4.14.10). They shall be erected in advance of the junction with the alternative route.

The alternative legend NARROW BRIDGE AHEAD ... m WIDE VEHICLES DETOUR may be substituted on sign G9-3.

3.6.7 Detour for vehicles (G9-5)



G9-5-1(L)



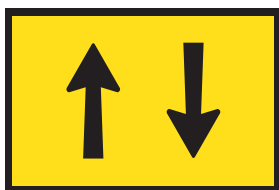
G9-5-2(L)

The DETOUR FOR ... VEHICLES sign shall be erected at the junction with an alternative route where certain classes of vehicle are unable to negotiate the work area. The words WIDE or LONG may be used in lieu of HIGH and HEAVY, where appropriate.

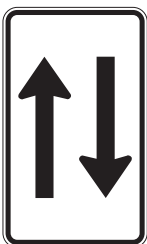
**3.6.8 Two-way traffic (W4-11)
Two-way traffic (T2-24)**



W4-11



T2-24



R2-11

The Two-way Traffic sign is used to warn road users that the roadway carries two-way traffic.

The signs should be erected on both sides of the road at the beginning of each section over which two-way conditions temporarily apply. A second set of signs should be located between 100 m and 400 m after the start of the two-way section with additional sets of signs placed at intervals of approximately 1.5 km where the speed limit is greater than 70 km/h, or otherwise at 400 m intervals.

The signs should be used for the following situations:

- (a) where a two-way road is the extension of a one-way road.
- (b) on any other road where, because of the road conditions, it is not clear whether a particular roadway carries traffic in one or both directions.
- (c) To face traffic soon after entering from a side road in either of the conditions in Items (a) and (b).

The largest sign (W4-11D) shall be used for the situation in item (b) above.

The rectangular version of this sign (T2-24) is for short term use only.

Where a roadway designed or normally used for one-way traffic is temporarily being used for two-way traffic, or where legislation prescribes that roadways, e.g. service roads, are one-way but two-way operation is desirable or necessary, the regulatory TWO-WAY sign (R2-11) shall be used at each end of the section of road to indicate the points at which the two-way traffic regulation temporarily applies.

3.6.9 All traffic turn (R2-14)



R2-14 (L)

The All Traffic Turn sign may be used at situations where all approaching traffic must turn in the direction indicated by the arrow.

3.6.10 Local traffic only (G9-40-2)



G9-40-2

The LOCAL TRAFFIC ONLY sign may be used at detours where local traffic is permitted to enter the work area (see Clause 4.14.5).

3.7 ROAD CONDITION SIGNS

3.7.1 General

Signs used to advise road users of road conditions are listed in Table 3.4.

Table 3.4 ROAD CONDITION SIGNS - SIZE TABLE

Sign	Sign Number	Size mm *
Slippery	T3-3A	900 x 600
	T3-3B	1500 x 900
SOFT EDGES	T3-6A	900 x 600
ROUGH SURFACE	T3-7A	900 x 600
	T3-7B	1500 x 900
Loose Stones	T3-9A	900 x 600
	T3-9B	1500 x 900
NEW WORK, NO LINES MARKED	T3-11	1500 x 900
NO LINES, DO NOT OVERTAKE UNLESS SAFE	T3-12	1500 x 900
GRAVEL ROAD	T3-13A	900 x 600
LOOSE SURFACE	T3-14A	900 x 600
	T3-14B	1500 x 900
X km/h (portrait format)	T3-16-1A	600 x 600
	T3-16-1B	900 x 900
X km/h (landscape format)	T3-16-2A	900 x 400
	T3-16-2B	1500 x 600

* Application of sign size designations in the T Series is given in Clause 3.2.3.

3.7.2 Slippery (T3-3), Soft edges (T3-6), Rough surface (T3-7), Gravel road (T3-13), Loose stones (T3-9), Loose surface (T3-14)



T3-3



T3-6



T3-7



T3-9



T3-13



T3-14

The Slippery, SOFT EDGES, ROUGH SURFACE, GRAVEL ROAD, Loose Stones and LOOSE SURFACE signs are used to warn road users of conditions which render the surface of the roadway or its edges temporarily hazardous. The signs should be erected 2D (see Table 4.2) metres before the beginning of the hazard. Road condition signs placed other than at an active work area may not require the use of other advance warning signs in conjunction, provided that the normal traffic lanes are not obstructed. If the hazardous conditions extend over a considerable length the signs may need to be repeated at regular intervals of not more than 500m. Advisory Speed signs (T3-16) (see Clause 3.7.3) may be required in conjunction with these signs.

The Slippery sign (T3-3) may be used to warn of a slippery condition caused by water, ice or loose material on the road surface. In the latter case, the sign LOOSE SURFACE (T3-14) may be used as an alternative to the Slippery sign.

The Loose Stones sign (T3-9) is used for any situation where flying stones may be a hazard. It may also be used to protect the road surface against excessive loss of aggregate and to warn of the possibility of flying stones where fresh bituminous surfacing work has been carried out.

3.7.3 Advisory Speed signs (T3-16)



T3-16-1



T3-16-2

Advisory Speed signs may be used in conjunction with signs in the Road Condition Series (see Clause 3.7.2) in situations where a reduction in speed is desirable for road user comfort or protection of damaged pavement or partially completed works. They are not appropriate where a roadworks speed limit is required for either traffic safety or workplace safety.

If the T3-16-1 sign is used, it is designed to be placed beside the sign to which it refers. The T3-16-2 sign is designed to be placed under it.

These signs shall not be used without another sign.

3.7.4 New work, no lines marked (T3-11) No lines do not overtake unless safe (T3-12)



T3-11

These signs are used in advance of locations where pavement markings normally required for driver guidance have been removed or have not been placed on new surfacing work.

The T3-11 sign should be used in locations such as multilane or one-way roadways where there is no overtaking risk from oncoming traffic.



T3-12

The T3-12 sign shall be used at locations where barrier lines would normally be installed and should be used in any situation on two-way roadways where there will be overtaking in an oncoming traffic lane.

3.8 SIGNS AND DEVICES FOR LANE AND ROAD CLOSURES

3.8.1 General

Signs used to effect lane and road closures are listed in Table 3.5.

Table 3.5 SIGNS FOR LANE AND ROAD CLOSURES - SIZE TABLE

Sign	Sign Number	Size mm *
ROAD CLOSED	T2-4A	1800 x 300
Lane Status (2 lane)	T2-6-1A T2-6-1B	1200 x 900 1800 x 1200
Lane Status (3 lane)*	T2-6-2A T2-6-2B	1800 x 900 2400 x 1200
EXIT CLOSED	T2-20	2100 x 1200
... EXIT CLOSED (arrow) ALTERNATIVE	T2-21 (L or R)	2600 x 1700
ROAD CLOSED ... km AHEAD	T2-Q02	1800 x 600

* Lane Status signs for more than three lanes may be designed to be similar to this sign.

3.8.2 Signs

The following signs are used for lane and road closures:

(a) Lane status (T2-6)



T2-6-1

The Lane Status sign is used where one or more lanes of a multi-lane roadway are closed.

The Lane Status sign is not used where a turn lane is closed. A No Right Turn sign or No Left Turn sign shall be used as appropriate.

The Lane Status sign shall be used only to give advance warning of lane closures and not in lieu of adequate signing and delineation of the closure.



T2-6-2

The 'bars' indicate the closed lanes while the arrows indicate lanes available to traffic. This sign may be made with removable and reversible symbols so that the number and location of each type can be varied to suit the particular

lane closure in operation. Versions of these signs designed along the same lines to show more than three lanes may also be used.

Whenever practicable the Lane Status sign should be placed on both sides of the road.

(b) Road closed (T2-4)



T2-4

The ROAD CLOSED sign shall be used where a roadway is closed to traffic. Barrier boards shall be erected across the roadway in conjunction with the sign and the bars should be aligned to point to the sign (see Clause 3.8.3).



T2-Q02

Consideration should be given to providing traffic detours.

The ROAD CLOSED ... km AHEAD sign may be placed in advance of the road closure. This sign should be erected at the junction with an alternative route, if practicable.

(c) ... Exit closed - alternative (T2-21)



T2-21 (L)

The ...EXIT CLOSED - ALTERNATIVE sign is used on freeways at the exit in advance of the closed exit if this is an appropriate alternative route. Signs may be ordered for specific exits or bolt-on overlays may be utilised (see Clause 4.14.9).

(d) Exit closed (T2-20)



T2-20

The EXIT CLOSED sign is placed in advance of a closed freeway exit.

3.8.3 Barricades

Barricades comprise either barrier boards (see Figure 3.2) or stand-alone non-interconnected lightweight modules. They shall be used to inhibit access to a work area. They should be erected approximately perpendicular to the direction of traffic flow at intervals not exceeding 100 m. Barricades shall not be used for delineation purposes.

The requirements for each type of barricade are as follows:

(a) Barrier boards

Barrier boards shall be 150 mm to 200 mm in height and not more than 4 m in length. They should be mounted on trestles or fixed posts at about 1 m above the pavement. The colour combination used for barrier boards shall be alternate diagonal stripes of black and retroreflective yellow, terminating in yellow at each end as illustrated in Figure 3.3.

They shall not be placed parallel to the direction of traffic flow. Barrier boards so placed can become a spearing hazard if struck end on by an out-of-control vehicle.

(b) Stand-alone lightweight modules

Stand-alone non-interconnected lightweight modules when used as barricades shall be placed behind a line of delineating devices.

Both types of device shall satisfy the requirements of Impact tests 70 and 71 of NCHRP 350 for work zone traffic control devices.

NOTE: Tests 70 and 71 of NCHRP 350 are used to assess the structural integrity of traffic control devices. Both tests use an 820 kg test vehicle which impacts the device along the central axis of the vehicle with an impact angle of 20 degrees or less. Test 70 impacts at 35 km/h (Test Level 1) and Test 71 impacts at 70 km/h (Test Level 2). Both tests determine the structural integrity of the impacted device by considering whether or not the device fragments, generating projectiles or spearing elements that could be hazardous to the occupants of errant vehicles or nearby pedestrians.



Note: In this figure, vehicles pass to the left of the board. The bars should be aligned to point down to the right for vehicles to pass to that side.

Figure 3.2 TYPICAL BARRIER BOARD

3.9 DEVICES FOR DELINEATING AND INDICATING THE TRAVELLED PATH

3.9.1 Traffic cones and temporary bollards

Traffic cones and temporary bollards should be used on works to define the traffic path within the work site.

Requirements and recommendations for their use are as follows:

(a) *Traffic cones*

Traffic cones shall comprise cones of fluorescent red or fluorescent orange material that is resilient to impact. Various sizes available should be used as follows:

(i) Small cones

450 to 500 mm height - most built-up area and open road applications including footpaths, shared paths and bicycle paths where posted speed limits do not exceed 70 km/h.

(ii) Standard size cones

700 mm height or greater all other road applications where posted speed limits exceed 70 km/h. Standard size cones may also be used on lower speed roads.

(b) *Temporary bollards*

Temporary bollards shall comprise a vertical parallel sided or tapered tube of fluorescent orange or red material that is resilient to impact. They shall be at least 750 mm in height and a minimum of 100 mm in diameter.

For night-time use, cones and bollards shall be fitted with a white horizontal retroreflective band having a retroreflective performance at least equal to Class 1 material as specified in AS/NZS 1906.1. The size and positioning of retroreflective bands on traffic cones and bollards are given in Table 3.6.

Table 3.6 SIZE AND POSITIONING OF RETROREFLECTIVE BANDS ON TRAFFIC CONES AND BOLLARDS (millimetres)

Item	Height	Band width	Distance from top of device to band
Cone	450 to 500	150	130 ±5
Cone	700 and over	250	220 ±5
Bollard	all heights	250	220 ±5

Cones and bollards shall be designed to be stable under reasonably expected wind conditions and air turbulence from passing traffic. However, they can be displaced by passing traffic and therefore, unless workers are there to replace them, should not be used unless they are securely fixed to the pavement or weighted to provide adequate stability from passing traffic when unattended.

Cones should be spaced so as to discourage entry to the work area, generally from 5 m to 25 m apart. Spacing of cones and bollards may need to be reduced to as little as 1 m if needed to prevent traffic taking a wrong turn or wrong opening through a line of bollards.

3.9.2 Roadworks delineators

Roadworks delineators shall comprise red delineators on the left side and white delineators on the right (two-way roadway) or yellow on the right (one-way roadway).

Delineators used at or near works on roads shall meet the requirements of AS/NZS 1906.2 for either the sheeting or discrete device type. Delineators made from orientation-sensitive material shall be made and installed at the material manufacturer's recommended orientation for optimum performance.

NOTE: Orientation-sensitive material is generally regarded as material whose CIL at the specified measurement angles changes by more than 10% as it is progressively rotated in its plane.

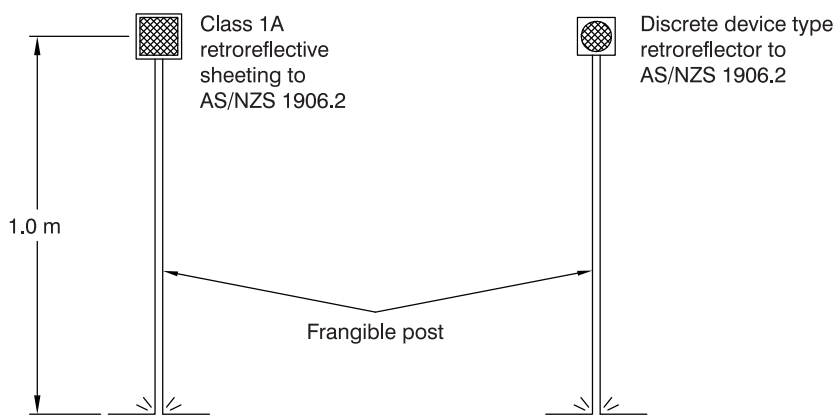
Delineators should be erected 1 m minimum from the edge of the travelled path and at a uniform height of approximately 1 m above the road surface. Delineator posts should be frangible or otherwise non-hazardous.

Delineators should be installed so as to provide a single continuous line defining the travelled path. The spacing of delineators should be as follows:

- (i) Immediately adjacent to or through work areas -
 - (A) 24 m maximum at posted speed limits up to 70 km/h;
 - (B) 60 m maximum at higher posted speed limits.
- (ii) On side tracks and detours - as specified in Clause 4.14.6.

Temporary road safety barrier systems installed through work areas should be delineated at approximately 20 m spacings. Barriers installed to form curves or tapers may require additional delineation.

Typical post-mounted delineators are shown in Figure 3.3.



Note: Delineator colour is specified in Clause 3.9.2.

FIGURE 3.3 EXAMPLES OF ROADWORKS DELINEATORS

3.9.3 Temporary hazard markers (T5-4, T5-5, T5-Q02)



T5-4



T5-5



T5-Q02

Sign Number	Size mm
T5-4	1500 x 450
T5-5	600 x 600
T5-Q02	250 x 1200*

* This dimension may vary from 1140 to 1200mm.

Temporary Hazard markers should be used to show any lateral change of direction of the travelled path through a work site and to delineate hazards and non-trafficable work areas adjacent to the travelled path. They should be erected with their edge about 1 m from the edge of the travelled path and at a uniform height above the road surface, and the chevrons shall always point to the side to which traffic is required to pass.

On works extending overnight or being conducted at night where an obstruction encroaches onto the roadway, a series of T5-4 Temporary Hazard markers may be used in lieu of traffic cones or bollards to form the taper guiding traffic away from the obstruction. The T5-4 markers should be spaced so that as the taper is approached they appear as a continuous line (see Clause 4.8.3). If temporary delineation is required on both sides of the vehicle path at a taper, hazard markers should only be used on the side primarily steering traffic away from the obstruction. Since in most cases two parallel lines of hazard markers will lead to confusing visual patterns, traffic cones or bollards should be used on the other side. For daytime-only works, traffic cones or temporary bollards used in conjunction with the T5-5 Temporary Hazard marker as indicated below, will generally suffice.

The T5-5 Temporary Hazard marker may be used on works extending overnight, in lieu of the T5-4 marker, in confined areas where there is insufficient space to use the wider marker.

The T5-5 marker should also be used at short-term works to indicate the beginning of a line of traffic cones or bollards where the devices themselves may not be sufficiently visible to approaching traffic.

If other signs, such as ROAD CLOSED or DETOUR, are required at a site in conjunction with a line of Temporary Hazard markers they should be placed so as to appear above but not among the line of Temporary Hazard markers.

The Temporary Collapsible Chevron delineator T5-Q02 may be used to delineate hazards and non-trafficable work areas adjacent the travelled path.

3.9.4 Pavement markings

This Clause applies to roads where there were pavement markings in existence prior to the works.

Appropriate pavement markings should be provided or maintained to guide traffic through and past a work area. The following principles apply:

- Where existing markings are satisfactory, they should be maintained in good condition throughout the period of the work.
- If existing markings are not appropriate or are potentially misleading, they should be removed and replaced by more suitable markings, taking care that markings are not obliterated by material which may become slippery.

NOTE: It is inadvisable to obliterate markings using black or grey paint as under certain light or wet weather conditions (e.g. specular illumination by opposing vehicle headlights) they may appear indistinguishable from white markings.

- Consideration should be given to the use of retroreflective pavement marking tape for all temporary lines as the removal of road marking paint is often difficult and may leave a mark which may be mistaken for a line under certain lighting or wet weather conditions.

- (d) Temporary lines used to guide traffic through substantial diversions or changes in direction, should be supplemented by raised retroreflective pavement markers.
- (e) Where, during or at the conclusion of pavement-surfacing works, a section of roadway is to be left for a period of time without linemarking, temporary raised retroreflective pavement markers should be used to provide delineation of the separation or lane lines. The use of appropriate signs warning of the need to exercise caution in the absence of lines is set out in Clause 3.7.4.

3.9.5 Raised retroreflective pavement markers

Raised retroreflective pavement markers (RRPMs) complying with AS 1906.3 may be used in conjunction with temporary pavement markings at long-term work sites. The spacing and application should be as specified for permanent use in Part 2 of this Manual.

Temporary RRPMs recommended under Clause 3.9.4(e) at freshly surfaced pavements should be sufficiently robust to survive under traffic until permanent markings are installed.

Where special emphasis of a dividing line is required, e.g. where a multilane or divided road has been temporarily reduced to a two-way road, lane dividers typically comprising a larger base than the RRPM, with a vertical flexible flap attached and incorporating a retroreflector, may be placed along the dividing line, generally at the same spacing as RRPMs.

3.9.6 Temporary kerbing

Temporary kerbing may be used to form temporary medians, traffic islands or pavement edges during long-term works. Such kerbing shall be not greater than 150 mm in height and should be securely fastened to the pavement. It should be white, and as seen by approaching traffic shall appear as a continuous line at least 150 mm wide.

