Traffic control at work sites

[Inside front cover
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Traffic Control at Work Sites

RTA

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Foreword

The Occupational Health and Safety Act 2000 requires that an employer must ensure the health, safety and welfare of its employees, contractors, visitors and the public at its work sites. The application of the principles outlined in this *Traffic Control at Work Sites Manual* will ensure that road users will be able to travel through, past or around road and bridge work sites in safety. Adherence to the *Manual* will also ensure that the workforce is able to work safely in the vicinity of road users and their vehicles and work site plant.

This is the third version of the *Manual* and its release has been made following the publication of the 2002 edition of the Australian Standard 1742.3, *Manual of uniform traffic control devices*, Part 3, *Traffic control devices for works on roads* and to bring it up to date with developments made in traffic control practice since the release of the second version in 1998.

Whilst this manual must be used on all RTA road and bridge sites for work being undertaken by the RTA's own work force, RTA contractors or local government and public utility bodies undertaking work on behalf of the RTA, its use is commended to all practitioners who are responsible for the control of traffic at work sites, on non-RTA sites.

Acknowledgement

The review of this manual has been undertaken by staff from RTA's Traffic Management Branch on behalf of the Traffic and Transport Directorate of the RTA. This review, however, could not have been undertaken without regular and considerable input from a wide range of areas both within and outside the RTA.

To those many contributors sincere appreciation is given for all your efforts.

Note regarding authorities and responsibilities

This third version of the *Traffic Control at Work Sites Manual* continues the practice of adopting the levels of delegated authority as they are generally used within the RTA. These authority levels are as follows:-

- Team Leader (previously ganger)
- Supervisor (works supervisor)
- Unit Manager (engineer)
- Section Manager (manager)
- Branch Manager

The scope of this third version of the Manual has been expanded to include contractors, local government and public utility bodies undertaking work on behalf of the RTA. Because of the diversity of operations of such organisations it has not been possible to define the positions in those organisations where specific authorities lie. It is the responsibility of those organisations to determine and assign the authorities and responsibilities detailed in this manual at appropriate levels within their own structures. Having determined this the RTA should be advised accordingly.

Practitioners undertaking works not on behalf of the RTA may follow the principles of this Manual to assign authorities and responsibilities within their own organisations.

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Amendment record

Please note that this Manual is Version 3 dated September 2003 and all pages in this Manual are marked Issue 1, dated September 2003. Each time amendments are made to any part of the Manual the details of the amendments made will be recorded on this form which will then be posted onto the RTA web site as shown on the bottom of Page ii of this Manual. It is the responsibility of owners of the Manual to ensure that they have up to date copies of all pages of the Manual by printing from the web site as amendments are made.

As changes are made to pages of the Manual the footer on the page will be updated to show the issue number of that page and its issue date.

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The Roads and Traffic Authority NSW has both a moral and legal responsibility for the safety of all persons at RTA work sites. This includes RTA's own staff, its contractors and members of the public.

Of paramount importance in ensuring the safety of people at work sites is the need to provide a high standard of traffic control around, past or through those work sites. This can only be undertaken by a systematic consideration of the conditions to be encountered at each site and implementing or designing a specific plan for the control of traffic.

This Manual must be used on all RTA road and bridge work sites.

The manual contains a large number of standard traffic control plans (TCPs) which can be selected and implemented at work sites for which the plan meets all requirements. Where a standard plan does not meet the traffic control needs of a particular site the manual provides procedures for the design of a new or site specific plan. These procedures must be followed. Compliance with traffic control plans is to take precedence over operational expediency in all situations.

The design, selection and implementation of traffic control measures detailed in this manual are based on Australian Standard 1742.3, *Traffic control devices for works on roads*. If this manual does not contain advice on a particular aspect of traffic control then AS 1742.3 must be consulted and, its advice adopted, if such advice exists.

Traffic control and the selection or design of TCPs must only be undertaken by persons who are qualified, authorised and have passed RTA approved training courses. The training of personnel will be an integral part of the implementation of this policy.

Local government, contractors and public utility authorities are required to adopt the manual for works undertaken on RTA controlled roads and are encouraged to adopt the manual for works on roads outside the control of the RTA.

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2.1 Purpose and scope

This manual is for personnel responsible for road and bridge work sites. It contains standard traffic control plans (TCPs) for a range of works, instructions on how to design new TCPs and guidance for traffic control in a number of specific situations.

The purpose of this manual is to maximise safety by ensuring that traffic control at work sites consistently complies with best practice. It is also intended to help personnel to comply with the Occupational Health and Safety Act, 2000 and the Occupational Health and Safety Regulation, 2001.

For works conducted by contract, the manual complements RTA specifications G10, *Control of Traffic* and G11, *Control of Traffic (Maintenance Works).*

The principles outlined in this Manual detail the minimum treatments required. Additional signs or devices may from time to time be required at specific sites to ensure the maximum guidance possible. Extreme care is required to ensure that the inclusion of additional signs and devices improves and does not detract from the safety of a work site.

2.2 Application

This manual must be used on all RTA road and bridge work sites.

Appendix D, *Traffic control plans*, contains standard TCPs covering many maintenance works and common construction activities. Where a standard TCP does not exist for the work planned then a new TCP is to be developed. This may be especially the case for works near intersections. This manual contains general procedures for selecting, implementing and designing TCPs.

Not all TCPs in this manual will be applicable in every area of the State.

See Section 9, *Specific situations*, for further guidance.

In this Manual the term "Standard TCP" refers either to a TCP contained in this Manual or a TCP designed by a person with a Design and Audit Traffic Control Plans Certificate and duly authorised, contained in the Local Office Manual. The term "New TCP" refers to a TCP which does not exist as a standard TCP and which cannot be produced by minor modification of a standard TCP and will need to be designed by a person with a Design and Audit Traffic Control Plans Certificate and, once authorised, may become a Standard TCP.

2.3 Definitions

See the definitions listed in AS 1742.3, as well as the following:

85th percentile speed (V_{85}) – the speed at or below which 85% of vehicles are observed to travel under free flowing conditions past a nominated point.

AADT (annual average daily traffic) – the total traffic volume over the whole year, divided by the number of days in the year.

Adjacent to Traffic - work which is not undertaken on trafficked roads but immediately to the side of them and at locations where traffic from time to time might be expected to be found. For instance on shoulders, footpaths or medians. Extreme care must be exercised in crossing roads to reach medians and opposite shoulders or footpaths.

ADT (average daily traffic) – the total traffic volume during a stated period, divided by the number of days in that period.

Advance warning signs – roadworks warning signs which have a general message, used in advance of other roadwork signs with a more specific message. Advance warning signs include:

ROADWORK AHEAD (T1–1)
ROADWORK 1 KM AHEAD (T1–16).

Advance warning vehicle – a vehicle used well in advance (up to 1 km or more) of mobile works to provide advance warning of those works, to following traffic.

Approach speed (D) – the speed of traffic approaching the work site measured in km/h or the speed limit applying to the road, whichever is the greater. The symbol "D" is used together with an appropriate factor to indicate the distance in metres between associated signs.

Where a roadwork speed zone is in place (or a Traffic Controller used) the value of D used is to be the approach speed of traffic or the speed limit existing before the roadwork speed zone was placed.

Around – traffic will move either around, past or through work areas.

Past – a work area with traffic on the same carriageway as the work area, to the side of, and not directly over the area being worked on

Around – a work area with traffic on a detour, side track or different carriageway

Through – a work area with traffic over the area being worked on with or without a pilot vehicle and intermingling with workers or plant.

Assistant Maintenance Engineer – see definition for *Engineer.*

Condition signs – temporary signs indicating the condition of the road surface through the work area. Condition signs include:

Slippery surface (T3–3)
SOFT EDGES (T3-6)
ROUGH SURFACE (T3–7)
Loose stones (T3-9)
NEW WORK NO LINES MARKED (T3-11)
NO LINES DO NOT OVERTAKE UNLESS SAFE (T3-12)
GRAVEL ROAD (T3-13)
LOOSE SURFACE (T314)
CYCLE HAZARD GROOVED ROAD (T2–207).

Containment fencing - a physical barrier sufficient to provide separation between the travelled path of pedestrians and the work area, but not so rigid as to become a hazard if struck by vehicles, or to act as a safety barrier.

Clear of traffic and plant - a location where traffic and plant would not normally be expected. For instance between the road reserve boundary and the nearest road shoulder or kerb, on a footpath or within the reserve of a proposed but unconstructed road. Warning signs will not generally be required whilst working in such locations.

Crossover (roadworks) – used where one carriageway of a divided road is closed to traffic and the traffic is transferred to the other carriageway which then operates as a two way road.

Crossover (emergency vehicles) – used to allow access from one carriageway to the adjacent carriageway for emergency vehicles (Police, Ambulance, Fire etc) and roadwork vehicles but not for use by general road users.

D (approach speed) - see definition for approach speed.

Delineation – a general term for treatments which enhance the information needed to select the appropriate path and speed, or position, to allow a manoeuvre to be carried out safely and efficiently. In this manual, delineation refers to devices such as line marking, raised pavement markers, traffic cones, bollards and flaps and post mounted reflectors.

Device – see definition for *traffic control device.*

Engineer – the roadworks Engineer, Project Manager, Maintenance Engineer, Assistant Maintenance Engineer, Surveyor or other officer responsible for the work with suitable experience, usually at Unit Manager level or above. On contracts it is the Contractor's Representative.

Footpath – the paved area in a footway.

Footway – a public way largely reserved for the movement of pedestrians.

High speed roads - roads on which the posted or general speed limit is above 60 km/h.

High volume roads – roads carrying more than 1500 vehicles per day.

Intermittent work – work which is undertaken on travel lanes, in gaps in traffic, without obstructing traffic and without compromising the safety of workers. Intermittent work may be either planned or unplanned.

Lead vehicle - a vehicle used at the head of mobile works on two way roads to give advance warning of the works to traffic approaching from the opposite direction and to enable the driver to alert following workers of any impending hazard.

Legibility distance – the maximum distance that the various types of traffic control signs or devices are clearly seen under normal operating conditions and where there is no restriction to the line of sight.

Long-term work – work requiring traffic control and taking **longer** than one work shift and where some form of traffic control must remain when the site is left unattended and may need to operate both day and night.

Low speed roads - roads on which the posted or general speed limit is 60 km/h or less.