3.10 CONTAINMENT FENCES AND ROAD SAFETY BARRIER SYSTEMS

3.10.1 Containment fences

Containment fences comprising tapes, plastic mesh fencing or longitudinal channelising barricades may be used to provide visible containment as described in Items (a) and (b), and Clause 3.10.2 in situations where physical protection by use of a road safety barrier system (see Clause 3.10.3) is not warranted.

All types of containment fence shall have sufficient stability to resist displacement, fracture or deflection of more than 0.5 m resulting from all expected wind conditions, air turbulence from passing traffic and minor vehicular impacts.

Descriptions and use of tapes and mesh fencing used as containment fences are as follows:

(a) Tapes

Containment tapes may be used to contain workers on foot and plant within the safe workplace boundary established at the particular work site in accordance with Clause 4.2. The tape should be a minimum of 100 mm wide with alternate stripes of contrasting colour, and should be supported approximately 1 m above ground level with supports spaced so that the minimum height of the tape above ground is not less than 800 mm. The maximum breaking strength should be low enough not to cause hazard to any vehicle or motor cycle which might run into it. Tapes shall not be used for pedestrian containment adjacent to traffic.

(b) Plastic mesh fencing

Plastic mesh fencing may be used for pedestrian containment as well as for the containment of workers on foot and plant as in Item (a). It comprises a flexible orange mesh approximately 1 m high. It shall be supported so that the top of the fence is at least 800 mm above ground level at all times.

3.10.2 Longitudinal channelising barricades

Longitudinal channelising barricades shall comprise interconnected lightweight modules such as plastic water ballasted modules. They may be used either as containment fences for workers or pedestrians, or as delineation devices in situations where a road safety barrier system as specified in Clause 3.10.3 is not required. Their use shall be subject to the following:

- (a) They shall satisfy the requirements of Impact tests 70 and 71 of NCHRP 350 for work zone traffic control devices together with such additional tests as may be required in the revised edition of AS 3845 (a new edition of AS 3845 was in preparation at time of publication of this Part of the Manual).
- (b) They shall be marked 'NOT A SAFETY BARRIER' in letters at least 50 mm high.
- (c) Edge clearances to traffic shall be in accordance with Clause 4.13.4(a).

Stand-alone, non-interconnected lightweight modules shall not be used for the above purposes. Their use shall be confined to inhibiting access to a work area as specified in Clause 3.8.3.

3.10.3 Road safety barrier systems

Road safety barrier systems are designed to provide a physical barrier between the travelled path and the work area, which will inhibit penetration by an out-of-control vehicle (see Note) and will have vehicle redirecting properties. They are typically used between traffic and a severe hazard such as a deep excavation, a bridge pier or a hazardous stockpile, and for the protection of workers and non-vehicular road users in vulnerable situations where lateral clearance to moving traffic would otherwise be insufficient for safety. They may also be used to separate opposing traffic.

NOTE: The satisfactory performance of a barrier system will depend on its being struck by a vehicle no larger than the 'design' vehicle for which it is to be designed. Selection of the design vehicle should be subject to a risk assessment taking into account traffic mix past the site and the nature and length of the works.

Vehicles can be protected from collisions with hazardous fixed objects by crash attenuators as an alternative to safety barrier systems (see Clause 3.10.4).

The type selection and installation of a temporary road safety barrier system including positioning and end treatments shall be in accordance with AS/NZS 3845. For the protection of workers from dynamic deflection of the barrier in a crash, if the work area is close to the rear of the barrier a containment fence or longitudinal channelising barricade shall be placed behind the barrier a clear distance equal to the likely dynamic deflection. Data on the dynamic deflection of the barrier type used when impacted by the selected design vehicle will be needed to determine the positioning of the containment fence. The positioning of protective fencing behind a barrier is illustrated in Figure 3.4.

The positioning of barriers in relation to high obstructions such as power poles, bridge piers or underpass scaffolding shall take into account the likely extent of body roll of a high vehicle striking the barrier.

Fittings other than delineators shall not be attached to safety barrier systems unless they have been designed to accommodate the fitting.

Edge clearances to traffic shall be in accordance with Clause 4.13.4(c).

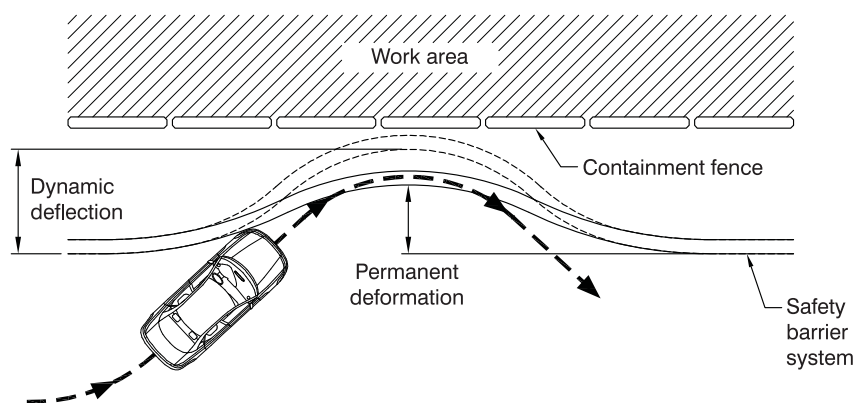


FIGURE 3.4 PROTECTIVE FENCING BEHIND A SAFETY BARRIER SYSTEM

3.10.4 Temporary crash attenuators

Hazardous fixed objects that have become exposed to traffic due to roadwork, such as bridge piers or safety barrier ends, may need to be equipped with purpose designed energy absorbing terminal devices to reduce the severity of collision by an out-of-control vehicle.

The need should be determined from a risk assessment that takes full account of the additional risk due to works on roads.

NOTE: Reference should be made to NCHRP 350 and NCHRP 358 for the selection, design and positioning of temporary crash attenuators.

3.11 LAMPS

Flashing yellow lamps may be used at work sites to draw attention to advance signs. They are typically used with the ROADWORK AHEAD (T1-1) or BRIDGEWORK AHEAD (T1-2) signs in areas where road lighting is poor or absent. Flashing lamps shall not be used for delineation purposes.

NOTE: The use of steady or ripple lamps for any purpose including delineation has now been omitted from this Part of the Manual. Any mandatory requirements for the use of flashing lamps have also been omitted.

3.12 VEHICLE-MOUNTED SIGNS AND DEVICES

3.12.1 Vehicle-mounted warning device

A vehicle-mounted warning device shall consist of one or other of the following:

- (a) A single yellow beacon lamp for emergency or other infrequent use on a vehicle not normally used for roadworks purposes, or for use on a plant item working within a static work area, or an inspection vehicle operating in accordance with Clause 4.3.6(a)(ii) or (b).
- (b) A pair of yellow beacon lamps for use on vehicles (e.g. patrol trucks) working on all roads and positioned on the vehicle so that at least one and preferably both lamps are visible from any direction.

NOTE: Strobe lamps may be permitted as an alternative if it can be shown that their on-time performance in each flash cycle is equal to or longer than the beacon lamp.

- (c) An illuminated flashing arrow sign as specified in Clause 3.12.2 for mobile works where indicated in Clause 4.6.

The vehicle-mounted warning device shall be mounted as high as practicable on the vehicle for best visibility to other traffic, e.g. on top of the cab of a truck. It may need to be placed near the rear of the vehicle if a cab-mounted sign could be obscured by a load. Supplementary signs used in conjunction with the illuminated flashing arrow sign (see Clause 3.12.3), may be mounted either in conjunction with that sign or elsewhere in a prominent position on the vehicle.

Where signs are mounted on the device or elsewhere on a vehicle, they shall be capable of being removed from view (e.g. by covering, folding or turning off) when not needed.

3.12.2 Illuminated flashing arrow sign

This sign comprises a matrix of lamps in the form of an arrow that is flashed in a cyclic manner to provide advance warning of a temporary diversion. It includes a backing board for the lamps together with ancillary equipment necessary for mounting and operating the sign, and reducing its light output (dimming) for night-time use.

The following three size designations are used:

- (a) *Size A*
1260 mm x 650 mm - designed for roof mounting on a light vehicle, and is typically used for short-term lane closure and mobile works on roads with a posted speed limit (prior to roadworks) of 60 km/h or less.
- (b) *Size B*
1500 mm x 770 mm - designed for cab mounting on a truck. It is typically used for short-term lane closures or mobile works, and is suitable for use on roads with a posted speed limit (prior to roadworks) of greater than 60 km/h.
- (c) *Size C*
2400 mm x 1200 mm - trailer mounted with its own power supply and suitable for medium and long-term lane closures on multilane roads with a posted speed limit (prior to roadworks) of greater than 60 km/h, freeways and elsewhere where a high level of long distance advance warning is desirable for safety.

The sizes given above are the maximum signboard sizes specified in AS/NZS 4192.

High intensity flashing 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.

Requirements for the flashing of different patterns of the lights are as follows:

- (i) When traffic is expected to pass the sign on a particular side and can do so in safety, i.e. it is not required to seek a gap in oncoming traffic, the bar of the arrow and the barb directing traffic to that side shall be flashed.
- (ii) When the sign is used to give a general warning of works activity ahead including mobile works, but either the sign is located clear of the traffic path or the display of an arrow would not be appropriate for some other reason, either the bar of the arrow only or the four corner lights at the extremities of the barbs shall be flashed. In the latter case diagonal pairs should be flashed alternately.

A typical sign as part of a vehicle-mounted warning device is shown in Figure 3.5.

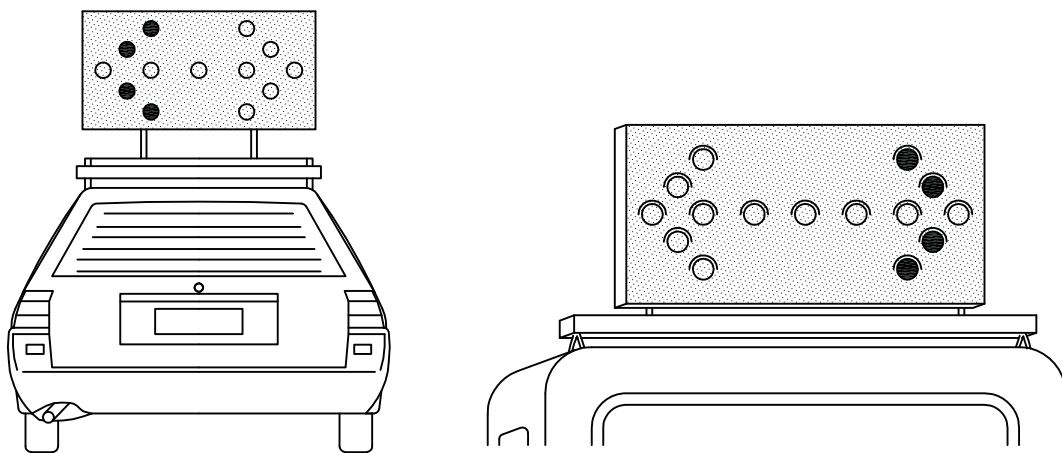


FIGURE 3.5 ILLUMINATED FLASHING ARROW SIGN

3.12.3 Supplementary vehicle-mounted signs

The following lists signs appropriate for use in conjunction with the illuminated flashing arrow sign where necessary to warn road users of the presence of workers on foot or the nature of the work:

- (i) *Workers (symbolic) (similar to sign T1-5)* - This sign shall be used on all vehicles in a mobile works convoy (see Clause 4.9) whenever workers on foot are part of the operation. The colour requirements for this sign are the same as specified for the T1-5 sign in Clause 3.4.4. The symbol size shall be not less than that specified for sign No. T1-5A or B according to the requirements of Clause 3.2.3.
- (ii) *LINE MARKING (T6-Q07)* - This sign shall be used on advance warning vehicles as well as on the work vehicle. The colour requirements for this sign are specified in Item (a) below.

Where used, these signs shall be mounted either on the vehicle-mounted warning device along with the flashing arrow sign, or elsewhere in a permanent position on the body of the vehicle.

Standard signboard sizes are not specified for these signs. They shall be tailored to suit the positioning and mounting arrangements on the vehicle.

Legends shall be of sufficient size to be read by drivers at a distance of at least D (where D = 60 to 80 m).

The following signs may be used in conjunction with other signs and devices to warn traffic that work is in progress on the road ahead. The signs incorporate a panel of chevrons which is adjusted to indicate the side of the vehicle to which traffic should pass.

Table 3.7 SUPPLEMENTARY VEHICLE MOUNTED SIGNS - SIZE TABLE

Sign	Sign number	Size, mm*
KEEP CLEAR (with chevron panel)	T6-Q02A (L or R)	1200 x 600
	T6-Q02B (L or R)	1800 x 750
LINE MARKING (with chevron panel)	T6-Q06A (L or R)	1200 x 600
	T6-Q06B (L or R)	1800 x 750
LINE MARKING	T6-Q07A	1200 x 300
	T6-Q07B	1800 x 450

* Guidance on size selection is given in Clause 3.2.3.

(a) Line marking (T6-Q06, T6-Q07)



T6-Q06(L)

The LINE MARKING sign T6-Q06 or T6-Q07 shall be used on linemarking vehicles while traffic lines are being painted.

The T6-Q06 sign incorporates a panel of chevrons which is adjusted to indicate whether the overtaking manoeuvre is to the left or to the right. Lamps shall be used with this sign.



T6-Q07

The T6-Q07 sign is mounted above an illuminated flashing arrow sign (see Clauses 3.12.1 and 3.12.2 and Figure 4.3).

(b) Keep clear (T6-Q02)



T6-Q02(L)

The KEEP CLEAR (T6-Q02) sign may be used on pavement testing vehicles for pavement testing operations which are carried out at a slow speed (about 1-2 km/h).

3.12.4 Painting of vehicles and machinery

Vehicles and machinery required to work in or alongside normal road traffic should be painted a distinctive bright colour. The colour should contrast with the colour of high-visibility clothing used by personnel.

3.12.5 Truck-mounted crash attenuator

Slow-moving or stationary work vehicles which are exposed to potential collisions by approaching traffic may be fitted with truck-mounted crash attenuators. They should be selected to have a collision speed rating appropriate to the traffic speed environment in which they are to be used. Suggested performance characteristics for these devices are given in NCHRP 350.

NOTE: Guidance (under development) on the use of truck-mounted attenuators is given in the Traffic and Road Use Management Manual.

3.13 BLASTING WORK SIGNS

3.13.1 General

Signs used at blasting works are listed in Table 3.8.

NOTE: The use of explosives is covered in AS 2187.2.

Table 3.8 SIGNS USED AT BLASTING WORKS - SIZE TABLE

Sign	Sign number	Size, mm*
BLASTING AREA, SWITCH OFF RADIO TRANSMITTERS AND MOBILE PHONES	T4-7A	1200 x 900
END BLASTING AREA	T4-3AA	1200 x 450
	T4-3A	1800 x 600

* Guidance on size selection is given in Clause 3.2.3.

3.13.2 Blasting area switch off radio transmitters (T4-7)



T4-7

When electric detonators are to be handled or used within 40 m of a road, the sign BLASTING AREA, SWITCH OFF RADIO TRANSMITTERS AND MOBILE PHONES shall be prominently displayed at the edge of the roadway on all road approaches at a distance of not less than 200 m from the handling or blasting site.

This sign is used in conjunction with the END BLASTING AREA sign (T4-3).

3.13.3 End blasting area (T4-3)



T4-3

The END BLASTING AREA sign shall be placed a minimum of 200 m beyond the blasting area to indicate where radio transmitters may again be used.

3.14 SIGNS AND DEVICES FOR PEDESTRIAN CONTROL

3.14.1 General

Signs for pedestrian control are listed in Table 3.9. See also Clause 2.3.7.

Table 3.9 SIGNS FOR PEDESTRIAN CONTROL - SIZE TABLE

Sign	Sign number	Size, mm
PEDESTRIANS WATCH YOUR STEP	T8-1	900 x 600
PEDESTRIANS (arrow)	T8-2 (L or R)	1200 x 300
USE OTHER FOOTPATH	T8-3	900 x 600
FOOTPATH CLOSED	T8-4A	900 x 600
LOOK BOTH WAYS, TWO-WAY TRAFFIC	T8-5A	900 x 600

3.14.2 Pedestrians watch your step (T8-1)



T8-1

The PEDESTRIANS WATCH YOUR STEP sign should be used where the route for pedestrians across incomplete works could be hazardous because of roughness, level differences, or loose or other surface material.

3.14.3 Pedestrians (arrow) (T8-2)



T8-2

The PEDESTRIANS (arrow) sign should be used at a work site where it is necessary to direct pedestrians via a particular path.



3.14.4 Use other footpath (T8-3) Footpath closed (T8-4)



T8-3

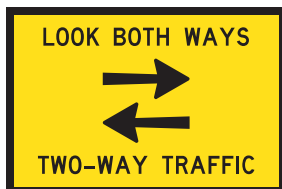


T8-4

The USE OTHER FOOTPATH sign shall be used where works make it necessary to deny use of the footpath on one side of the road. PEDESTRIANS (arrow) (T8-2) signs shall be used as necessary in conjunction with this sign.

The FOOTPATH CLOSED shall be used at a footpath which is not in use. The footpath should be closed with barriers.

3.14.5 Look both ways, two-way traffic (T8-5)



T8-5

Where one roadway of a divided road is temporarily closed, this sign shall be placed at non-signalised pedestrian crossings on both sides of the open roadway to face pedestrians about to cross, if there is a risk that pedestrians might not notice that the roadway is two-way.

3.14.6 Pedestrian containment

Barricades (see Clause 3.8.3) or mesh fence (see Clause 3.10.1) may be used to control pedestrian movements at a work site. Where pedestrian traffic has been diverted onto an existing roadway, a safety barrier may be required (see Clause 3.10.3). Barrier boards or tapes shall not be used for pedestrian containment adjacent to moving traffic.

3.15 SIGNS AND DEVICES FOR VEHICLE HEIGHT AND MASS RESTRICTIONS

3.15.1 General

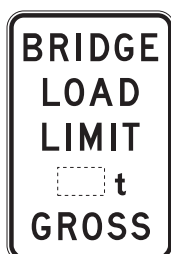
Signs indicating vehicle height and mass restrictions are listed in Table 3.10.

Table 3.10 SIGNS FOR VEHICLE HEIGHT AND MASS RESTRICTIONS - SIZE TABLE

Sign	Sign number	Size, mm*
BRIDGE LOAD LIMIT ... t GROSS	R6-3A R6-3B	600 x 900 900 x 1350
LOW CLEARANCE ... m	R6-11	1950 x 600
CLEARANCE ... m	R6-12	1500 x 600
LOW CLEARANCE ... m	W4-8B W4-8C	750 x 750 900 x 900

* Guidance on size selection is given in Clause 3.2.3.