Low volume roads – roads carrying between 200 and 1500 vehicles per day.

Maintenance Engineer – see definition for *Engineer.*

Mobile work – work which entails vehicles moving continuously along the roadway at speeds significantly lower than other traffic. All signs and devices are either vehicle mounted or are regularly moved along the road.

Past – see definition for *around.*

Physical works – the visible on–site activity of workers, plant or trucks.

Remote location – a location that is generally clear of traffic but may include plant items or tip trucks. Examples of such locations are gravel pits and stockpile sites. Whilst traffic would not generally be expected at these locations care should be taken as access to traffic may not be denied.

Road user – any driver, rider, passenger or pedestrian using the road.

Roadside - that area between the reserve boundary and the nearest road shoulder.

Roadworks Engineer – see definition for *Engineer.*

RTA work site – a work site under the control either of RTA or its contractors. See also definition for *work site.*

Safety barrier - a physical barrier separating the work area and the travelled way, designed to resist penetration by an out-of-control vehicle and as far as practicable, to redirect colliding vehicles back into the travelled path. Approved barriers are those that have passed NCHRP 350 and conform to the requirements of AS3845.

Shadow vehicle - a vehicle which provides close up protection to the rear of workers on foot.

Shall - understood to be mandatory.

Should - understood to be non-mandatory, i.e. advisory or recommended.

Short-term work – work requiring traffic control during work taking **less** than or equal to one work shift and where traffic control is not required when the work is complete and where road conditions are returned to normal when the shift ends.

Sight distance – the distance between the point at which an approaching driver first sees the whole of an object (in the context of this manual the object is the traffic control sign or device) and the object itself. The desirable sight distance is sufficient to enable a driver to see, perceive, respond and react, and is usually approximately equal to 8 – 10 seconds of travel or about 2.5D m where D is the approach speed in km/h.

Signals Technician – see definition for *Technician*.

Site Supervisor – see definition for *Technician*, for traffic signals work and *Works Supervisor* for road and bridge works.

Spotter – a person whose sole responsibility is to watch out for and warn workers of approaching traffic.

Tail vehicle - a vehicle used at the tail of mobile works to provide advance warning of the works to following traffic, to divert traffic around the work area and to enable the driver to alert workers ahead of any impending danger.

TCP – see definition for *traffic control plan.*

Team Leader – the person on–site full time who directly manages the other workers. This includes the leader of a survey party.

Technician – a person with electrical qualifications, holding either a current Qualified Supervisor Certificate endorsed "Electrician" or an Individual Contractor Licence endorsed "Q" for electrical work, issued under the provisions of the Building Services Corporation Act 1989. A traffic signal technician is one who has the above qualifications and has had training in traffic signals operation.

Through – see definition for *around.*

Traffic – all vehicles, persons or animals travelling on a road.

Traffic control – guidance given to road users using any signs, devices, pavement markings, signals or directions from a traffic controller to regulate, warn or guide road users.

Traffic control device – any sign, signal, pavement marking or other installation placed or erected by a public authority, authorised agent or contractor to regulate, warn or guide traffic.

Traffic control plan (TCP) – a diagram showing signs and devices arranged to warn traffic and guide it around, past or, if necessary through a work site or temporary hazard. The TCP shall detail the location, spacing and sizes of all signs and devices, the location and lengths of tapers, all pavement markings and delineators, any containment or safety fencing, flashing arrow signs, portable traffic signals, variable message signs, roadwork speed zones, pedestrian routes and any other devices required for guidance at the work or hazard site.

Traffic controller - a trained person whose duty it is to control traffic at a work site. This control is normally exercised by the use of STOP/SLOW bats, but may be by manual control of traffic signals or other devices.

Variable message sign – an electronic sign that displays electronically generated messages on a screen. They provide road users with information about road and traffic conditions. When used at road work sites they are usually positioned adjacent to the roadway.

Vehicle movement plan (VMP) – A diagram showing the preferred travel paths for vehicles associated with a work site entering, leaving or crossing the through traffic stream. A VMP should also show travel paths for trucks at key points on routes remote from the work site such as places to turn around, accesses, ramps and side roads. A VMP may be combined with or superimposed on a TCP.

Very low volume roads – roads carrying less than 200 vehicles per day.

VMP – See definition for vehicle movement plan.

Work area – the specific area on the road or bridge or within the road reserve where the construction or maintenance work is being done, including vehicle regulation duties and work on public utilities. The work area usually includes areas where trucks and machines engaged in the work assemble and manoeuvre.

Work site – an area of road or bridge or road reserve which includes the work area or areas and any additional length of road or bridge required for traffic control such as signs and tapers.

Work vehicle - in mobile works this is the vehicle or plant item immediately proceeding the work area and undertaking the work (such as a linemarking machine) or supporting the workers on foot behind it.

Works Supervisor – the first person in line management who directly supervises field personnel – generally at Group Supervisor level.

2.4 Training

2.4.1 General

The success of a system of traffic control at a work site depends on the knowledge, skills, cooperation and efforts of all the people with a responsibility for the work.

Training in traffic control at work sites shall therefore be provided to all personnel with a responsibility for roadworks operations (this includes traffic facilities and bridgeworks) or those likely to be working within the reserve of a public road.

Training courses have been developed as follows:-

- **Traffic Control Using a STOP/SLOW Bat -** ***Duration 1 day***

  This course is for staff required to control traffic at a work site, by using **STOP/SLOW** (R6-8/T7-1) bats in accordance with an approved TCP.

  This course complies with the NSW Code of Practice for Occupational Health & Safety Induction Training for Construction Work April 1999, Work Activity Training

  This course ***qualifies*** the participant to control traffic, it does not ***authorise*** the participant to control traffic. The participant must ensure they are "authorised" to control traffic by the relevant roads authority pursuant to Roads (General) Regulation 2000.

- **Introduction to Traffic Control at Roadworks** ***Duration 1 day***

  This course is for staff required to set up and work with Traffic Control Plans (TCP) issued to them by Supervisors, Line Managers or others as qualified.

  This course instructs participants in how to set out and remove TCPs and control any on-site hazards. This course complies with the NSW Code of Practice for Occupational Health & Safety Induction Training for Construction Work April 1999, Work Activity Training.

  It does NOT allow the participant to select or modify existing TCPs

- **Traffic Control Worksite (TCAW) Planning** ***Duration 2 days***

  This course is for staff required to select and make minor modifications to standard Traffic Control Plans to suit the work locations, i.e. Works Supervisors, Team Leaders, Gangers and others etc.

  It does NOT allow the person to design a new Traffic Control Plan or to Audit Traffic Control Plans on a road construction site.

- **Design and Audit Traffic Control Plans** ***Duration 1 Day***

  This course is for staff required to design new Traffic Control Plans or produce major upgrades of standard plans and/or staff who will be required to Audit Traffic Control Plans on any road or bridge work site.

  This course will cover the requirements for Designing Traffic Control Plans in further detail and review and develop Auditing checklists as required for any Road Construction and or Maintenance Sites.

2.4.2 Audit of training effectiveness

The RTA training packages on traffic management at work sites for field staff and Traffic Controllers should be supplemented with an auditing process to ensure that managers and field staff:-

- possess a consistent level of knowledge of and commitment to safe work practices in relation to traffic control
- are aware of their responsibilities under OH&S legislation
- are aware of their responsibilities under this manual
- know that field personnel are required to select, install, maintain and remove signs and other devices on the basis of TCPs
- are aware of the procedure for amending standard TCPs
- are utilising the training received.

2.5 Traffic control safety audits

A traffic control safety audit is a structured procedure whereby an independent and suitably qualified person uses a checklist to review and report on the selection, design and implementation of Traffic Control Plans (TCPs).

Traffic control safety audits are consistent with the principles of continuous improvement. The overriding objective of a traffic control safety audit in relation to work sites is to ensure that they operate as safely as possible.

All work sites are subject to traffic control safety audits.

For examples of traffic control safety audit check lists refer to Appendix E.

2.6 Liaising with external organisations

RTA will endeavour to keep its standard TCPs current by liaising with:-

- overseas road and traffic agencies (the formal liaison with the United States Highways Research Program is an example), and
- other road agencies in Australia and New Zealand through the AUSTROADS liaison groups, and
- Local Government (Councils) and WorkCover in NSW.

When new information becomes available and new techniques are developed, they will be assessed and if suitable incorporated into the standard TCPs or notes in Section 9, *Specific situations*. RTA will make any amendments to the manual on the RTA web site.

RTA will liaise with public utility agencies on the issue of traffic control at work sites through the Sydney Street Opening Conference and similar groups where they exist outside Sydney.

2.7 Improving public awareness

2.7.1 Aim

The aim is to improve the recognition and response of drivers to roadworks traffic control devices and Traffic Controllers at work sites.

2.7.2 Drivers' perspective

Problems in public awareness at work sites include:-

- road users may not understand the devices, particularly newer devices such as symbol signs and flashing arrows, and
- drivers do not appreciate the dangers to motorists and workers if traffic control devices are not given adequate respect, attention and appropriate response, and
- drivers lose respect for signs, which are used incorrectly.

For example, if the sign traffic controller ahead (T1–200) is displayed while there is no Traffic Controller ahead, then drivers may interpret this sign as meaning there **may** be a Traffic Controller ahead. This could lead to a lessening of the impact of the sign when next encountered by the drivers.

2.7.3 Methods

The following methods may be used to raise public awareness of work sites:-

- erecting special signs informing the public of traffic guidance schemes
- advertising on television and radio (possibly during community service segments)
- advertising in local papers and magazines i.e. the NRMA's *Open Road*
- including suitable material in RTA's *Road Users' Handbook*
- conducting campaigns with the Police to reinforce responsible behaviour on the roads especially at work sites
- presenting road safety videos and posters in public areas of RTA offices, particularly Motor Registries
- presenting training kits on road safety in schools
- including brochures with registration and licence renewals
- handing out brochures at public events such as shows.

2.7.4 Topics

The public needs to be educated in the following topics:-

- what Traffic Controllers do
- the meaning of advance warning signs
- symbol signs particularly traffic controller ahead (T1–200), workers ahead (T1–5) and lane status (T2–6)
- longitudinal line marking operations
- night work particularly in urban areas
- risks faced by motorists at work sites.

2.7.5 Ongoing advice

The media should be encouraged to advise on current and planned roadworks on an ongoing basis, providing information on the:-

- extent of the work
- location of the work
- likely delays to traffic
- need to take care in the light of changed road and traffic conditions.