3.15.2 Bridge load limit ... t gross (R6-3)



R6-3

The BRIDGE LOAD LIMIT ...t GROSS sign shall be used to indicate the maximum permissible gross load in tonnes on a bridge and shall be erected at, or on, the immediate approaches to the bridge.

The sign G9-4 (see Clause 3.6.6) should be erected at an appropriate intersection in advance of the bridge to advise road users of the limitation on load and to indicate an alternative route.

The DETOUR FOR HEAVY VEHICLES sign (G9-5-2) (see Clause 3.6.7) should be erected at appropriate intersections to advise road users of an alternative route bypassing the load limitation.

An alternative to this sign with the legend BRIDGE WIDTH LIMIT ...m shall be used if required to indicate the maximum permissible width of a vehicle crossing the bridge.

3.15.3 Low clearance ... m (R6-11)



The LOW CLEARANCE ... m sign shall be erected on all bridges, underpasses and other structures where the safe vertical clearance above the road pavement is less than 4.6 m. The sign should be attached to or located adjacent to the structure and over the centre of the roadway to face approaching traffic. The sign shall show a clearance in metres to the nearest 0.1 m below the safe clearance. (See Clause 2.4.7.)

The warning sign LOW CLEARANCE ... m (W4-8) (see Clause 3.15.5) should be located in advance of the structure.

3.15.4 Clearance ... m (R6-12)



The CLEARANCE ... m sign may be erected on structures where the safe vertical clearance is greater than 4.6 m but less than 5.3 m. The sign shall show a clearance in metres to the nearest 0.1 m below the safe clearance.

3.15.5 Low clearance ... m (W4-8)



The LOW CLEARANCE ... m sign shall be used in advance of all bridges, underpasses and other structures where the clearance is less than 4.6 m. The sign shall show a clearance in metres to the nearest 0.1 m below the safe clearance.

In locating this sign, the needs of a driver of a large vehicle that may have to stop at a safe turning area in advance of the structure should be taken into account.

The LOW CLEARANCE ... m sign (R6-11) (see Clause 3.15.3) located on or adjacent to the structure is used in conjunction with this sign.

The informative sign (G9-3) (see Clause 3.6.6) should be erected at an appropriate intersection in advance of the structure to advise road users of the height limitation and to indicate an alternative route.

A supplementary detour sign (G9-5-1) (see Clause 3.6.7) should be erected at appropriate intersections to advise road users of an alternative route bypassing the low clearance hazard.

3.15.6 Low clearance warning gauge

A low clearance warning gauge is a device which may be erected in advance of an overhead structure where there is a safety risk to workers or other traffic in the event of impact. It should be designed either to physically inhibit passage under the structure, or to visually or audibly warn that a vehicle exceeds the available clearance. The gauge should be located sufficiently in advance of the structure to permit a vehicle which exceeds the available clearance and is driven at not more than the speed limit, to stop safely. The gauge should apply to the full width of the approach roadway, be mounted approximately at right angles to it and be signposted appropriately.

3.16 OTHER SIGNS AND DEVICES

3.16.1 General

Signs used at roadworks sites which do not fall into previously defined classifications, are listed in Table 3.11.

Table 3.11 OTHER ROADWORKS SIGNS - SIZE TABLE

Sign	Sign number	Size, mm*
Trucks (Diamond)	W5-22B W5-22C	750 x 750 900 x 900
TRAFFIC HAZARD	T1-10	1200 x 900
Trucks (Rectangle)	T2-25A	900 x 600
POWER LINE WORKS IN PROGRESS	T4-5	1800 x 900

* Guidance on size selection is given in Clause 3.2.3.

3.16.2 Trucks (T2-25) Trucks (W5-22)



T2-25

The Trucks (T2-25) sign should be used where trucks may cross, enter or leave the road from an adjoining property at a frequency and in circumstances which create a hazard. The sign should be displayed only when the need exists and removed or covered when truck activity has ceased.

The sign should be placed on the side of the road from which trucks will be crossing or entering.

The diamond version of this sign (W5-22) is for long-term use only.



W5-22

3.16.3 Power line works in progress (T4-5)



T4-5

This sign is an example of signs which may be used to describe specialised works carried out on or near roads by public authorities which are responsible for power supply, communications, and other utilities. Such signs shall supplement and not replace the appropriate standard signs and devices required in accordance with this Manual for the particular work site. Typical legends would be: TELECOM, PIPELINE, LEVEL CROSSING etc, WORKS IN PROGRESS.

3.16.4 High-visibility clothing for work personnel

High visibility clothing meeting the requirements of AS/NZS 4602 for Types D, N or D/N garments shall be worn by all personnel working in or adjacent to traffic, including traffic at work sites, in quarries and on construction haul roads. The clothing is designed to make personnel more conspicuous and to warn road users of their presence.

The clothing shall be used as follows:

- (a) For general use by all personnel at a works site - a Type D/N (day/night) garment.

NOTE: This requirement covers the contingency that a worker may be required to work in darkness or in partial darkness at the beginning or end of a day shift, or may be called out unexpectedly at night.

- (b) Where the garment is to be worn during daylight hours - a Type D (day only) garment
- (c) Where the garment is to be worn during hours of darkness - a Type N (night only) garment.

Clothing shall be properly fastened when being worn at a works site so that the entire available area of high visibility material for each direction of observation, can be seen.

3.16.5 Traffic hazard (T1-10)



T1-10

The sign TRAFFIC HAZARD is for emergency use only, and may be used whenever any unexpected event causes a traffic hazard. Should the hazard remain for any appreciable time, this sign shall be replaced as soon as possible, generally within 24 hours, by signs more appropriate to conditions imposed on traffic. Use of this sign at emergency and unplanned works is set out in Appendix H.

3.16.6 Variable message signs

Where variable message signs are to be used at or near a roadworks site to carry warning or other messages relating to the works, the following requirements shall apply:

- (a) Word legends shall comprise not more than four words or numbers on any one screen.
- (b) Letter forms and legend height shall be adequate to be comfortably read by drivers at the posted speed limit (see also Item (d)).
- (c) There shall not be more than two separate screens in any alternating series of screens.
- (d) Where there are alternating screens the “on” time of each screen should be 0.6 ± 0.1 s per word or number and the total time required to read the message on both screens shall be taken into account when determining message length and letter height.

NOTE: A procedure for determining letter sizes for signs is given in Part 2 of this Manual. The letter series which most nearly matches the on-screen fonts should be used in the calculations. It is recommended that the calculated letter height be doubled for this purpose.

- (e) Symbols shall not be used unless they have been tested for comprehension in their on-screen format (i.e. taking into account distortions due to pixel size limitations).
- (f) Messages shall be relevant to the nature and phase of the work in progress and shall be changed or switched off when they are not relevant.
- (g) Except as specified in Item (h) messages shall be additional to and not substituted for any sign, or warning or delineating device required by this Part of the Manual. The nature and positioning of the messages not to detract from those signs or devices.
- (h) Variable message signs on roads near a work site displaying unrelated messages shall be switched off. Attempts should also be made to have such signs on adjacent property switched off.

Variable Speed Limit signs, if used, shall be in accordance with Part 4 of the Manual and other requirements of this Standard relating to temporary speed zones.

3.16.7 Antiglare screen

An antiglare screen which reduces excessive headlight glare to an acceptable level should be considered where temporary diversions result in directly opposing traffic. Screens should also be provided where oncoming headlights could mislead drivers as to their correct travel path. The screen supports should be of sufficient strength to ensure the stability of the screen in windy conditions but frangible under vehicle impact.

3.16.8 Miscellaneous signs

- (a) Probable delay 15 minutes (T1-Q02)



T1-Q02

Sign Number	Size mm
T1-Q02	900 x 600

The PROBABLE DELAY 15 MINUTES sign may be erected in advance of roadworks where delays are expected to be longer than normal.

(b) No entry (R2-4)



R2-4

Sign Number	Size mm
R2-4A	450 x 450
R2-4B	600 x 600
R2-4C	750 x 750
R2-4D	900 x 900

The NO ENTRY sign is used at the termination of a one-way roadway to prohibit access from the wrong direction.

At one-way streets at least one NO ENTRY sign shall be erected at the intersection facing in the opposite direction to the one-way flow. It may need to be located a short distance into the one-way street if there is a possibility of drivers becoming confused as to which street is closed to entry. Sufficient signs shall be erected to ensure that at least one is clearly visible to drivers approaching from any direction, and some signs may have to be set at an angle to achieve this purpose.

(c) Project information signs

Where a public authority with the necessary jurisdiction decides to erect project information signs at or near a road or bridge construction job which has commenced or is about to commence, such signs should be dignified in appearance and shall conform to the best practices for the design of highway signs. The main part of the legend shall be of sufficiently large letters, and of such brevity that the motorist travelling at the posted speed limit can read the legend without being unduly distracted from the driving task. Additional information may be given in small size legend provided that the sign is located so that the motorist may safely stop to read the sign.

For detailed information on the use of project information signs, refer to the Traffic and Road Use Management (TRUM) manual.

(d) Danger gas no smoking (T4-Q03)



T4-Q03

Sign Number	Size mm
T4-Q03	1200 x 600

The DANGER GAS NO SMOKING sign shall be used where there is a risk of road users causing an explosion of gas.

This sign shall supplement, and not replace, the appropriate standard signs and devices required in accordance with this Manual for the particular work site.

(e) Other signs

Signs may be used to indicate the special loads being carried or the specialised nature of work being undertaken by service vehicles which could create a hazard to traffic whilst so engaged, provided that the signs are approved as Official Traffic Signs. Typical legends would include: OVERSIZE, EXPLOSIVES, VEHICLE CONSTANTLY STOPPING.

SECTION 4. PROCEDURES FOR THE INSTALLATION AND OPERATION OF TRAFFIC CONTROL DEVICES

4.1 GENERAL

4.1.1 Scope of section

This Section sets out the procedures for installing and operating traffic control devices to ensure that they are used consistently to provide the highest practicable level of protection to roadworks personnel and road users.

4.1.2 Maintaining a safe workplace

In maintaining a safe workplace, the following shall be taken into account in the first instance:

(a) *General obligation*

As indicated in Clause 1.5, there is an obligation on both Organisations and contractors carrying out works on roads together with supervisory personnel at all levels, to maintain a safe workplace. This entails the prevention of injury to workers due to hazards within the work site, the protection of workers from oncoming or passing traffic, and the protection of road users from hazards within the work site.

(b) *Hierarchy of control*

In the planning and conduct of works it needs to be recognised that there is a hierarchy of control which can be used to assess whether the highest practicable level of protection or separation from traffic is being applied in a particular case. The hierarchy of control has the following elements in descending order of safety reliability:

- (i) Hazard elimination from the immediate location of the work area by relocating traffic movement via a remote detour or side-track.
- (ii) Hazard elimination by stopping all traffic movement for short periods when workers need to occupy the roadway.
- (iii) Separation of the work area from moving traffic by means of engineering controls or isolation, i.e.-
 - (A) placing a substantially impenetrable barrier at the boundary of the work area, i.e. a road safety barrier system as specified in this Standard; or
 - (B) maintaining an acceptable minimum lateral separation, risk assessed as requiring no physical protection or traffic control other than signs advising of the presence of workers or plant.
- (iv) Management of the risk using administrative and behavioural controls, i.e.-
 - (A) in cases where the work area is close to but not within the travelled path by controlling the behaviour of traffic (e.g. traffic speed) according to the lateral separation; or
 - (B) in cases where the work area is within the traffic stream, by training in and strict observance of appropriate work methods and safety requirements.

4.1.3 Works protection methods

A summary of the works protection methods specified in this Section is given in Table 4.1.

TABLE 4.1 WORKS PROTECTION METHODS

Works method	Applicable tasks	Reference
Static work site	All works which are greater in scope and duration than can be handled by the short term, low impact provisions listed below or by mobile works.	Clause 4.2
Short term, low impact works - open road areas	Isolated work on pavements of up to 5 min duration, traffic volumes permitting. Shoulder grading and verge mowing.	Clause 4.3

TABLE 4.1 WORKS PROTECTION METHODS (cont.)

Works method	Applicable tasks	Reference
Short term, low impact works - built-up areas	Work adjacent to or in a traffic lane of duration 5 min to 1 hour depending on traffic volume. Median and verge mowing, footpath works.	Clause 4.4
Works on unsealed roads	Maintenance grading. Short term partial road closures.	Clause 4.5
Mobile works	Linemarking, pavement marker laying or removal, pavement testing where all signs and other protective devices are carried on vehicles.	Clause 4.6

4.1.4 Components of a typical work site

The components of a typical work site are illustrated in Figure 4.1.

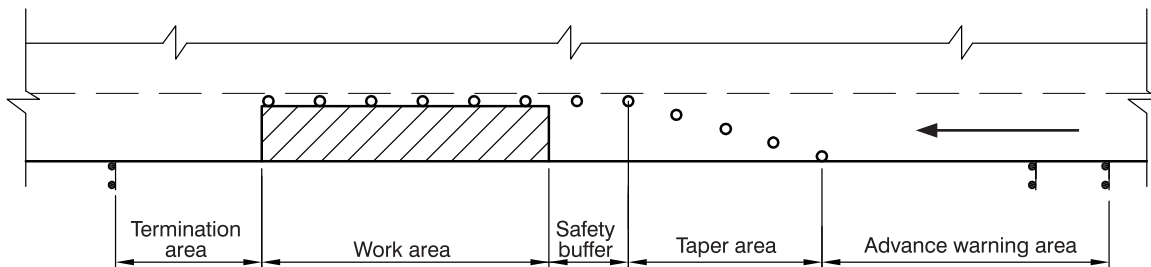


FIGURE 4.1 COMPONENTS OF A TYPICAL WORK SITE

Requirements and recommendations for signs and devices in each of the areas are as follows:

- (a) *Advance warning area*
Advance warning signs are dealt with in Clause 4.7.
- (b) *Taper area*
The provision of devices to form tapers and associated signs and other devices is dealt with in Clause 4.8.
- (c) *Safety buffer*
A safety buffer immediately in advance of the work area shall be provided wherever the posted speed limit is 60 km/h or more. An area 20 to 30 m in length is normally sufficient; however, if the works are hidden from approaching traffic, e.g. by a crest or curve, the safety buffer should extend back to a point which can be adequately seen by approaching traffic. Primary positional signs or devices such as temporary hazard markers or trailer mounted illuminated flashing arrow signs should be located at the beginning of the safety buffer. Vehicular access to the work area can be permitted through the safety buffer. **The safety buffer shall be kept clear of work vehicles, plant, stockpiled material or other activity.**
- (d) *Work area*
The work area comprises the area where works are physically being carried out.
- (e) *Termination area*
Signs indicating the end of the works where normal traffic conditions resume, and, where appropriate, the end of a roadworks speed zone should be placed at the end of the termination area.

4.1.5 Dimension D

Dimension D as shown on illustrations and diagrams in this Part of the Manual for the positioning of advance signs and related purposes shall be determined as shown in Table 4.2. The value shown in Table 4.2 is the permanent posted speed of the road before the worksite is established.

TABLE 4.2 VALUE OF DIMENSION D

Posted speed limit (prior to roadworks) km/h	Dimension D m
40 or less	5 to 10
50	10 to 15
60	15 to 45
Greater than 60	60 to 80

4.1.6 Tolerances on positioning

Where this Part of the Manual gives a specific distance for the longitudinal positioning of signs or devices with respect to other items or features, the placement of the sign or device will need to take into account proximity of intersection(s), bridges and other features to ensure that the sign or device can be readily seen by road users at all times.

4.2 STATIC WORK SITES

This Clause sets out requirements and recommendations for protecting workers from oncoming or passing traffic, and road users from hazards within the site at a static worksite. Short term and low-impact works permitted under Clauses 4.3, 4.4 and where indicated in Clause 4.5.2, and mobile works permitted under Clause 4.6 are exempted from these requirements and recommendations provided that the requirements of those Clauses are observed.

The clearances to edge of work area in the following Items shall be measured from the traffic-side edge of the line of delineating devices or barriers as specified in Clause 4.13.4.

(a) *Work area 6 m or more clear of traffic*

If the entire work area including all vehicles and plant is located a minimum of 6 m from the nearest edge of a lane carrying traffic, no traffic delineation of the work area or temporary speed limit will be required but a Worker (symbolic) (T1-5) sign should be placed on the left side of the roadway in advance of the work area if workers or plant are visible to passing traffic.

(b) *Work area 3 m to 6 m clear of traffic (Option 1)*

If the entire work area including all vehicles and plant is located a minimum of 3 m from the nearest edge of a lane carrying traffic, no traffic delineation of the work area will be required but the following shall be provided:

- (i) A Worker (symbolic) (T1-5) sign in advance of the work area when workers or small items of plant are present on the site.
- (ii) A vehicle mounted warning device (see Clause 3.12.1).
- (iii) In speed zones higher than 80 km/h, a temporary speed limit of 80 km/h where the traffic volume exceeds 10 000 vpd.

This situation is illustrated as Option 1 on Figure 4.2.

The minimum length of an 80 km/h temporary speed zone should be 500 m.

A containment fence (see Clause 3.10.1) should be used to delineate the clearance line for workers if the work area clearance is close to the 3 m minimum.

(c) *Work area closer than 3 m to traffic*

If the clearance between the work area and the nearest edge of a lane carrying traffic is less than 3 m one or other of the following options shall be used:

(i) Protection by road safety barrier system (Option 2)

If the work area is protected by a road safety barrier system (see Clause 3.10.3), there will be no requirement to reduce traffic speeds for the protection of workers. Advance signing and delineation, including Worker (symbolic) (T1-5) signs when workers are on site, are required, and temporary speed zoning may be required for the safety of traffic negotiating the site outside the barrier. Steps should be taken to ensure that workers and plant will remain within the protection of the barrier. A containment fence behind the barrier as recommended in

Clause 3.10.3 and temporary crash attenuators as recommended in Clause 3.10.4 should also be used. This situation illustrated as Option 2 on Figure 4.2.

(ii) Clearance to traffic between 1.2 m and 3 m (Option 3)

If there is no road safety barrier system between the edge of the work area and the nearest edge of a lane carrying traffic, but the clearance between the two is from 1.2 m to less than 3 m, the following are required when workers or small items of plant are on site, in addition to the requirements for other work site management devices specified in the Standard:

- (A) A Workers (symbolic) (T1-5) sign in advance of the work area.
- (B) Delineation of the edge of the traffic lane by cones, bollards or similar means, see Clause 4.13.4.
- (C) Separate delineation of the edge of the work area by means of a containment fence (see Clause 3.10.1) if there is a risk of workers or small items of plant infringing the clearance area.
- (D) The speed of passing traffic shall be reduced to 60 km/h through-
 - (1) the use of appropriate traffic control devices such as signs, flashing lights, traffic controllers and tapers (as approved by the State road authority); or
 - (2) imposing a temporary road work speed zone; or
 - (3) a combination of the above.