This is important information that can be helpful to motorists as well as assisting workers in controlling traffic at a work site.

2.8 Evaluation and review

Implementation of this manual will be evaluated as part of RTA's overall program of evaluations and assessment audits.

A Traffic Control at Work Sites Committee exists to assist in the review of this manual on a regular basis. Factors taken into account in these reviews include the circumstances of incidents and accidents at work sites and the results of safety audits.

The Committee is also responsible for:

- evaluating and approving new standard TCPs, signs and devices
- developing and recommending strategies to improve safe systems of work
- evaluating training and accreditation issues
- the consideration of work site OH&S issues.

The Committee has representatives from most areas of the RTA.

The basic criteria for the evaluation and acceptance of a new sign, device or standard TCP for general use throughout NSW are:-

- it conforms with the principles in Section 3, *General procedures* and Section 5*, Designing new TCPs*
- it has application in more than one area of the State
- other standard signs, devices or TCPs are not suitable or not effective.

2.9 Exclusions from this Manual

As well as following the principles contained in this Manual, some work groups may have separate documented procedures by which they operate. Such groups include the RTA Vehicle Regulation Inspectors (IVRs) and the RTA Traffic Emergency Patrollers (TEPs). These separate procedures have not been included in the Manual because of the specialist activities of these groups.

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3.1 Introduction

3.1.1 General

In setting up traffic control measures at work sites the following broad principles shall be complied with:-

- close the minimum length and width of a road at each stage to ensure minimum disruption and inconvenience to road users whilst maintaining working efficiency
- inform supervisors of any unexpected events that result in excessive lengths of queues or delays
- place signs and devices before work begins, ensure they are clearly visible to road users and not obscured by vegetation, vehicles, plant or other signs and devices and are displayed in the correct sequence
- Traffic Controllers shall be qualified, having passed RTA approved training courses, and shall be authorised
- whilst Traffic Controllers are not required for every work site situation they **shall** be used if road users are to be directed to disobey a traffic regulation, such as crossing a barrier line (portable traffic signals may also be used to direct road users across barrier lines)
- signs, devices and TCPs shall be used to warn, inform and guide road users safely around, past or through work areas and shall be removed at the completion of the work
- work is to be arranged so that workers shall be able to work safely and workers and road users are separated wherever possible
- work is to be staged to ensure minimum disruption to traffic especially at peak times, nights, weekends, holidays and during special events.

3.1.2 Through, past or around a work site

Through - passage of traffic through a work area, where it intermingles with workers or plant, shall only be permitted where both the traffic and the work can be adequately controlled. Traffic controllers or signals shall be used as necessary to slow traffic on the approach to a work area, to stop traffic for short periods when required or to control single line flow.

A pilot vehicle may be used to lead traffic along the desired path and to control its speed.

(See Section 3.6.3, *Clearance less than 1.2 m to traffic (Option 4)*, for other requirements for "through" traffic.)

Past - where traffic is diverted to the side of a work area and does not travel over the work area. On multi lane roads traffic stays within its own carriageway.

Around - where traffic is moved on a detour using existing roads or a specially built side track or different carriageway using a cross over.

3.1.3 Short-term and long-term work

As detailed in Section 2.3, *Definitions*, short-term work is work requiring traffic control but taking less than or equal to one shift. Long-term work is work requiring traffic control but taking more than one work shift where some form of traffic control must remain in place when the site is unattended. Traffic control is required where road conditions are different to normal and may take the form of lane closures, roadwork speed zones, no linemarking, detours, shoulder closures etc.

An example of short-term work would be the maintenance of Freeway safety barriers over a period of days, where the adjacent lane is closed during the shift. Another example is median mowing over successive days. At the end of each shift the lane is opened to traffic and no further traffic control is required whilst personnel are not in attendance.

An example of long-term work would be the bitumen resealing of a length of road where, even though the work might be finished within one shift and personnel are no longer in attendance, ongoing traffic control would be required in the form of speed restriction signs, signs indicating a loose surface or signs advising of no lines marked.

3.2 Traffic control signs

3.2.1 Types of signs

Roadworks and bridgeworks traffic control signs are grouped into five broad categories. Some examples of signs to be found in those categories are shown below:-

- **roadworks signs** - used at work site approaches and departures to warn road users of temporary hazardous conditions that could be encountered. Signs such as **ROADWORK AHEAD** (T1-1), **BRIDGEWORK AHEAD** (T1-2), **GRADER AHEAD** (T1-4), **END ROADWORK** (T2-16) and lane status signs (T2-6-1 and T2-6-2).

- **guide** - indicating the way road users should proceed. Signs such as **DETOUR** (T5-1, L or R), **PEDESTRIANS** (T8-2, L or R), temporary hazard markers (T5-5) and flashing arrow signs.
- **regulatory** - indicating the laws that shall be obeyed. Signs such as speed restriction signs (R4-1), roadwork speed restriction signs (R4-212), **STOP/SLOW** bats (R6-8 and T7-1), **PREPARE TO STOP** (T1-18) and **STOP HERE ON RED SIGNAL** (R6-6). Approval is required before regulatory signs or devices are erected.
- **warning** - indicating what road users can expect to encounter on or adjacent to the road ahead and advising of conditions, which require caution. Signs such as signals ahead (W3-3) and trucks crossing or entering (W5-22, L or R).
- **road condition** - indicating to road users the conditions that will be encountered such as **ROUGH SURFACE** (T3-7), **GRAVEL ROAD** (T3-13) and loose stones (T3-9). On long work sites these signs may need to be repeated at intervals of not more than 500 metres.

Signs shall be designed and manufactured in accordance with AS 1743. Details of each letter shall be as shown in AS 1742.2. The retroreflective material used on signs shall be Class 1 material complying with AS 1906.1 except as otherwise specified. The colour of background material used on workers symbolic (T1-5) and RTA traffic controller ahead (T1-200) signs shall be a combination of fluorescent/retroreflective red or orange.

3.2.2 Sign sizes

Standard signs shall be used wherever one suitable for the purpose exists. Individual signs may be available in 1, 2, 3 or 4 different sizes described as (A), (B), (C) or (D), where (A) is the smallest and (D) is the largest. (For signs used on mobile work vehicles see Section 9.19, *Mobile work*). Each category of sign is used, generally, under the following conditions:

- A - roads with low traffic volumes and low approach speeds
- B - roads with high traffic volumes or high approach speeds or both
- C - normally used on freeways and should be used on other roads where approach speeds are greater than 100 km/h

- D – may be considered on roads where approach speeds are greater than 100 km/h, where there is considered to be a need to emphasise the message or there is excessive lateral displacement of the sign.

The works supervisor is responsible for selecting sign sizes and for ensuring that they are shown on the TCP.

Flashing arrow signs are also available in three sizes as follows:-

- A - 1250mm by 650mm for roof mounting on light vehicles and typically used for short-term lane closures and mobile works under urban or low-speed rural conditions.
- B - 1500mm by 750mm for cab mounting on trucks and typically used for short-term lane closures and mobile works and suitable for use on high-speed roads. It is also suitable for mobile works on high-speed multilane roads and freeways.
- C - 2400mm by 1200mm for trailer mounting and using its own power source and suitable for long-term lane closures on high speed multilane roads where long distance advance warning is required.

High intensity flashing lamps may be operated adjacent to the flashing arrow sign and at the same time that the flashing arrow sign is operating provided that they do not draw attention away from the flashing arrow.

3.2.3 Spacing between signs

Local constraints may not allow signs and devices to be placed exactly in accordance with the relevant TCP. Judgement will therefore be necessary to place signs and devices as close as possible to the spacings indicated. Should variations to the recommended spacing be required then it is generally preferable to increase the spacing slightly. **Any sign location changes are to be marked on the TCP held on site, with the name and initials of the person making the changes.**

For fixed site, short-term works and long-term works or detours the advance warning sign closest to the work area shall be located at a minimum distance of 2Dm from the start of transition area or traffic diversion, traffic controller or traffic signals position or work vehicle position.

Each work site should be carefully examined to determine if additional advance signs are required. The position of an additional advance sign shall be 0.5Dm from the closest sign in the direction of approaching traffic. Any other advance signs shall be spaced at 0.5Dm.

For frequently changing work sites (during minor pavement maintenance, shoulder grading, longitudinal survey work etc), where the work is continually progressing along the route, advance signs may be placed up to 2 km in advance of the work. This may be increased to 5 km on lightly trafficked roads with good sight distance, subject to appropriate approval.

The team leader is responsible for spacing and placing signs and devices.

For the purposes of sign spacing the value of Dm shall be the greatest of the existing or transition speed limit or the approach speed of traffic, and not the value of any roadwork speed limit as indicated on a Speed Restriction Ahead (R4-225) sign.

3.2.4 Duplication of signs

The works supervisor shall consider whether duplication of signs should be used to improve driver awareness or ensure compliance:-

- on medians of dual carriageway roads, provided there is sufficient space
- on the outside of left hand curves where the sign is seen on approach to the work site
- on medians of dual carriageways where parked vehicles or other objects would obscure kerb side/footpath signs
- at other locations where conditions are such that duplicate signs would improve safety and guidance.

Signs for works, which will be in progress for longer than 2 weeks, should be erected in a permanent manner and duplicated on the right hand side of the road. Also, unless it is physically impracticable lane status signs (T2-6-1, T2-6-2 etc) shall be duplicated on the right hand side of the road.

On multi–lane roads where there is no room for duplicate signs on medians, consider placing supplementary signs on the left hand side, particularly workers ahead (T1–5), and traffic controller ahead (T1-200).

3.2.5 Multiple sign displays

Where two signs are to be displayed together at the one position (i.e. a worker symbolic and authorised speed restriction sign) they may be displayed on the same mounting. Whilst it is allowable to slightly reduce the sizes of the signs to suit the mounting, provided that the size of legend, size of symbol or area occupied by the legend is unchanged from the approved sign, it is **preferable** to increase the size of the mounting device and retain approved sign sizes.

3.2.6 Sign mountings

Sign mountings shall:-

- be quick and easy to install
- provide secure sign attachment
- be stable in windy conditions
- be suitable for both gravel and bitumen surfaces
- be able to accommodate various sign sizes
- be easy to handle, transport and store
- be forgiving if hit by traffic.

3.2.7 Sign positions

Signs should generally be placed 1 metre clear of the travelled path.