This action is not required if the posted speed during roadworks past the site is already 60 km/h or less.

This situation is illustrated as Option 3 on Figure 4.2.

A temporary 60 km/h speed zone shall be at least 150 m long.

(iii) Clearance to traffic less than 1.2 m (Option 4)

If the clearance requirement of 1.2 m in Item (ii) above cannot be achieved, all of the requirements of Item (ii) shall apply except that the posted speed during roadworks shall be reduced to 40 km/h using the methods specified in Item (ii)(D). Use of a containment fence may be omitted if there is insufficient space to place it.

This situation is illustrated as Option 4 on Figure 4.2.

A temporary 40 km/h speed zone shall be no longer than 1 km and workers shall be visible.

See also Item (e) where further speed reduction may be warranted at a hazardous site.

(d) *Protection of traffic controller*

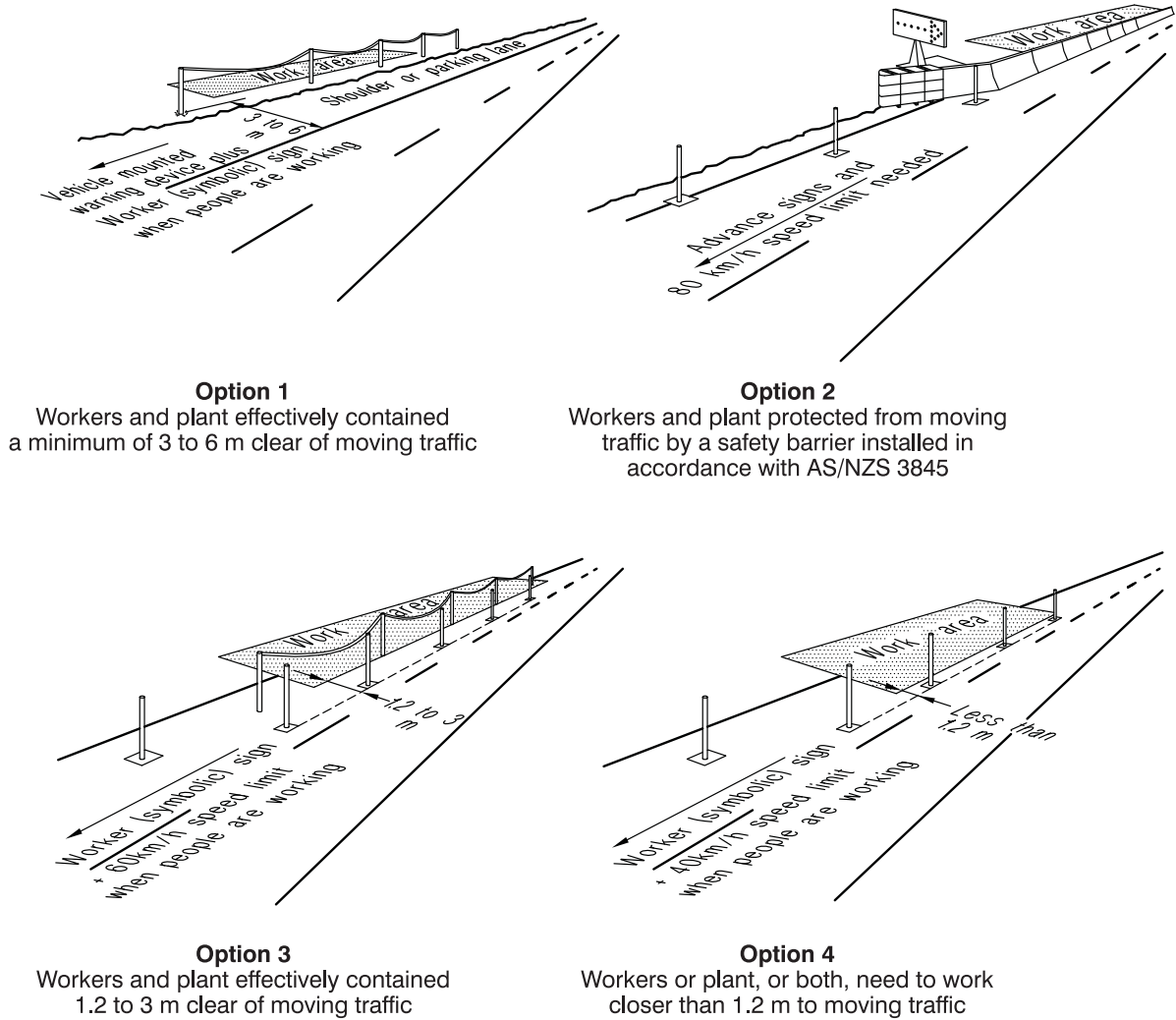
Traffic controllers are not subject to the requirements of Item (c) above, but shall be allowed to operate only in an area where the posted speed during roadworks has been reduced to 60 km/h or less as set out in Item (c)(ii)(D).

(e) *Speed control at hazardous sites*

Where any one or more of the following conditions apply at a static site, the the posted speed during roadworks shall be reduced to a value less than 40 km/h using the methods specified in Item (c)(ii)(D) together with traffic controllers or pilot vehicles (see Clause 4.12) as needed:

- (i) An unusually high level of hazard for workers on foot within 1.2 m of moving traffic or other road users as a consequence of the work area.
- (ii) It is impracticable to separate pedestrians or cyclists from vehicular traffic in the work area.
- (iii) The works do NOT involve any of the following:
 - (A) Works being undertaken using large item of plant exclusively.
 - (B) Workers and road work delineation which are separated from moving traffic by at least 1.2 m.
 - (C) Grading or mowing on a median or verge which does not encroach onto a moving traffic lane.
 - (D) Works on a residential street where the speed limit is 40 km/h or less.

If traffic speeds are to be reduced by means of a temporary speed zone less than 40 km/h, the length of the zone shall not exceed 200 m. It should not be less than 100 m.



NOTE: This Figure does not show all of the advance signs or approach delineation which may be required.

FIGURE 4.2 STATIC WORK SITES

4.3 SHORT-TERM LOW IMPACT WORKS - OPEN ROAD AREAS

4.3.1 General

The treatments in this Clause (4.3) are permitted in recognition of the need to allow certain short-term low impact works to be carried out without the use of fully protected static work sites or mobile works convoys. It is vital that a risk assessment (see Clause 2.2.3) be made of the proposed adoption of these treatments in particular environments taking particular account of factors such as traffic volume and speed, road geometry and width, and the general behaviour of road users. If the risk cannot be tolerated, a fully protected static work site (Clause 4.2) or mobile works convoy (Clause 4.6) will be required. These treatments shall not be applied on expressway type roads.

4.3.2 Work between gaps in traffic

Work that is of such short duration that it can be carried out within gaps in traffic may be done without advance signs or delineation provided that -

- (a) a lookout person who can see approaching traffic in time to warn workers to vacate the roadway before its arrival, is posted; and
- (b) work vehicles and equipment are parked clear of moving traffic lanes.

A vehicle mounted warning device shall be displayed on the work vehicle.

This treatment shall not be applied on roads with traffic volumes greater than 400 vpd.

4.3.3 Short term work in traffic

Workers with a vehicle or item of plant equipped with a vehicle-mounted warning device may work on the roadway or within 1.2 m of moving traffic without the use of advance signs provided the roadway at any one work site is not occupied for more than 5 min and the conditions below are observed. Traffic volumes shall be less than 400 vpd.

Sight distance to the vehicle-mounted warning device for approaching drivers shall be -

- (a) greater than 150 m in a 60 km/h or lower speed zone; or
- (b) greater than 250 m elsewhere.

The vehicle-mounted warning device shall not be obscured, e.g. by overhanging vegetation or a raised truck body.

The work shall not reduce -

- (i) the overall width to less than that required for safe passage for two-way traffic (or one-way traffic if the volume is less than 50 vpd); or
- (ii) the running lane width adjacent to a barrier line to less than that needed to allow vehicles to proceed without crossing the line.

A lookout person shall be posted to warn workers on foot on the roadway of the approach of any vehicles whose speed or size might constitute a safety threat. If two or more locations within a space of 2 km or less are to be worked as above, the site shall be treated as a frequently changing work area (see Clause 4.3.4). The lookout person is not required if the works are more than 1.2 m clear of moving traffic.

The lookout person may be dispensed with if the work will not take longer than 10 seconds and approaching traffic can be seen for a distance away equal to 20 seconds of travel time.

4.3.4 Frequently changing work area

For activities such as minor maintenance on the pavement or shoulder, including road furniture maintenance and longitudinal survey work at successive locations less than 2 km apart, the frequently changing work area treatment may be applied. If it is applied the treatment shall be subject to the following requirements:

- (a) In all cases the following requirements of Clause 4.3.3 shall be observed:
 - (i) Work vehicle positioning and length of occupation of any one site (maximum of 5 min).
 - (ii) Traffic volumes less than 400 vpd.
 - (iii) Display of the vehicle mounted warning device.
 - (iv) Sight distance to the work vehicle for approaching traffic.
 - (v) Running lane width reduction.
 - (vi) The need for a lookout person to warn workers on foot on the roadway of approaching traffic.
- (b) Advance signs up to 2 km in advance of each work position or item of moving plant shall be displayed. The distance between advance signs for opposing directions of travel shall not exceed 2 km at any time and the location of such signs shall be progressively changed to ensure the maximum separation is not exceeded as the work progresses along the road.
- (c) At each advance sign location the following signs shall be used:
 - (i) Workers (symbolic) (T1-5) where there are workers on foot.
 - (ii) ROAD PLANT AHEAD (T1-3-1) where moving road plant only will be encountered.

The sign NEXT 2 km (T1-28) shall be placed with whichever of these signs is used.
- (d) If any of the requirements of Item (a) cannot be met at a particular location, e.g. sight distance is substandard, that site shall be set up as a fully protected short-term work site with advance signs at the standard distances.

4.3.5 Shoulder grading on sealed roads in open road areas

Shoulder grading on sealed roads with traffic volumes less than 1500 vpd may be undertaken in bounds of up to 10 km in length under the following conditions:

- (a) If sight distance to the vehicle mounted warning sign on the grader is at least 250 m throughout the section of road being worked on, advance signs ROAD WORK NEXT 10 km (T1-24) shall be placed at each end of the section. Loose stones (symbolic) (T3-9) or similar signs may be needed at the beginning and along the section.
- (b) If the sight distance falls to less than 250 m at some locations, GRADER AHEAD (T1-4) or ROAD PLANT AHEAD (T1-3-1) together with NEXT 2 km (T1-28) shall be used on each approach to the section covering the location of diminished sight distance. A 60 km/h temporary speed zone (see Clause 4.9) will be required if the posted speed limit is 80 km/h or more.
- (c) Subsections of 2 km or less in length created as in Item (b) shall be completed and signs including if used, speed zone signs, shall be relocated before proceeding with the next section. If there is difficulty turning a grader around at the end of a 2 km section it may be extended to the next available turning point but not to more than 6 km in total length.

Where traffic volumes are greater than 1500 vpd the works shall be undertaken either as a mobile works (see Clause 4.6) or as static work site (see Clause 4.2).

4.3.6 Mobile inspections

Mobile road inspections are carried out according to one of the following requirements or recommendations:

- (a) If the inspection vehicle maintains speed that -
 - (i) is less than 20 km/h below the speed limit; or
 - (ii) on a road with less than 200 vpd is at least 25 km/h,
 it may travel in the traffic stream, but in the case of Item (ii) shall display a pair of yellow beacon lamps.
- (b) If the inspection vehicle can operate by travelling along a shoulder or verge clear of moving traffic, using gaps in traffic to pass any obstructions in the shoulder or verge, it may operate as a single vehicle but shall display a pair of yellow beacon lamps.
- (c) If the inspection vehicle is required to block or partially block a traffic lane continuously at speeds lower than in Item (a) it shall operate within a mobile works convoy as specified in Clause 4.6.

4.3.7 Work off-roadway

For activities involving a vehicle or item of plant running off the road such as mowing and sign/road edge guide post maintenance where the machine is running on the shoulder or work vehicle is parked clear of the road so that traffic does not have to deviate from the normal travelled path, the work may proceed without the use of advance signs under the following conditions. Sight distance to the vehicle-mounted warning device for approaching drivers shall be-

- (a) greater than 150 m in a 60 km/h or lower speed zone; or
- (b) greater than 250 m elsewhere; and
- (c) the vehicle-mounted device is displayed and not be obscured either by overhanging vegetation or a raised truck body.

4.3.8 Work protected by specialist vehicles

This work involves the use of a vehicle fitted with a truck-mounted attenuator. The vehicle shall be fitted with an illuminated flashing arrow sign. The activities may include:

- (a) placement and recovery of temporary signing and barriers;
- (b) mobile lane closures; and
- (c) slow moving or stationary vehicles operating on the roadway e.g. maintenance of traffic signals, street lighting and emergency phones.

A temporary speed zone may be created by the use of a vehicle-mounted speed restriction sign.

If determined acceptable by a risk assessment, the specialist vehicle may be replaced by a shadow vehicle fitted with an illuminated flashing arrow.

4.3.9 Survey work

The occupation of the roadway for survey work may be in accordance with one of the previous treatments. A risk assessment will determine the treatment adopted in a particular environment.

4.3.10 Traffic investigations

For activities associated with traffic engineering investigations or inspecting, viewing or measuring a section of roadway or road feature (e.g. for maintenance or planning purposes), no controls are needed where:

- (a) the activity is clear of the roadway. The exception to this would be where the activity is carried out while crossing the road, e.g. measuring the lane width;
- (b) the vehicle used for the investigation is parked well clear of the traffic lanes;
- (c) personnel utilise existing footpaths or verges;
- (d) inspecting personnel may cross the road safely within gaps in traffic. In this case, sight distance to personnel for approaching drivers is:
 - (i) greater than 150 m in a 60 km/h or lower speed zone;
 - (ii) greater than 250 m elsewhere.

Personnel carrying out investigations should wear high visibility clothing at all times when they are not in their vehicle.

4.4 SHORT-TERM LOW IMPACT WORKS - BUILT-UP AREAS

4.4.1 General

The treatments in this Clause (4.4) are permitted in recognition of the need to allow certain short-term low impact works to be carried out without the use of fully protected static work sites or mobile works convoys which could otherwise lead to significant work inefficiencies. Since they could be seen as a partial relaxation of safety standards, it is vital that a risk assessment (see Clause 2.2.3) be made of the proposed adoption of these treatments in particular environments taking particular account of factors such as traffic volume and speed, road geometry and width, and the general behaviour of road users. If the risk cannot be tolerated, a fully protected static work site (Clause 4.2) or mobile works (Clause 4.6) convoy will be required.

Regardless of any risk assessment, where the speed limit, traffic volume, traffic separation or occupation time constraints specified below cannot be met, a static or mobile work site shall be used.

The speed limits specified are existing permanent speed limits. Temporary speed limits shall not be used unless a static or mobile work site as specified in this Standard is to be set up.

4.4.2 Frequently changing work area - Work not within traffic lane

The work shall be carried out with a vehicle equipped with a vehicle mounted warning device parked on a shoulder or parking lane or elsewhere where parking is permitted adjacent to moving traffic. The vehicle shall shadow the work area at all times, either to the front or back of it. The limitations that shall apply are -

- (a) speed limit - 70 km/h or less; and
- (b) minimum sight distance to oncoming traffic - 50 m; and
- (c) maximum work period at any one location -
 - (i) 20 min at any traffic volume; or
 - (ii) 40 min at traffic volumes 150 vph or less; or
 - (iii) 1 hour at traffic volumes 40 vph or less.

The work area may move frequently between successive locations.

The following are examples of short-term works appropriate for this treatment when they do not require encroachment onto a moving traffic lane:

- (A) Pit cleaning or repair.
- (B) Litter collection.
- (C) Tree pruning or planting.
- (D) Road signs or street furniture maintenance.
- (E) Street light maintenance.

NOTE: A static work site will be required if these conditions cannot be met, see Clause 4.4.1.

4.4.3 Frequently changing work area - Work within a traffic lane

The work shall be carried out using a work vehicle or large plant item, and a shadow vehicle, both equipped with a vehicle mounted warning device.

NOTE: A large plant item should generally be considered to be the equivalent of a medium size farm or industrial tractor or larger.

If work is being carried out by a large plant item and there are no workers on foot or small plant items present, the shadow vehicle shall follow the plant item 15 m to 30 m behind it, either in the lane or shoulder to the left of the work lane if free, or otherwise, within the work lane.

If the work is being carried out by workers on foot or small items of plant, even though large plant items may also be present, the shadow vehicle shall travel in the same lane as the work area, 20 m to 40 m behind the work vehicle.

The following limitations apply:

- (a) Speed limit - 60 km/h or less.
- (b) Maximum work period at any one location, large item of plant, no workers on foot -
 - (i) 20 min at any traffic volume; and
 - (ii) 1 hour at traffic volumes up to 40 vph.
- (c) Maximum work period at any one location, workers on foot - 1 hour at traffic volumes up to 40 vph.

The shadow vehicle may be dispensed with at volumes less than 60 vph provided sight distance to oncoming traffic is at least 50 m or 2D, whichever is the greater.

The work may be moved frequently between successive locations.

Examples of work appropriate for this treatment are -

- (A) pavement marker laying (other than on dividing lines);
- (B) pavement testing; and
- (C) any of the items listed in Clause 4.4.2 where encroachment onto a traffic lane is likely to occur.

NOTE: A static or mobile work site will be required if these conditions cannot be met, see Clause 4.4.1.

4.4.4 Road lighting works

Road lighting works may be undertaken in build up area by workers on foot with a vehicle equipped with a vehicle mounted warning device and an illuminated directional arrow sign without the use of advance warning signs under the following conditions:

- (a) Where the vehicle is positioned where parking would normally be permitted and does not obstruct the traffic flow:
 - (i) The maximum work period at any one location shall be 1 hour.
 - (ii) A minimum clearance of 5.5 m must be maintained above the road surface to any part of the maintenance vehicle that encroaches upon the open traffic lane.
- (b) Where the vehicle is positioned other than outlined in (a):
 - (i) The maximum work period at any one location shall be:
 - (A) 5 minutes if on the roadway or within 1.2 m of moving traffic; or
 - (B) 20 minutes if between 1.2 m and 3 m of moving traffic.
 - (ii) The following sight distance to the vehicle mounted warning device for approaching drivers shall be:
 - (A) In a residential street 75 m or to the end of the street; or
 - (B) Greater than 150 m in a 60 km/h or lower speed zone (non residential); or
 - (C) Greater than 250 m elsewhere.
 - (iii) The vehicle mounted warning device shall not be obscured by either overhanging vegetation or a raised truck body; and
 - (iv) The work shall not reduce -
 - (A) The overall width to less than required for safe passage for two-way traffic (or one-way traffic in the volume is less than 50 vehicles per day); or
 - (B) The running lane width adjacent to a barrier line to less than that needed to allow vehicles to proceed without crossing the line.