For works lasting longer than 2 weeks they should be mounted on poles sunk into the ground and duplicated on the right hand side of the road if physically possible.

In **rural areas** where signs are to be mounted on posts, they should be erected a minimum of 1.5 metres above the level of the nearest edge of the travelled path to the underside of the sign.

In **urban areas** adjacent to footpaths or where vehicle parking may occur, signs should be erected a minimum of 2.2 metres above the level of the kerb or footpath to the underside of the sign.

Mountings for short-term operation shall be arranged so that the signs are prominently displayed to traffic and will command attention. Ideally the minimum height to the lower edge of the sign should be 200mm but signs may be placed on the surface subject to them being clearly visible to traffic. In this regard the visibility of a sign may be affected by deep shade, the direction of sunlight, background conditions and oncoming headlights. These factors should be considered when signs and devices re erected to ensure they can be clearly seen at all times.

Signs shall face towards approaching traffic approximately at right angles to the line of sight from drivers to the sign and on curves shall be placed approximately 50 metres in advance of drivers.

3.2.8 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) 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 prevailing approach speed of traffic.

(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 shall be 0.6 $\pm$ 0.1 second 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 AS 1742.2. 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) Messages shall be additional to and not substituted for any sign, or warning or delineating device required by this Manual. The nature and positioning of the messages shall not detract from those signs or devices. Variable message signs near roadworks sites displaying unrelated messages shall be switched off.

Variable message signs shall not be used to set speed limits, but they may be used as a reminder of any set speed limit.

3.3 Traffic control and delineation devices

3.3.1 Barrier boards

Barrier boards shall comply with RTA QA Specification 3385 and shall be up to 4m long.

Barrier boards are used to prohibit access to the ends of work (where they may have flashing yellow lights mounted on them) or to prevent use of a traffic lane, and are to be placed at right angles to traffic flow at a maximum spacing of 100m.

They are not to be used as delineation devices but may be used on footpaths for the guidance of pedestrians. They shall not be placed parallel to the direction of traffic flow, unless they are at least 4 metres clear of traffic, as they will be difficult to see and may act like spears if hit by traffic.

Trestles supporting the barrier boards may be manufactured of timber, metal or other suitable approved material and shall be yellow. The trestles shall provide firm supports for the barrier board and be kept in place by filled sand bags or other acceptable devices. The bases of the trestles shall not protrude beyond the ends of the boards.

3.3.2 Plastic containment fences

Containment fences may be used to provide visible separation between pedestrians and the travelled way or the work area, in situations where physical protection by use of a safety barrier is not warranted.

When used for containment from the travelled way the clearance requirements of Section 3.6, *Safe clearances between workers and through traffic* shall be met.

All types of containment fencing shall be supported by posts at not more than 5 m centres and shall not have horizontal deflections greater than 0.5m from the nominal line of the fencing.

Containment tapes may be used to contain workers on foot and plant within the safe workplace boundary established at the particular work site. Tapes should be 100 mm wide with alternate black and yellow stripes and supported on posts approximately 1 m above ground.

Plastic mesh fencing shall be used for excluding pedestrians from a work area and for the containment of workers on foot and plant as for containment tape. It shall comprise a flexible orange mesh approximately 1 m high.

Plastic containment tapes and fences are not to be used as safety barriers and when used adjacent to traffic are not to act as delineation. Delineation shall be achieved using reflectors on the supporting posts or using appropriately placed cones or bollards.

3.3.3 Cones, bollards and flaps

Traffic cones shall comply with MR Form No 1352 and be used on short-term works under the following conditions:-

medium cones 450mm high - most low speed urban and rural applications including footpaths, shared paths and bicycle paths

large cones 700mm high - freeways and other high speed applications.

Bollards shall be at least 750 mm high and 100 mm in diameter.

These devices shall be used on short-term works to define the traffic path through or past the work area. At no time shall they be used as a substitute for barriers and signs at either end of the work. They shall only be used while work is in progress (day or night) where employees are in attendance to reinstate any of the cones and bollards dislodged by traffic or wind. For long-term works other devices such as road marking tape, raised pavement markers or post-mounted delineators shall be considered.

Cones and bollards used under night conditions shall be reflectorised in accordance with MR Form No 1352.

Pavement flaps are a more forceful form of delineation to discourage lateral movements (lane crossing) at potentially hazardous locations. Typical uses are to:-

(a) improve lane control

(b) supplement barrier lines or painted medians

(c) form an approach treatment to a median or other central obstruction.

The use of **flaps** shall be limited to the following:-

(i) approach speeds are less than 75 km/h

(ii) they are to be less than 300 mm high and 120 mm wide

(iii) they are not to be used on two-way carriageways less than 6.8 metres in width

(iv) they are not to be used if they would pose a threat to pedestrians or motorcycle or bicycle riders

(v) they shall be spaced at about 3 metres apart.

3.3.4 Roadwork delineators ("guideposts")

On long-term works (or short-term works where a device more "permanent" than bollards is required) roadwork delineators may be used.