- (c) A lookout person shall be posted to warn workers on foot of the approach of any vehicle whose size or speed may constitute a safety treat. The lookout person is not required if the works are more than 1.2 m clear of moving traffic.

Where the requirements of this clause or another suitable clause of Section 4.4 cannot be met, a static or mobile work site shall be used.

Examples of work appropriate for this treatment includes but is not limited to:

- (a) maintenance; and
- (b) installation.

4.4.5 Works on medians, verges and footpaths

The following works may be carried out without any support vehicle on the roadway, subject to the work duration being limited to a single shift and to the conditions listed in Items (i) and (ii):

- (a) Median and verge mowing, and related activities such as tilling, seeding and weed spraying.
- (b) Works on a footpath.
- (c) Garden maintenance.

The following conditions shall be met:

- (i) *Large plant items only (see Note to Clause 4.4.3)*

Where there are no workers on foot, the relationship between speed limit and clearance to edge of traffic lane shall be as follows:

- (A) Speed limit 90 km/h or more - clearance shall be greater than 1.2 m.
- (B) Speed limit 80 km/h or less - clearance may be less than 1.2 m but plant items shall not encroach onto the traffic lane.

- (ii) *Workers on foot or small items of plant*

Where there are workers on foot or small items of plant, or both, the work method shall be restricted to one of the following:

- (A) The speed limit is 60 km/h or less and the work area does not encroach onto a moving traffic lane.
- (B) The speed limit is 80 km/h or less and the clearance to edge of traffic lane is at least 1.2 m.
- (C) The entire work area is at least 3 m clear of a moving traffic lane.

The Worker (symbolic) (T1-5) sign or ROAD PLANT AHEAD (T1-3) shall be displayed respectively, when either workers on foot or plant items alone are present and working closer than 3 m to a moving traffic lane.

Wherever there are workers on foot or small items of plant working 3 m or less clear of a moving traffic lane, cones or bollards, in accordance with Clause 3.9.1, shall be placed along the kerb line or edge of traffic lane if no kerb.

NOTE: A static or mobile work site will be required if these conditions cannot be met (see Clause 4.4.1).

4.4.6 Street sweeping and garbage collection

Street sweeping and garbage collection operations which do not involve workers on foot working closer than 1.2 m to the edge of a moving traffic lane may be carried out under the following conditions:

- (a) Vehicle to be equipped with a vehicle mounted warning device.
- (b) Speed limit 70 km/h or less generally, or 80 km/h or less if the work vehicle can operate at least 1.2 m clear of the edge of nearest running lane.
- (c) The minimum sight distance for following traffic is:
 - (i) greater than 150 m in a 60 km/h or lower speed zone;
 - (ii) greater than 250 m elsewhere.

4.4.7 Work between gaps in traffic

Work which is of such short duration that it can be carried out within gaps in traffic may be done without advance signs or delineation provided that -

- (a) a lookout person who can see approaching traffic in time to warn workers to vacate the roadway before its arrival is posted; and

(b) work vehicles and equipment are parked clear of moving traffic lanes.

A vehicle mounted warning device shall be displayed on the work vehicle.

NOTE: This activity is not recommended where traffic lane volumes exceed 100 vehicles per hour unless significant gaps are being created by upstream traffic control such as intersection traffic signals.

4.4.8 Work protected by specialist vehicles

This work involves the use of a vehicle fitted with a truck-mounted attenuator. The vehicle shall be fitted with an illuminated flashing arrow sign. The activities may include:

- (a) placement and recovery of temporary signing and barriers;
- (b) mobile lane closures; and
- (c) slow moving or stationary vehicles operating on the roadway e.g. maintenance of traffic signals, street lighting and emergency phones.

A temporary speed zone may be created by the use of a vehicle-mounted speed restriction sign.

If determined acceptable by a risk assessment, the specialist vehicle may be replaced by a shadow vehicle fitted with an illuminated flashing arrow.

4.4.9 Survey work

The occupation of the roadway for survey work may be in accordance with one of the previous treatments. A risk assessment will determine the treatment adopted in a particular environment.

4.4.10 Traffic investigations

For activities associated with traffic engineering investigations or inspecting, viewing or measuring a section of roadway or road feature (e.g. for maintenance or planning purposes), no controls are needed where:

- (a) the activity is clear of the roadway. The exception to this would be where the activity is carried out while crossing the road, e.g. measuring the lane width;
- (b) the vehicle used for the investigation is parked well clear of the traffic lanes;
- (c) personnel utilise existing footpaths or verges;
- (d) inspecting personnel may cross the road safely within gaps in traffic. In this case, sight distance to personnel for approaching drivers is:
 - (i) greater than 150 m in a 60 km/h or lower speed zone;
 - (ii) greater than 250 m elsewhere.

Personnel carrying out investigations should wear high visibility clothing at all times when they are not in their vehicle.

4.5 WORKS ON UNSEALED ROADS

4.5.1 General

The following treatments are permitted on unsealed roads in recognition of the generally lower volumes and traffic speeds encountered on those roads than on sealed roads and the need to be economical in the expenditure of resources on these low usage facilities. Since they could be seen as a partial relaxation of safety standards, it is vital that a risk assessment (see Clause 2.2.3) be made of the proposed adoption of these treatments in particular environments taking particular account of factors such as traffic volume and speed, road geometry, width and surface condition, and the general behaviour of road users.

The treatments shall not be applied to roads with traffic volumes greater than 400 vpd.

The treatments shall not be applied to any road which would normally be sealed but has been left unsealed either temporarily or permanently due to, for example, economic or climatic factors or is in the process of construction or reconstruction as a sealed road.

4.5.2 Maintenance grading and resheeting

Maintenance grading and resheeting shall be undertaken as set out below. They may be carried out either with or without leaving a windrow as indicated below. Work done without leaving a windrow normally involves use of either a windrow eliminator or a second grader in tandem. Wherever practicable, grading on the right side of the road against oncoming traffic should be avoided.

(a) *Maintenance grading*

Maintenance grading shall be undertaken as follows:

- (i) If the grader is always to operate leaving room for opposing traffic to pass it without driving off the roadway and the sight distance to the grader's vehicle mounted warning device is at least 250 m throughout the entire section of road being worked on, no advance warning signs for either direction of travel are required.
- (ii) If the operating conditions in Item (i) cannot be met, the work shall be carried out as follows:
 - (A) The work shall be undertaken in bounds of not more than 10 km in length. The sign ROADWORK NEXT 10 km (T1-24) shall be placed at each end of the section being worked on.
 - (B) At locations where the sight distance falls to less than 250 m the sign GRADER AHEAD (T1-4) or ROAD PLANT AHEAD (T1-3-1) together with NEXT 2 km (T1-28) shall be used at each end of each subsection with reduced sight distance of up to 2 km in length. The signs shall be placed at least 100 m in advance of the start of any windrow.
 - (C) Subsections of 2 km or less in length created as in Item (B) shall be completed and signs including (if used) speed zone and end of zone signs, shall be relocated before proceeding with the next section, which may be a further sight distance deficient subsection or the remaining whole section. If there is difficulty turning a grader around at the end of a 2 km section it may be extended to the next available turning point but not to more than 6 km in total length.
- (iii) Road condition signs shall be placed at various locations if the freshly graded surface has loose material that may be a hazard. One or more of the following may be required depending on the nature and degree of hazard:
 - (A) Slippery (symbolic (T3-3)).
 - (B) Loose Stones (symbolic (T3-9)).
 - (C) LOOSE SURFACE (T3-14).

NOTE: Where graded or resheeting material cannot be traversed by traffic, in order to allow traffic to overtake the grader, the grader driver should be instructed to raise the blade from time to time and move forward a short distance to allow that traffic to pass.

(b) *Maintenance resheeting*

Maintenance resheeting shall be undertaken in accordance with Items (a)(ii) to (a)(iii) above.

4.5.3 Short term partial road closures

The following apply to the treatment of short term partial road closures:

(a) *Omission of advance signs*

Advance signs may be omitted provided that -

- (i) the vehicle mounted warning device on the work vehicle can be seen by approaching traffic for at least 250 m;
- (ii) no traffic controller is required in accordance with Clause 4.13.1(i); and (iii) either -
 - (A) traffic volumes are 20 vpd or less; or
 - (B) there is room for two-way traffic past the work area, or both.

(b) *Using a single traffic controller*

Traffic control is required and may be performed by a single traffic controller under the following conditions:

- (i) There is a single lane section not exceeding 50 m in length.
- (ii) Traffic volumes are not more than 20 vph.
- (iii) The traffic controller has a good view of traffic approaching from both directions when stationed at one end of the job.

(d) *Other cases*

Situations not meeting the conditions set out in Items (a) or (b) shall be treated in the same way as sealed roads.

4.6 MOBILE WORKS

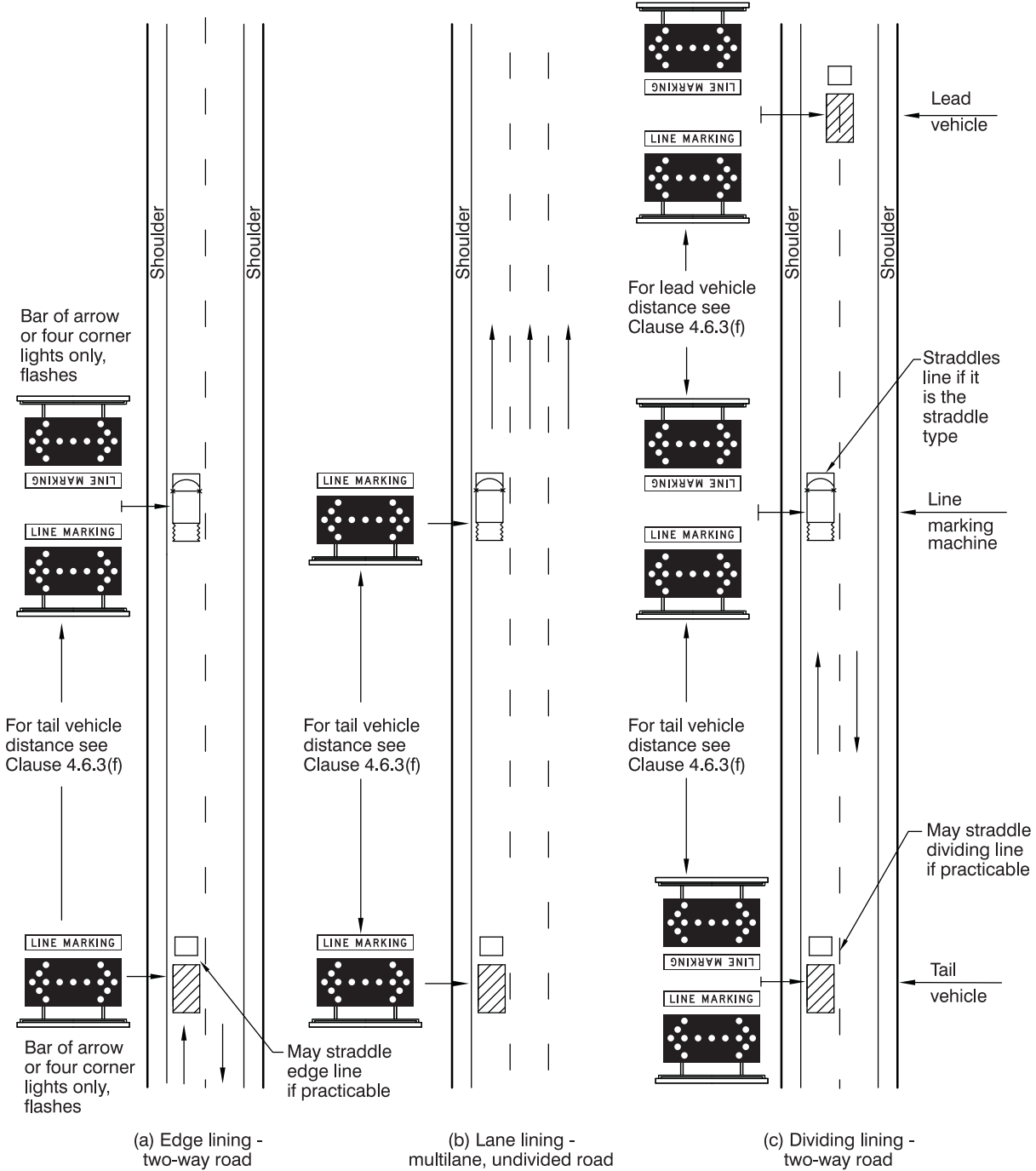
4.6.1 General

Mobile works are works which entail vehicles moving along the roadway continually at a speed significantly lower than other traffic and obstructing or partially obstructing traffic lanes. All signs and warning devices shall be displayed on moving vehicles in the convoy.

Mobile works include the following:

- (a) Linemarking activities and pavement marker laying or removal where a shadow vehicle (see Clause 4.6.2(c)) is used. Examples are shown in Figures 4.3 and 4.4.
- (b) Operation of pavement test vehicles.

Activities such as shoulder grading, pavement and edge patching, and other works involving workers on foot may be suitable for a mobile works convoy, but when undertaken without a shadow vehicle shall be regarded as frequently changing work areas and dealt with in accordance with Clause 4.3.4.

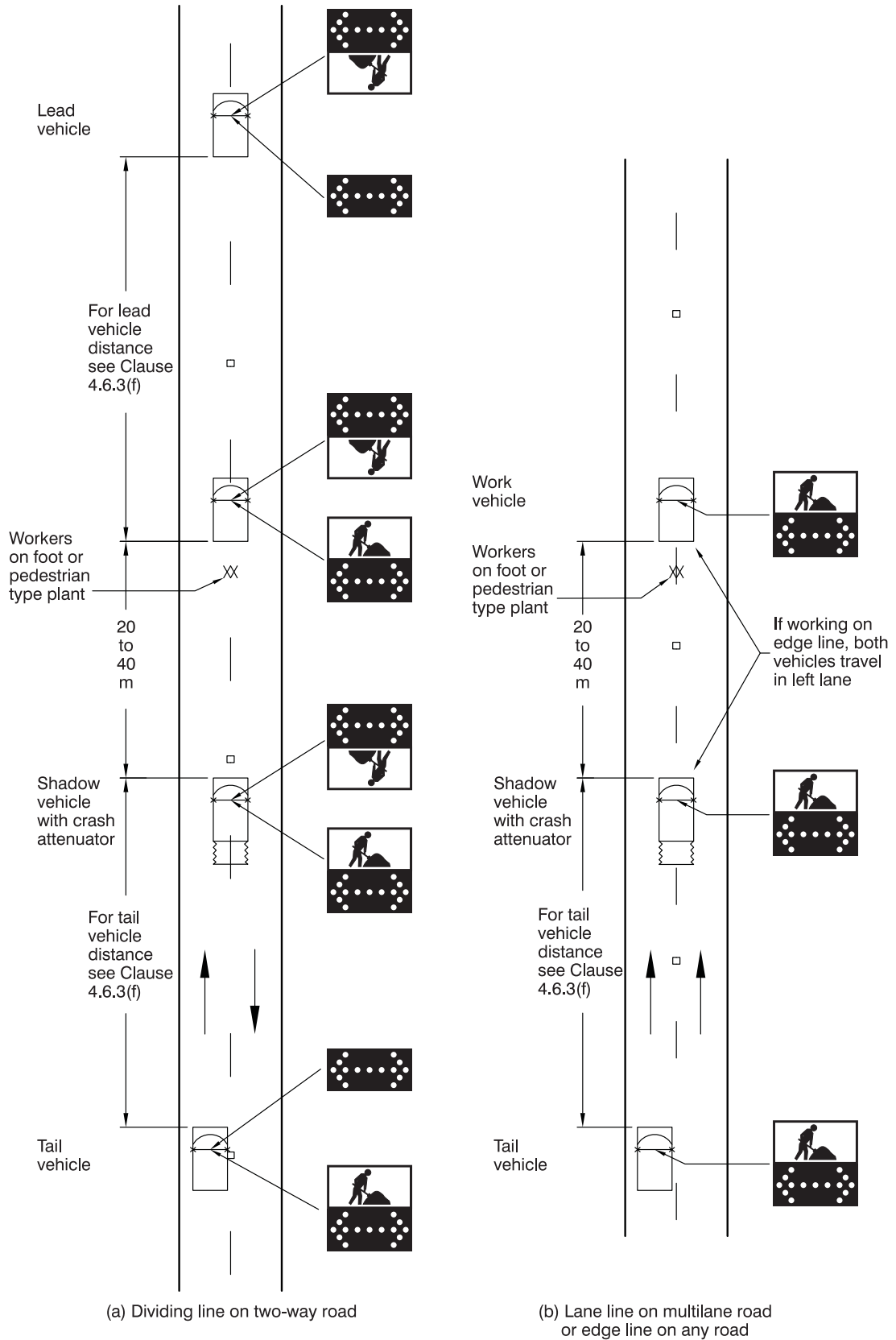


NOTES:

See Clause 3.12.2 regarding optional use of flashing lights on the vehicle-mounted warning devices.

A second tail vehicle should be provided (see Clause 4.6.3 (j)).

FIGURE 4.3 EXAMPLES OF MOBILE WORKS PROTECTION - RIDE-ON LINE MARKING



NOTES:

- 1 A mobile temporary speed zone may be required for these works (see Clause 4.6.5).
- 2 See Clause 3.12.2 regarding option use of flashing lights on the vehicle-mounted warning devices.

FIGURE 4.4 EXAMPLES OF MOBILE WORKS PROTECTION - PAVEMENT MARKER LAYING

4.6.2 Work convoy arrangements

A mobile works convoy shall be made up of the following vehicles as required for the relevant road situation:

(a) *Lead vehicle*

A lead vehicle is required on two-way roadways when working on the dividing line to give advance warning of the works to traffic approaching from the opposite direction and also to enable the lead vehicle driver to alert the following workers to any impending hazard.

(b) *Work vehicle*

This is the vehicle or plant item undertaking the work (e.g. a linemarking machine) or supporting workers on foot immediately behind it. Some operations (e.g. pavement marker removal on a divided road) may not need a work vehicle.

(c) *Shadow vehicle*

A shadow vehicle is required to provide close-up protection to the rear of workers on foot (e.g. laying pavement markers, operating a pedestrian type linemarking machine). The shadow vehicle shall travel a clear distance of 20 m to 40 m behind the work vehicle and shall be equipped with a truck-mounted crash attenuator whenever it is protecting workers.

(d) *Tail vehicle*

A tail vehicle is required to provide advance warning of the works to following traffic, to divert traffic around the works and to enable the driver to alert workers ahead of any impending hazard.

4.6.3 Operating principles

The following are requirements and recommendations for the operation of a mobile works convoy:

(a) *Carrying signs and devices*

All signs and warning or delineation devices shall be carried on vehicles. This includes mobile temporary speed zone signs, see Clause 4.6.5.

(b) *Advance warning vehicle*

Advance warning of the works vehicle shall be provided by a tail vehicle and if required, a lead vehicle (see Clause 4.6.2(a)).

(c) *Plant and vehicle positioning*

Recommendations for the lateral positioning of plant items and vehicles on a mobile works convoy are given in Tables 4.3, 4.4 and 4.5 for work on two-way roads, multilane undivided roads and divided roads respectively.

TABLE 4.3 MOBILE WORKS ON A TWO-WAY ROAD - PLANT AND VEHICLE POSITIONING

Lateral work position	Work type	Lateral plant/vehicle position			
		Work vehicle	Shadow vehicle	Tail vehicle	Lead vehicle
Dividing line	Ride-on linemarking	Works in the left lane (see Note 1) or straddles the line if line marker is the straddle type	Not used	If following work vehicle, may straddle line if practicable, otherwise moves in left lane (see Note 1). If stopped, stops on shoulder. If closing up at traffic speed, moves in lane.	Straddles line when sight distance allows this to be done safely, otherwise travels in left lane
	Workers on foot or pedestrian type line marking (see Note 2)	Straddles line	Straddles line	As above	As above
Edge line	Ride-on linemarking (see Note 2)	Works in left lane (see Note 3)	Not used	Travels in left lane or straddles line	Not required
	Workers on foot or pedestrian type linemarking (see Note 2)	Works in left lane (see Note 3)	Travels in left lane	Travels in left lane or straddles line	Not required
Work within a lane (see Note 3)	Plant or vehicle only or vehicle plus workers on foot (see Note 2)	Works in lane (see Note 3)	If workers on foot present, works in lane	Travels in lane	Travels in lane

NOTES:

- 1 Requirements where traffic cannot pass safely to the left of the work vehicle are specified in Clause 4.6.3(e)(ii).
- 2 A mobile temporary speed limit, see Clause 4.6.5, is required when there are workers on foot (including pedestrian operated plant) within 1.2 m lateral clearance from moving traffic.
- 3 Requirements where following traffic may be partially deflected into the path of oncoming traffic, are specified in Clause 4.6.3(e)(iii).

TABLE 4.4 MOBILE WORKS ON A MULTILANE UNDIVIDED ROAD - PLANT AND VEHICLE POSITIONING

Lateral work position	Work type	Lateral plant/vehicle position			
		Work vehicle	Shadow vehicle	Tail vehicle	Lead vehicle
Dividing line	Ride-on linemarking	Works in lane to left of line	Not used	Travels in lane to left of line	Straddles line when sight distance allows this to be done safely, otherwise travels in lane to left of line
	Workers on foot or pedestrian type line marking (see Note 1)	Straddles line	Straddles line	Travels in lane to left of line	As above
Lane line - 4-lane road; or Right-hand lane line - 6-lane road	Ride-on linemarking (see Note 1)	Works in right lane (see Note 2)	Not used	Travels in right lane (see Note 2)	Not required
	Workers on foot or pedestrian type linemarking (see Note 1)	Straddles line (see Note 2)	Straddles line	Travels in right lane	Not required
Left-hand lane line - 6-lane road - no kerbside parking	Ride-on linemarking (see Note 1)	Works in left lane	Not used	Travels in left lane	Not required
	Workers on foot or pedestrian type linemarking (see Note 1)	Straddles the line	Straddles the line	Travels in left lane	Not required
Left-hand lane line - 6-lane road - cars parked in Lane 1	Ride-on linemarking (see Note 1)	Works in Lane 2	Not used	Travels in Lane 2	Not required
	Workers on foot or pedestrian type linemarking (see Note 1)	Straddles the line	Straddles the line	Travels in Lane 2	Not required
Edge line	Ride-on linemarking (see Note 1)	Works in left lane	Not used	Travels in left lane	Not required
	Workers on foot or pedestrian type linemarking (see Note 1)	Works in left lane	Travels in left lane	Travels in left lane	Not required
Work within a lane	Plant or vehicle only, or vehicle plus workers on foot (see Note 1)	Works in lane (see Note 2)	A shadow vehicle is required to protect workers on foot. Travels in lane	Travels in lane	Not required

NOTES:

- 1 A mobile temporary speed limit (see Clause 4.6.5) is required when there are workers on foot (including pedestrian operated plant) within 1.2 m lateral clearance from moving traffic.
- 2 Requirements where traffic cannot pass safely to the left of the work vehicle, are specified in Clause 4.6.3(e)(iii).

TABLE 4.5 MOBILE WORKS ON A DIVIDED ROAD PLANT AND VEHICLE POSITIONING

Lateral work position	Work type	Lateral plant/vehicle position		
		Work vehicle	Shadow vehicle	Tail vehicle
Left-hand edge line Lane line Work in lane	All work types	The same as the corresponding cases for multilane undivided road in Table 4.4		
Right-hand edge line	Ride-on linemarking	Works in the right-hand lane	Not used	Same lateral position as the work vehicle
	Workers on foot or pedestrian type linemarking	All vehicles travel in the right-hand lane (see also Note 2 to Table 4.3)		

(d) *Mobile temporary speed zones*

Mobile temporary speed zones shall be used at all works involving workers on foot or pedestrian type linemarking machines working under the conditions described in Clause 4.6.5.

(e) *Work on two-way roadway*

Requirements for the control and direction of traffic during work on two-way roadways are as follows:

- (i) Wherever practicable, following traffic shall be directed to pass to the left of the work vehicle and, where used, the shadow vehicle.
- (ii) When working on the dividing line or in some instances, a lane line, if at times traffic is unable to pass to the left of the work vehicle, opportunities to pass shall be provided periodically by means such as stopping the work vehicle temporarily at a localised widening of the roadway and shoulder, or temporarily pulling off the moving traffic lane. Traffic shall not be directed to completely cross a dividing line into the path of oncoming traffic.
- (iii) When working on lane or edge lines, or within a lane, and following traffic cannot be safely directed to pass to the left of the work vehicle, it may be permitted to overtake partially into the path of oncoming traffic. In this case 'partially' means that there is sufficient remaining width for an overtaking vehicle to pass an oncoming vehicle in an emergency. Only the bar or four corner lights of the illuminated flashing arrow shall be displayed in this case (see Clause 3.12.2).
- (iv) Traffic shall not be directed to cross a freshly marked line if that would result in the marking being damaged.

(f) *Advance warning*

Vehicles providing advance warning shall travel at the following convoy spacings:

- (i) In locations where sight distance is good
 - (A) Lead vehicle

200 m to 400 m in open road areas or 30 m to 100 m in built-up areas in advance of the work vehicle.
 - (B) Tail vehicle

300 m to 500 m in open road areas or 200 m to 300 m in built-up areas behind the work vehicle, or behind the shadow vehicle if one is being used. The tail vehicle may be dispensed with if the speed limit is 50 km/h or less.
- (ii) In locations where sight distance is poor
 - (A) The lead vehicle shall move as necessary beyond the distances given in Item (i) to a point where good sight distance is regained, and remain there until the work vehicle catches up.
 - (B) The tail vehicle shall hold at a position of good sight distance until the work vehicle has progressed to a point where the tail vehicle can move through the section with restricted sight to a point where good sight distance is regained.

(g) *Shadow vehicles*

A shadow vehicle is required wherever the operation involves workers on foot regardless of location or speed environment.

(h) *Safety of workers on foot*

Workers on foot in a mobile convoy shall be provided with means of communication with the tail vehicle and work vehicle (e.g. short range radio) to receive warning of any likely approaching danger.

(i) *Work on multi-lane roads*

A second tail vehicle shall be provided for works on freeways. The two vehicles should be arranged to form a 'mobile taper', the first vehicle travelling to the left or right of the occupied lane and the second vehicle (closest to the work vehicle) travelling in the occupied lane.

(j) *A second tail vehicle should be provided (see Figure 4.4). A second tail vehicle shall be provided for works on freeways. The two vehicles should be arranged to form a 'mobile taper'.*(k) *Traffic controllers*

Traffic controllers shall not direct traffic from a moving vehicle during mobile works. If a situation necessitates the use of a traffic controller, a static work position shall be established.

(l) *Sign deactivation*

All vehicle-mounted warning signs and devices shall be removed from display or deactivated when the vehicle is no longer working and becomes part of the normal traffic stream.

(m) *Traffic cone retrieval*

Where traffic cones are used to protect a freshly marked line, a separate work convoy shall be used to retrieve the cones.

4.6.4 Signs

All signs used in mobile convoys shall be carried on vehicles or plant.

All vehicles and items of plant in the mobile works convoy, other than minor items of plant protected by a works vehicle and a shadow vehicle shall carry a vehicle-mounted warning device to which is fitted an illuminated flashing arrow sign (see Clause 3.12.2(b)).

Requirements for flashing the arrow or other displays (i.e. bar only or four corner lights) are specified in Clause 3.12.2(i) and (ii).

Supplementary vehicle-mounted signs as specified in Clause 3.12.3, mounted either with the flashing arrow sign or elsewhere in a permanent position on the body of the vehicle, shall be used where necessary to indicate the type of work being done, or to provide essential additional warnings of the presence of workers on foot or driving instructions.

4.6.5 Mobile temporary speed zones

A 40 km/h mobile temporary speed zone shall be used at a mobile work site if there are workers on foot or using small items of plant on the roadway or shoulder/parking lane, and the workers are working closer than 1.2 m to moving traffic.

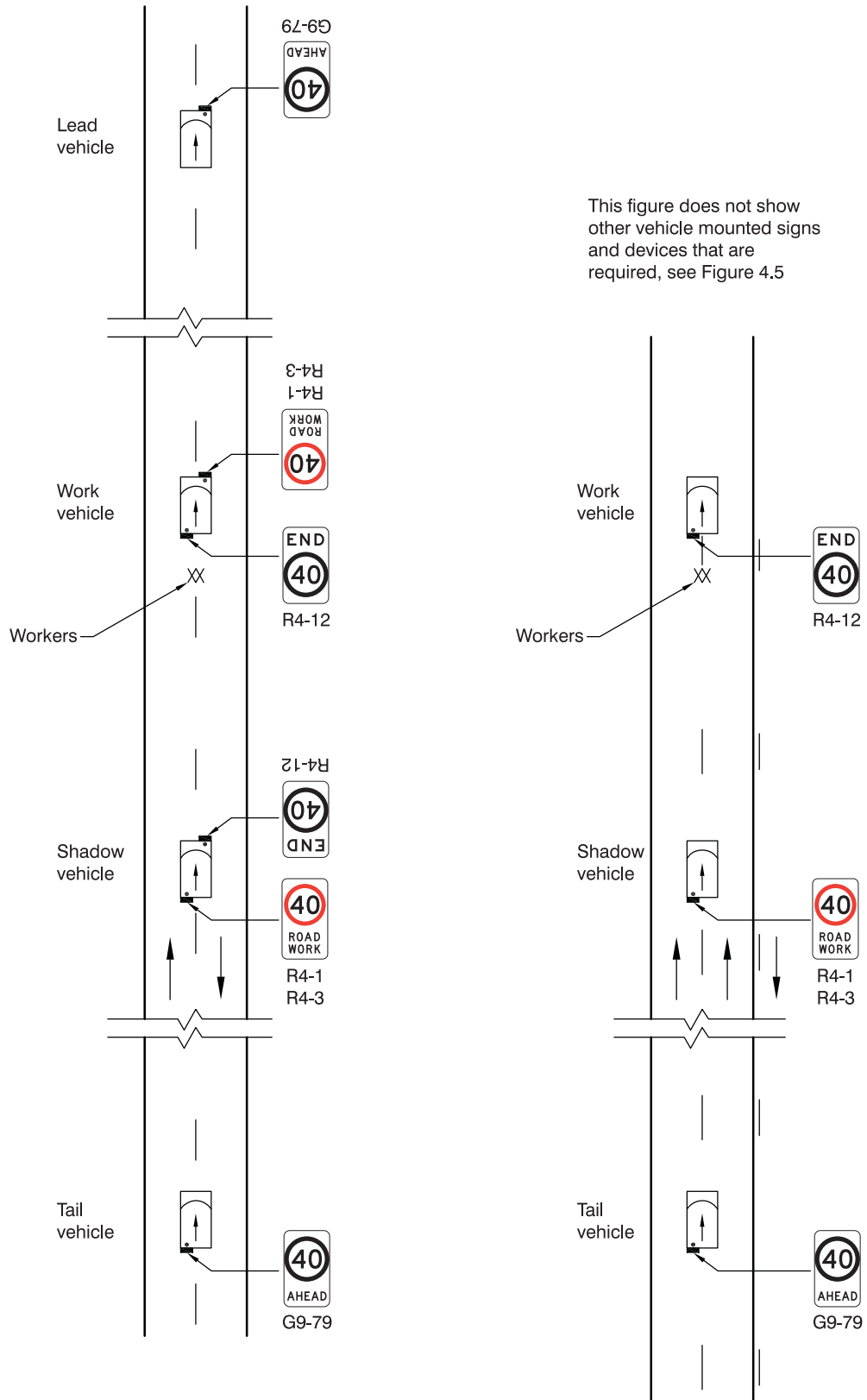
The zone shall be set up between the work vehicle or plant item, and the shadow vehicle by means of a 40 Speed Restriction sign (R4-1) and if required, the ROAD WORK supplementary plate (R4-3), displayed towards oncoming traffic as shown in Figure 4.5. In all situations, Tables 4.3, 4.4 and 4.5 requiring use of a lead vehicle, the zone shall be established for both directions of travel and the advance sign 40 AHEAD (R4-13) shall be displayed to approaching traffic on both the lead and tail vehicles. In other cases the zone need only be established for one direction of travel.

If a risk assessment indicates an unusually high risk to workers in a particular location, a lower speed limit may be required.

The end of the zone shall be signed as specified in Clause 4.9.7 by means of a sign on the work vehicle facing rearwards. It is recommended that the sign END Speed Limit (R4-12) be used for this purpose, except where the work is entirely on a length of road with a single speed limit throughout which can be shown on the end of zone sign.

NOTES:

- 1 The minimum number of vehicles needed to establish a zone to ensure that it is correctly started and terminated, and that advance warning is given, is three for one direction of travel and four for both directions.
- 2 The R4-1 and R4-3 signs may be mounted on the one signboard.
- 3 The END Speed Limit (R4-12) sign returns the speed limit applying beyond the sign to the default limit (50 km/h urban, or 100 km/h rural), including in locations where the road is zoned at a speed different from the default limit. This is usually considered to be of no significant practical effect.



This figure does not show other vehicle mounted signs and devices that are required, see Figure 4.5

(a) Work on dividing line - 2-way road

(b) Work on lane line - multilane road, undivided or divided

NOTE: Other signs and devices required on vehicles are shown in Figure 4.4.

FIGURE 4.5 MOBILE TEMPORARY SPEED ZONES

4.7 ADVANCE AND TERMINATION WARNING SIGNS

4.7.1 General

Requirements for the display of advance warning signs and devices will vary according to factors such as the speed of approaching traffic, the degree to which the hazard requires modification of speed or diversion of travel path, or extra vigilance for other reasons, and the sight distance available to the hazard, including sight obstruction caused by other traffic. Termination signs are required at long term work sites.

Typical advance sign layouts are illustrated in Figure 4.6.

Advance warning signs are not required in the following situations:

- (a) When the roadway is occupied for less than 5 min on an isolated occasion as provided for in Clause 4.3.2, 4.3.3 and 4.4.7.
- (b) On unsealed roads as specified in Clause 4.5.3(a).

4.7.2 Advance sign selection

The following signs shall be placed in advance of work areas:

- (a) *Workers (symbolic) (T1-5)* As follows:
 - (i) At short-term works not involving the diversion of traffic along a detour or side track.
 - (ii) At long-term works during all periods and at all locations where workers are actually working on or adjacent to the traffic path or are visible to oncoming traffic, or both.
- (b) *ROADWORK AHEAD (T1-1)* At works on road involving either a closure or part closure at long-term works, a diversion of traffic along a side track or detour, or a changed condition road users would not necessarily expect, e.g. loose stones or the absence of linemarking.

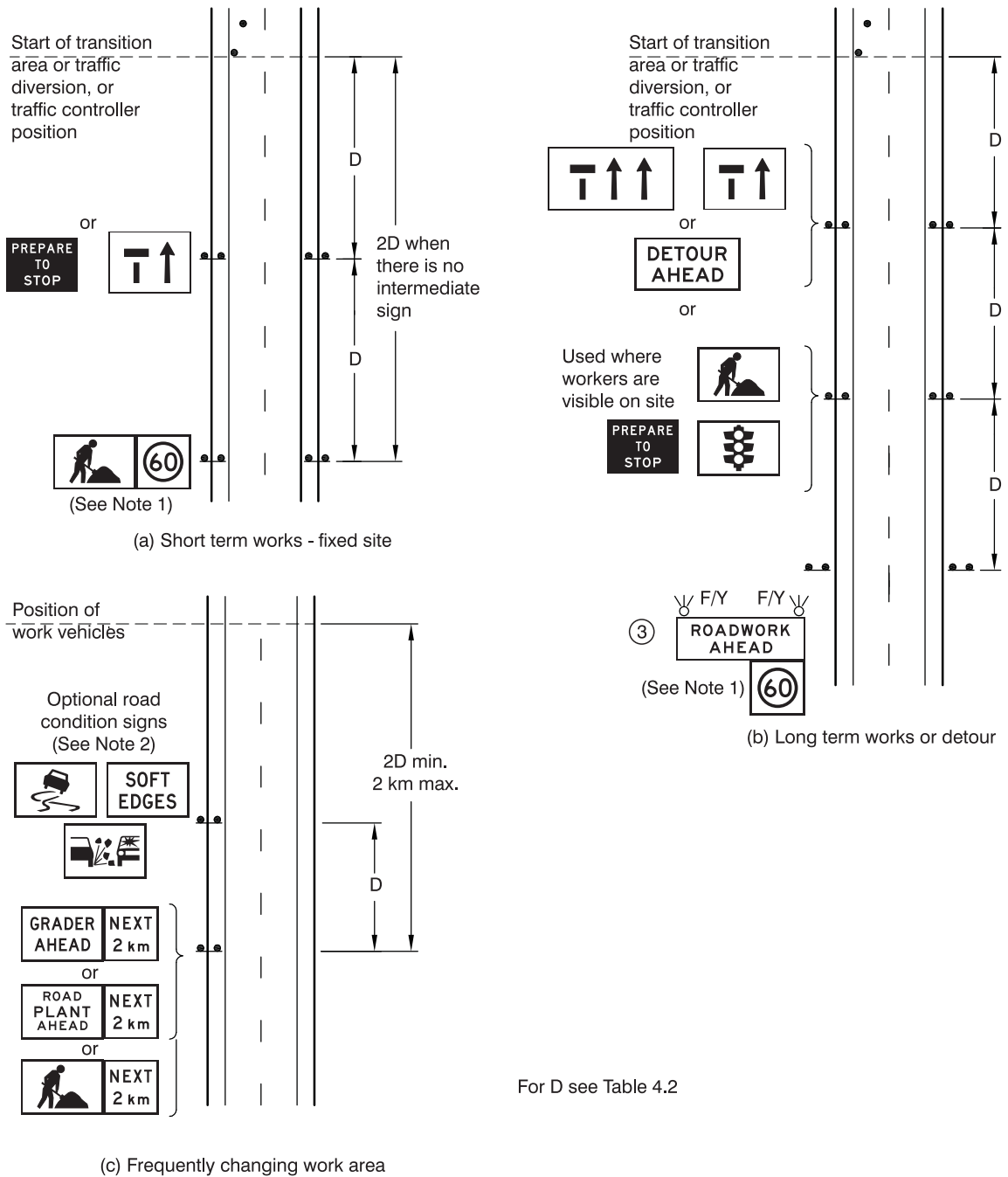
NOTE: The sign may also be used at short-term works where additional advance warning is considered necessary.

- (c) *BRIDGEWORK AHEAD (T1-2)* At long-term bridgeworks involving either a closure, part closure or diversion of traffic along a side track or detour.

Except for special cases given below, advance signs shall be limited to the above signs, i.e. they do not indicate the type of work being done or any more detailed nature of the hazard unless it is vital for a road user to have that information, e.g. existence of wet paint on the road. In instances such as work on overhead services, sufficient area of the roadway should be closed to ensure the safety of both workers and road users.

Exceptions to the above sign usages are as follows:

- (i) *Long distance advance signs*
On freeways and other roads where the posted speed limit is 90 km/h or greater, additional signs of the type ROADWORK X km AHEAD (T1-16) may be required, especially when the work site requires a substantial reduction in speed, i.e. 40 km/h or more. Distances of 500 m or 1 km would usually be considered.
- (ii) *Frequently changing work areas*
Under appropriate conditions (see Clause 4.3.4) advance signs may be displayed up to 2 km in advance of the work vehicle.
- (iii) *Mobile works*
Advance signs for mobile works are carried on vehicles (see Clause 4.6).
- (iv) *Temporary or portable traffic signals*
Long distance warning of the existence of unexpected traffic signals, e.g. in open road areas, may be required. The sign assembly Signals Ahead (W3-3) and 1 km (TC1826) supplementary distance plate should be used in this case.
- (v) *Advance warning of temporary speed zones*
See Clause 4.9.5.



NOTES:

- 1 For the need for and implementation of temporary speed zones, see Clauses 4.2 and 4.9.
- 2 Other optional road condition signs are ROUGH SURFACE, GRAVEL ROAD, LOOSE SURFACE (see Clause 3.7.2).
- 3 Flashing lamps are optional on these signs, see Clause 3.11.

FIGURE 4.6 TYPICAL ADVANCE SIGN LAYOUTS

4.7.3 Intermediate advance signs

Intermediate advance signs shall be used where, in addition to a general warning of the onset of works on road, warning is needed either of specific action a driver may be required to take, or of the condition of the road. The signs used are as follows:

- (a) Lane Status (T2-6) - shall be used to indicate closure of a lane on a roadway with two or more lanes in one direction.
- (b) DETOUR AHEAD (T1-6) - shall be used to indicate existence of a detour or sidetrack ahead.
- (c) Road condition signs as described in Clause 3.7.2 - shall be used to indicate road surface conditions which may be temporarily hazardous.
- (d) PREPARE TO STOP (T1-18), Signals Ahead (W3-3) - shall be used to indicate the existence of active traffic control and the possible need to stop.

4.7.4 Advance warning distances

Where there is only one advance sign, it shall be placed at 2D (see Table 4.2) metres from the work area for approach posted speed of 60 km/h or more, or D for approach posted speed less than 60 km/h.

This distance shall be measured from the sign position to the beginning of the taper area (see Clause 4.1.4) or beginning of a diversion associated with the work site.

Where there is more than one advance sign position (e.g. see Figure 4.6(b)), the advance signs nearest the work area shall be placed D from the beginning of the taper area or diversion and other advance sign positions at successive spacings of D further in advance of the work area.

Advance sign distances for mobile works are specified in Clause 4.6.3.

4.7.5 Sign display

Advance signs shall be displayed as prominently as possible by selecting the longitudinal location of the sign for best sight distance for approaching traffic. Signs continuously required for works which will be in progress for periods longer than 2 weeks should be erected in a permanent manner, e.g. on posts sunk into the ground, and duplicated on the right side of the road.

Flashing lamps may be used to draw attention to advance signs (see Clause 3.11).

4.7.6 Frequently changing work area

Requirements for advance signs are given in Clause 4.3.4 for open road areas and Clauses 4.4.2 and 4.4.3 for built-up areas.

4.7.7 Mobile works

Requirements for mobile works, including advance signing are set out in Clause 4.6.

4.7.8 Avoiding end-of-queue collisions

At an active traffic control position, under conditions of heavy traffic or lengthy delays, or a combination of the two, long queues may form. Depending on speed of traffic and sight distance to the end of a queue, additional advance warning may be required to avoid end-of-queue collisions.

End-of-queue protection shall be provided whenever a stationary queue is likely to extend to a point less than D (see Table 4.2) metres beyond the PREPARE TO STOP sign associated with the active control and either or both of the following apply:

- (a) Posted speed during roadworks is greater than 70 km/h.
- (b) Sight distance to the end of the queue for approaching traffic is likely to be less than 2D (open road areas) or D (built-up areas).

The following requirements and recommendations apply to the provision of end-of-queue protection where significant queues will form:

- (i) Where the maximum queue length can be predicted in advance, the primary PREPARE TO STOP sign shall be located so that the distance from this sign to the end of the queue is never likely to be less than D , see Figure 4.7. The distance may need to be adjusted if the queue length proves to have been underestimated. If the primary PREPARE TO STOP sign needs to be placed more than $4D$ (approximately 15 seconds of travel time) from the control point, repeater PREPARE TO STOP signs at intervals of not more than $4D$ should be provided between that point and the control point to provide for conditions after the queue has dispersed. In any relocation of the primary PREPARE TO STOP sign the distance D to the ROADWORK AHEAD sign shall be maintained.
- (ii) A second traffic controller can be employed to shift the PREPARE TO STOP sign and the ROADWORK AHEAD sign as necessary to maintain its minimum required distance in advance of the end of queue. The traffic controller may also display the SLOW bat at each location in which case a 60 km/h temporary speed zone shall be extended to cover that position.
- (iii) Distant advance warning using variable message signs should also be used where practicable.
- (iv) 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.

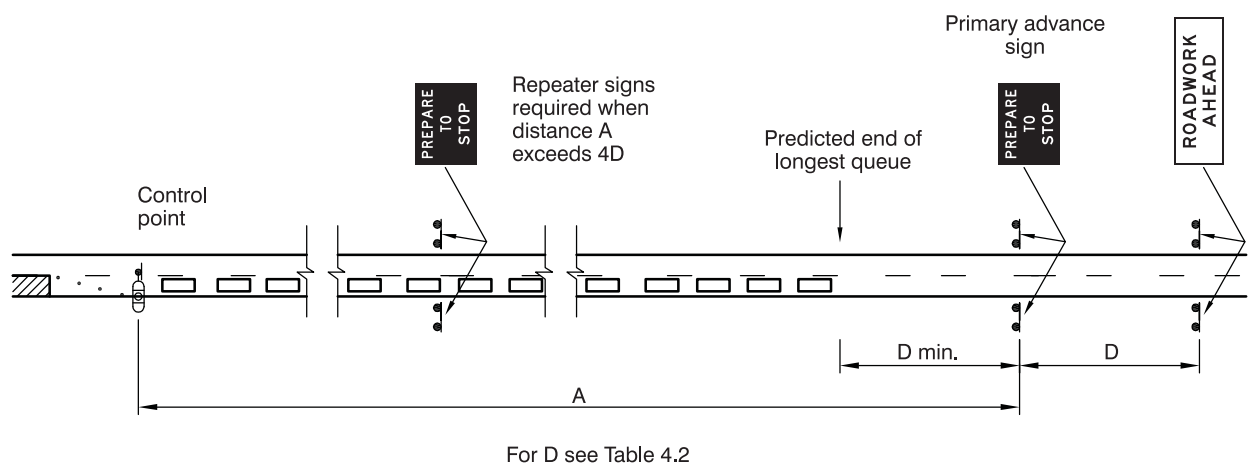


FIGURE 4.7 AVOIDING END-OF-QUEUE COLLISIONS

4.7.9 Termination signs

Termination signs END ROADWORK (T2-16, T2-17) (see Clause 3.4.8) shall be used at the departure end of long-term work sites. They shall be placed a distance D (see Table 4.2) metres downstream from the last point on the roadway or verge affected by the works.

4.8 APPROACH TAPERS

4.8.1 General

If a roadway has to be partially closed, an appropriate taper should be marked in the taper area (see Clause 4.1.4) and, wherever possible, should be located so that its full length is visible to approaching traffic. Typical applications of tapers are illustrated in Figure 4.8.

4.8.2 Lane closures

Recommended taper lengths for two-way roads and multilane roads are shown in Table 4.6.

The distances in the columns in Table 4.6 are applied as follows:

(a) *Traffic control at beginning of taper*

Applicable at a location where there is a traffic controller, or temporary or portable traffic signals just prior to a single lane.

(b) *Lateral shift taper*

Applicable where traffic is simply required to shift laterally without conflict with another traffic stream.

(c) *Merge taper*

Applicable where one lane of traffic is required to merge into another.

These three taper types are illustrated in Figure 4.9.

TABLE 4.6 RECOMMENDED TAPER LENGTH

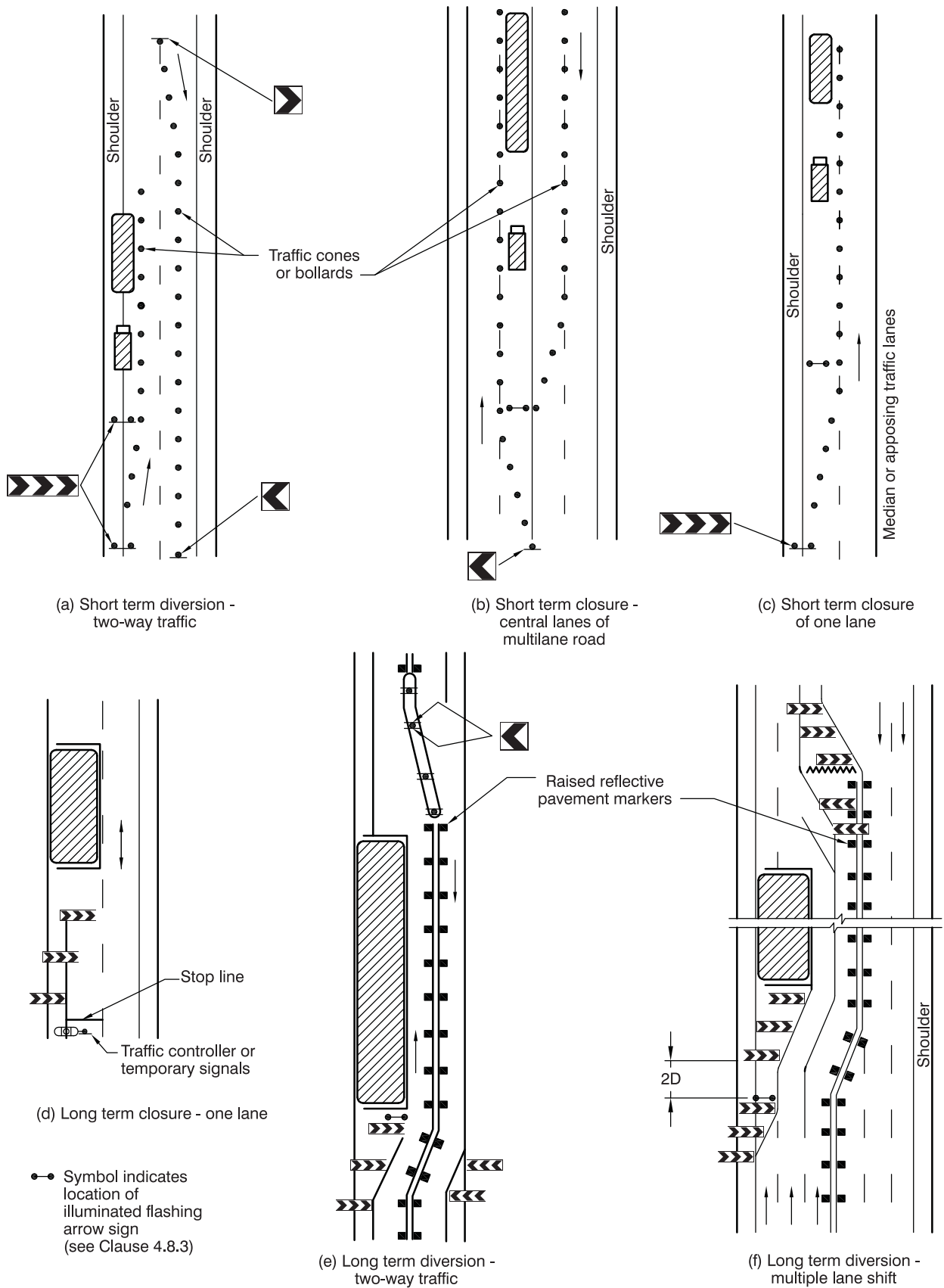
Permanent posted speed, km/h	Recommended taper length, m		
	Traffic control at beginning of taper	Lateral shift taper	Merge taper
40 or less	15	5	15
50	15	15	30
60	30	30	60
70	30	60 - 80	120 - 160
80	30	60 - 80	120 - 160
90	30	60 - 80	120 - 160
100	30	60 - 80	120 - 160
Greater than 100	30	60 - 80	120 - 160

NOTE: The taper lengths for speeds above 60 km/h are based on -

- (a) width of lane to be closed - 3.5 m;
- (b) lateral shift taper length - equivalent to 1.0 m/s lateral shift;
- (c) merge taper length - equivalent to 0.6 m/s lateral shift.

The speed of traffic in Table 4.6 is the permanent posted speed of the road before the work site is established.

The closure of more than one lane on multilane roadways should be effected one lane at a time, with the distance between tapers at least 2D (see Table 4.2) metres.



For D see Table 4.2

FIGURE 4.8 TYPICAL APPLICATION OF TAPERS IN ADVANCE OF PARTIAL ROAD CLOSURES

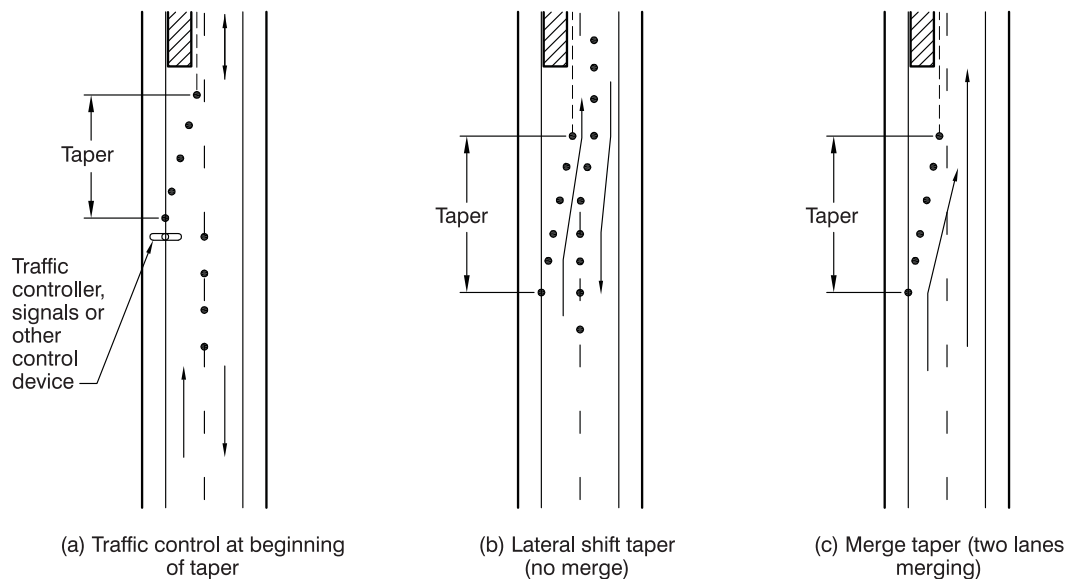


FIGURE 4.9 TYPES OF TAPER

4.8.3 Devices

Devices used for forming the taper may be temporary hazard markers, traffic cones or bollards with retroreflective bands if required for night use (see Clause 3.9) and these may be augmented by temporary line-marking.

A taper needed for a short-term daytime-only work site may be formed with traffic cones or temporary bollards. For night work the leading edge of a taper shall be formed with temporary hazard markers at approximately twice the spacing specified for cones or bollards.

For periods of longer duration, it is recommended as an alternative to the devices listed above, roadworks delineators as specified in Clause 3.9.2 be used to form the taper. These should be spaced so that to an approaching driver they appear as a continuous line.

Where temporary hazard markers are used to delineate the edge of a traffic path, they shall be used on one side only, e.g. the leading edge of a taper. Use on both sides of a traffic path can create confusing patterns of delineation.

Devices used to form tapers should be spaced so that traffic is discouraged from weaving through them (see Clause 3.9.1).

A vehicle- or trailer-mounted illuminated flashing arrow sign shall be used where the traffic volume is 1500 vpd or greater and the posted speed during roadworks is 70 km/h or greater, to assist traffic in negotiating the taper. Typical locations are shown in Figure 4.8.

4.9 CREATING A TEMPORARY SPEED ZONE AT WORKS ON ROADS

4.9.1 General

Requirements and recommendations for the use of temporary speed zones at works on roads are as follows:

(a) Workplace safety

Appropriate action to reduce traffic speeds at a work site to either 80 km/h, 60 km/h or 40 km/h to meet certain specified safe workplace requirements in Clause 4.2, which includes the protection of traffic controllers, is a requirement of this Part of the Manual. The application of temporary speed zones is specified in that Clause as a means of achieving that speed reduction.

NOTE: Clause 4.2(e) specifies certain conditions of extra hazard where a speed limit less than 40 km/h may be appropriate.

(b) Traffic safety

This Part of the Manual only gives guidance on the application of temporary speed zones for traffic safety purposes. However, where a decision has been made to create a temporary speed zone, requirements may be specified for its implementation. Workplace safety requirements (see Item (a)) shall take precedence over traffic safety guidelines wherever the former requires a lower speed limit to be imposed.

4.9.2 Speed zones for workplace safety purposes

The use of speed zones for workplace safety purposes is given in Clause 4.2.

4.9.3 Speed zones for traffic safety purposes

Temporary speed zones to be implemented for traffic safety purposes are appropriate where the consequences of excessive speed are not apparent and motorists are therefore unlikely to reduce speed voluntarily. A speed zone should not be introduced unless it is either self-enforcing or will be enforced. Roadwork speed limit signs shall not be used without other appropriate warning signs required by prevailing site conditions. Variable message signs should be used to carry the warning or other messages relating to the site conditions. Such messages could include ROAD NARROWS, SHOULDER CLOSED, etc.

Speed zones for traffic safety purpose should not be used where alternative means of traffic control such as warning signs with Advisory Speed supplementary plate, see Clause 3.7.3, would be adequate, nor should they be used to avoid the necessity for some other more appropriate action such as the use of a traffic controller to slow traffic at a critical location.

Temporary speed zones may be used where one or more of the following conditions exist:

- (a) Loose material or stones are present on the road surface.
NOTE: Speed limits should be removed after loose stone has been removed.
- (b) Sprayed seal works where higher speed may damage the new seal.
- (c) Dust or smoke may reduce visibility and cannot be controlled.
- (d) The standard of the pavement surface or the vertical or horizontal road geometry at a work site is reduced below that of the adjacent sections of road.
- (e) The unobstructed clear width of the roadway is substantially reduced.

The following principles should be applied in the selection of an appropriate speed limit:

- (i) The speed limit applied to a zone should not exceed the maximum safe speed of travel which depends on the degree of vehicular and pedestrian activity, and the type and extent of the work in progress, as well as the characteristics of the road. The more frequent the incidence of conflicts or hazards on the road, the lower the maximum safe speed of travel.
- (ii) The speed limit should not be so low that a significant number of drivers will disregard it. Prevailing conditions vary over a length of road so any speed limit imposed is a compromise.
- (iii) Speed limits should encourage uniform speed of travel but be low enough to allow drivers time to react to unusual events or to directions by personnel or traffic controllers.

A guide to the selection of roadworks speed limits is given in Table 4.7.

TABLE 4.7 GUIDE TO THE SELECTION OF ROADWORKS SPEED LIMITS

Speed limit km/h	Selection criteria	Notes on application
<40	<ul style="list-style-type: none"> Unusually high level of hazard for workers on foot. 	See Clause 4.2(e).
40	<ul style="list-style-type: none"> Workers on foot are working within 1.2 m of traffic with no intervening physical protection (see Clause 4.2(c)(iii))*. There would be structural danger to bridges at higher speeds. 	<p>This limit is specified as an option for meeting workplace safety requirements set out in Clause 4.2. It will not be observed if conditions do not appear to drivers to warrant it. Steps should always be taken in the first instance to avoid conditions requiring this limit.</p> <p>For worker safety, zone length is specified as 1 km maximum. There is a requirement for workers to be visible.*</p> <p>For traffic safety, zone length should be limited to less than 2 km (e.g. gravel resheeting or reseal operations) by roadwork programming or remedial treatments to improve traffic safety.</p>
60	<p>Workers on foot or operating plant are within 3 m of the trafficable area with no intervening physical barrier (see Clause 4.2(c)(ii))*.</p> <ul style="list-style-type: none"> A traffic controller is being used (see Clause 4.2(d))*. In advance of portable or temporary traffic signals (see Clause 4.11.3)*. Dust or smoke may reduce visibility. Traffic is subjected to a reduced standard alignment due to the works. The pavement surface has been degraded. A bituminous seal has just been laid. 	<p>This limit is specified as an option for meeting workplace safety requirements set out in Clause 4.2. It is also relevant within higher speed zones where there is significant temporary reduction in pavement surface condition, traffic path alignment or other travel conditions caused by the works.</p> <p>Zone length is specified as 150 m minimum.* No maximum length is specified.</p>
60 buffer	Used on approach to 40 km/h zone where approach speeds would otherwise be 80 km/h or greater (see Clause 4.9.5).	A buffer zone in advance of a 40 km/h road work zone should be 150 m minimum length. If required, due to site constraints, the length of this zone may be increased up to 300 m maximum.
80	<ul style="list-style-type: none"> Workers on foot or operating plant are between 3 m and 6 m of the trafficable area with no intervening physical barrier (see Clause 4.2(b))* The need for a lower limit does not exist, but there is some disturbance to alignment or pavement surface which makes unrestricted speeds undesirable on traffic safety grounds. 	<p>This limit should not be imposed on traffic safety grounds if unrestricted speeds through the work site can be tolerated at the prevailing level of driver behaviour.</p> <p>Long lengths of 80 km/h temporary speed zone on roads or freeways in open road areas will not be observed if there are no workers or plant in evidence, or they are behind a physical barrier, and there is relatively little reduction in travelling conditions evident as a result of the works.</p> <p>Zone length is recommended as 500 m minimum.</p>
80 buffer	May be used to give advance warning of a 40 km/h [†] or 60 km/h zone where the posted speed is 100 km/h or greater (see Clause 4.9.5).	A buffer zone in advance of a 60 km/h roadwork zone should be 300 m minimum length.* If required, due to site constraints, the length of this zone may be increased up to 500 m maximum.

* Mandatory requirements are specified for or relate to these items in the Clauses referenced.

† Applicable only to short-term works or works where the traffic volume is 200 vpd or less.

4.9.4 Duration

The temporary speed zone shall apply only while the relevant conditions exist. It shall be removed as soon as practicable after the need for its imposition passes. This requirement applies to either of the purposes in Clause 4.9.1 for which the speed zone is used.

Temporary speed zone signs used under Clause 4.2 for workplace safety shall be displayed only when workers, plant or traffic controllers are on site. At long-term works the signs shall be removed or covered up at other times unless they are deemed necessary for any of the other purposes listed in Table 4.7.

NOTE: These signs will normally be placed in conjunction with the Workers (symbolic) (T1-5) sign which is subject to the same requirements for display and removal.

A record shall be kept of the dates and times temporary speed zones are in operation including any changes made, and the names of personnel erecting, changing or removing signs (see Appendix A). It is also desirable to advise police of the speed limit so that enforcement action may be taken.

4.9.5 Advance warning of temporary speed zones (buffer zones)

Advance warning is required if the permanent posted speed limit on the approach to the temporary speed zone is more than 30 km/h higher than the temporary limit. If road conditions restrict the speed of traffic to a value below the speed limit on the approach, the speed of traffic shall be used to determine the need for advance warning.

Advance warning shall be provided by means of a buffer zone comprising either -

- (a) the Speed Limit AHEAD (G9-79) sign located 2D (see Table 4.2) metres in advance of the start of the lower speed zone; or
- (b) a speed zone of intermediate value (e.g. 80 km/h where the reduction is from 100 km/h to 60 km/h) (see also Clause 4.9.9).

A speed limit reduction of 60 km/h or more may be effected in two steps if needed for safety or other reasons. The steps may comprise either two successive speed zone steps in accordance with Item (b), or a speed zone step and a step using the Speed Limit AHEAD sign in accordance with Item (a).

NOTE: A typical change from 100 km/h to 40 km/h may comprise an 80 km/h buffer zone within which is placed a 40 km/h AHEAD sign.

4.9.6 Start of zone

Typical applications of speed zoning at roadworks sites are illustrated in Figure 4.11 for short-term work sites and Figure 4.12 for long-term work sites. These Figures illustrate the use of Speed Restriction signs at the start of a zone, and show their relationship to ROADWORK AHEAD (T1-1), Workers (symbolic) (T1-5) and supplementary ROAD WORK (R4-3) signs.

NOTE: These Figures do NOT show all of the signs that may be required at a work site.

Where the need for a temporary speed zone occurs part way into a roadworks site the zone may be started at that point rather than at the beginning of the site. A typical case would be a short term localised lowering of the limit to accommodate workers on foot closer than 1.2 m to moving traffic.

Two or more such localised zones may be permitted within the one work site noting that the distance between them should meet the minimum length of zone recommendation for the higher speed limit.

4.9.7 End of zone

To terminate a temporary speed zone, except as indicated below, Speed Restriction (R4-1) signs indicating the speed limit existing beyond the temporary zone shall be used. ROAD WORK Supplementary (R4-3) signs are not used with these signs. See also Clause 4.9.9(b) where a buffer zone has been provided for the opposite direction of travel. The END ROADWORK (T2-16, T2-17) sign shall be used together with the Speed restriction sign (see Clause 3.4.8).

If it is not practicable or desirable to indicate the speed limit beyond the temporary zone by means of Speed Restriction signs, the END Speed Limit (R4-12) sign (see Clause 3.5.5(c)) may be used in lieu. This case could typically occur where although the continuing speed limit (default rural limit or zoned limit) is 100 km/h, road surface, alignment or other conditions will not allow traffic to travel safely at that speed.

It is a legal requirement that a speed zone be terminated either by another regulatory speed control sign, or other means as specified in traffic regulations.

4.9.8 Repeater signs

Repeater speed restriction signs should be provided as follows:

- (a) To confirm and remind road users of the speed limit where it is imposed over a considerable length and there are locations where it may appear that the limit no longer applies, e.g. between work areas in an extended work site.
- (b) Where traffic enters from a side road and it is necessary to advise drivers of the speed limit in the road they have entered.

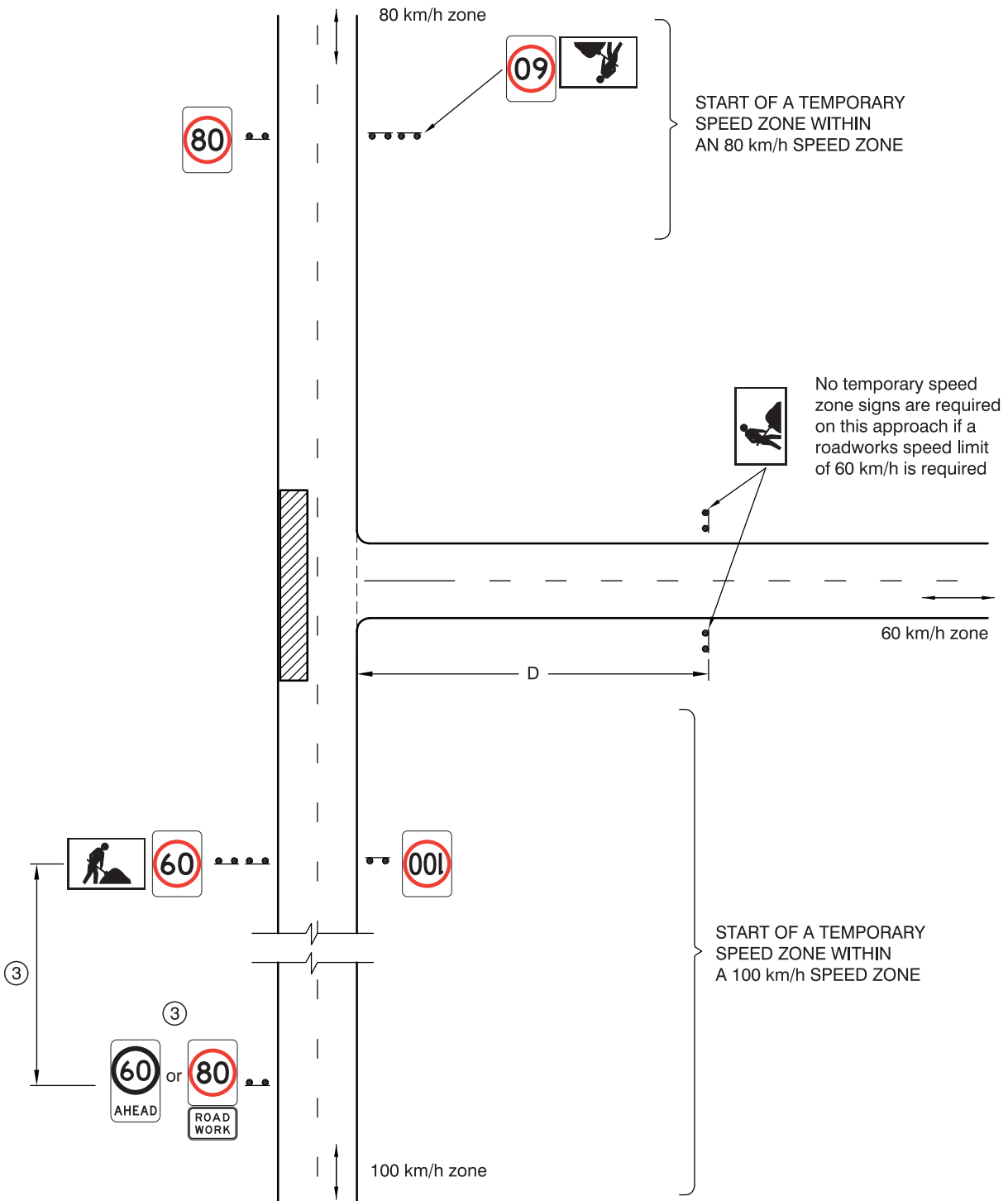
Where used, they shall be placed on the left side of the roadway at a maximum spacing of 1 km. In certain circumstances the spacing between repeater signs may be increased (up to 5 km maximum) where it is obvious to the driver that roadworks are continuing and the reduced speed limit will still apply, e.g. long lengths of reseal.

Where works are being carried out on multi-lane one-way or divided roads, repeater speed restriction signs should be duplicated on the right side of the roadway.

4.9.9 Offset speed zones

Temporary speed zoning which results in speed limits which are different for each direction of travel at a particular location shall be permitted under the following conditions:

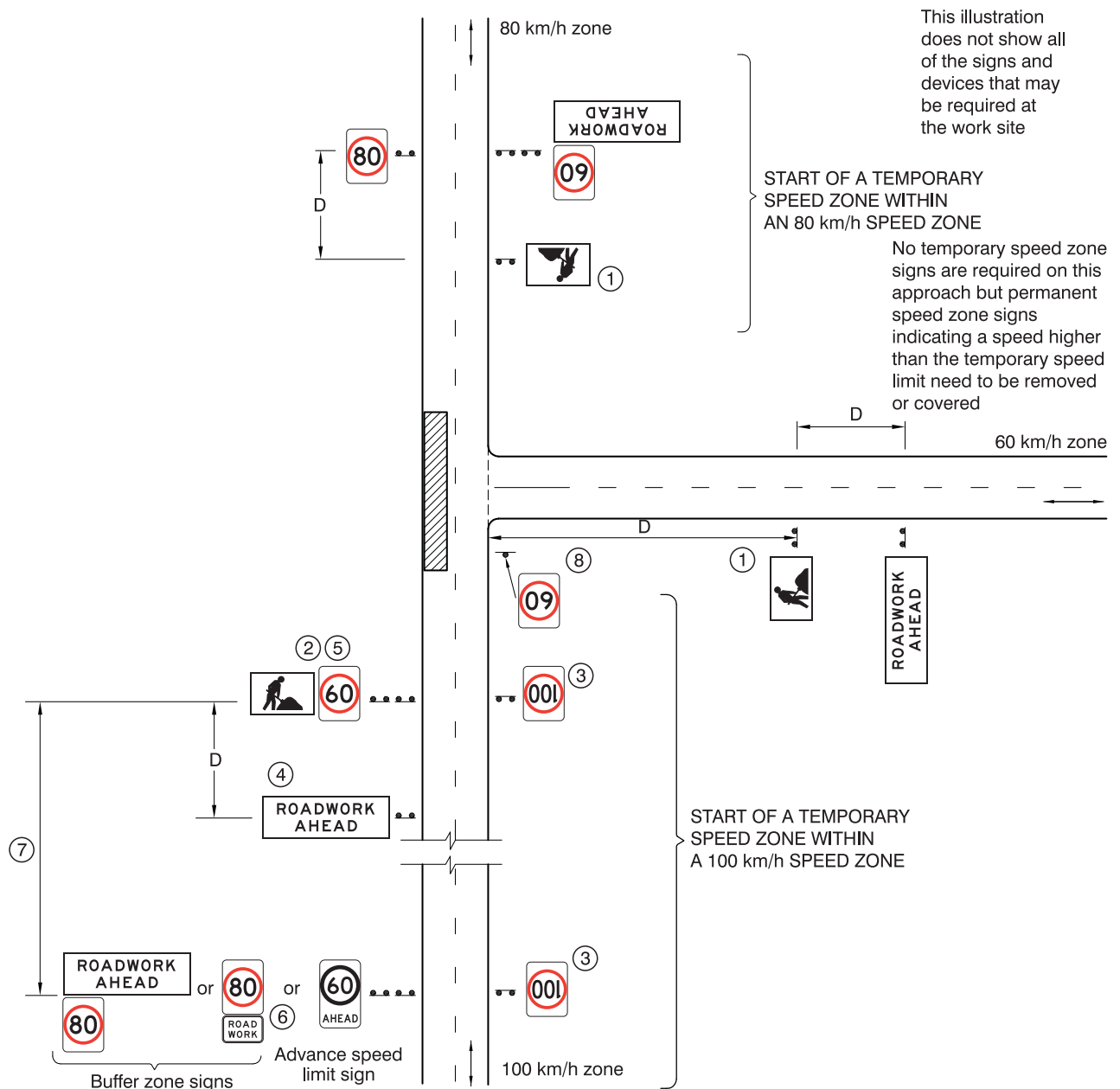
- (a) On a divided road where works affect traffic conditions on one side of the median only.
- (b) On a divided or undivided road where a buffer zone in accordance with Clause 4.9.5(b) has been provided. The buffer zone speed limit is not required for traffic leaving the lower speed limit merely because the limit applies to the opposite direction of travel.



NOTES:

- 1 This illustration does not show all of the signs and devices that may be required at the work site.
- 2 The requirement for and speed value of the temporary speed zone past the work area is as specified in Clause 4.2. (The case shown would apply to Case 3 (see Clause 4.2(c)(ii)).
- 3 Buffer zone of length as specified in Table 4.7.

FIGURE 4.11 TYPICAL SPEED ZONING AT SHORT-TERM WORK SITES



For D see Table 4.2

NOTES:

- 1 These signs are removed outside working hours.
- 2 These signs are removed outside working hours. The speed limit sign and supplementary ROAD WORK sign remain if the limit is to apply outside working hours.
- 3 Alternative positions for 100 km/h sign. It is placed behind the 60 km/h if 60 km/h limit is to remain after working hours.
- 4 The ROADWORK AHEAD sign is placed here if it is not used with the buffer zone sign.
- 5 The requirement for and speed value of the temporary speed zone past the work area is as specified in Clause 4.2. (The case shown would apply to Case 3 (see Clause 4.2(c)(ii)).
- 6 Buffer zone sign or Speed Limit AHEAD sign (see Clause 4.9.5).
- 7 Buffer zone of length as specified in Table 4.7.
- 8 Repeater signs may be required for side road traffic who have just turned into the through road.

FIGURE 4.12 TYPICAL SPEED ZONING AT LONG-TERM WORK SITES