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

Delineators should be either the 80mm diameter corner-cube Type A delineator specified in AS1906.2 or comprise retroreflective material equivalent to 100 cm^2 of Class 1A material as specified in AS1906.1 with a minimum width of 50 mm. Roadworks delineators shall be erected so that drivers will see only the following array of colours when approaching in the appropriate direction of travel:-

(i) a red delineator on each post on the left hand side

(ii) a white delineator on each post on the right hand side on two-way carriageways

(iii) a yellow delineator on each post on the right hand side of one way carriageways and medians separating traffic travelling in opposite directions.

Spacing of delineators shall be:-

(i) 24m maximum on low speed roads in work areas

(ii) 60m maximum on high speed roads in work areas

(iii) as specified in Section 9.21, *Detours, sidetracks and crossovers*.

3.3.5 Traffic warning lamps –flashing yellow lights

Traffic warning lamps shall comply with AS 1165.

There are two types of lamps used on temporary work sites as follows:-

unidirectional flashing yellow lamps - these are used to draw attention to a particular sign and are to be mounted above the sign or may be mounted on barrier boards indicating the ends of work sites. They are not to be used to delineate a path through a work site because of the confusing light pattern which a series of such lamps may produce. They may also be used to highlight safety barrier end treatments.

rotating yellow lamps - are used to draw attention to work vehicles and plant to which they are attached or to draw attention to signs in difficult light conditions or in high volume locations.

3.3.6 Temporary pavement markings and markers

Pavement markings and markers used at temporary work sites generally comprise:-

(a) barrier, lane and edge lines

(b) turning arrows

(c) raised retroreflective pavement markers.

All pavement markings shall be reflectorised and be in accordance with the relevant RTA specifications for Pavement Markings.

The pavement markings on temporary roadways and detours shall be of a similar standard to that in use at either end of the adjoining existing roadway and where the adjoining roadway is edgelined, temporary roadworks shall be similarly edgelined.

Where temporary linemarking (ie linemarking not in its final location) is required on the final wearing surface, or adjacent pavement, only approved pavement marking tape shall be used.

Where it is determined that the pavement **linemarking** has become ineffective, remarking shall be undertaken within forty-eight hours.

Where it is determined that **raised pavement markers** have become ineffective, they shall be replaced within twenty-four hours.

Where a single carriageway is opened adjacent to or used in lieu of an existing dual carriageway length, pavement arrows (in tape if they are required to be removed from a final wearing surface) indicating the direction of flow of traffic shall be placed as directed with the maximum allowable spacing being 500 m. The arrows shall be removed if the section is then reincorporated as dual carriageway.

All redundant pavement markings shall be immediately obliterated or removed in such a way as to leave a clean, undamaged pavement with a surface texture, reflectivity characteristics and colour comparable to the adjacent pavement surface.

Pavement markings shall be removed in a manner that will not materially or structurally damage the surface or texture of the pavement. Obliteration by painting over shall not be permitted. All redundant raised pavement markers shall be immediately removed from the pavement.

Where existing pavement markings are to be removed and replaced by other pavement markings, removal must not begin until adequate provisions have been made to complete the installation of the replacement markings. Pavement markings must be removed in such order that the markings remaining in place at any time will not be in a pattern that will mislead or misdirect road users.

The markings must be removed so that the surface is in proper condition for adequate bonding of the new markings. Any material deposited on the pavement as a result of removing pavement markings must be promptly removed as the work progresses by acceptable methods.

When these operations are completed, the pavement surface must be clear of any residue or debris. A minimum of ninety (90) percent of the total area of the existing pavement markings must be removed to uniformly expose the existing pavement surface.

Any damage to the pavement, pavement joint materials or the pavement surface caused by the removal of pavement markings shall be repaired. The pavement surface shall be left in a condition that will not mislead or misdirect road users.

On long-term works raised retroreflective pavement markers complying with AS1906.3 may be used in conjunction with temporary pavement markings. The spacing and application shall be as specified in AS1742.2.

Pavement markings are not required on very low volume roads or gravel roads where there were no markings prior to the work.

3.3.7 Plastic water filled containment fences

Plastic water filled devices that have not satisfied the requirements of NCHRP 350 (or equivalent) as a safety barrier shall only be used as a containment fence (see Section 3.3.2, *Plastic containment fences*). These devices will not contain a vehicle and might present a hazard to personnel if struck and displaced by a vehicle.

Typical uses include placement in a work area behind safety barriers to prevent workers from entering the area of deflection of the safety barrier. They may also be used to guide pedestrians and cyclists through or past work areas (subject to the restriction of item (i) below).

These units:-

(i) shall not be exposed to motor traffic in any situation where traffic speed is likely to exceed 20 km/h

(ii) shall satisfy impact tests 70 and 71 of NCHRP 350 for work zone traffic control devices

(iii) shall not be used at locations where a safety barrier is required as indicated by this Manual

(iv) shall each be labelled as shown below to indicate that it is not a safety barrier:-

WARNING

THIS DEVICE IS NOT TO BE USED AS A SAFETY BARRIER

IT MAY NOT PREVENT VEHICLE PENETRATION

(v) for night use, each unit shall be fitted with a reflector visible to approaching traffic, and where used to channel pedestrians away from a pre-existing route, lighting must be provided to the same level as the pre-existing pedestrian route

(vi) shall be filled with sufficient water (or sand) to provide the mass to resist displacement or overturning from expected wind conditions, air turbulence from passing traffic and minor vehicle impacts.

3.3.8 Unacceptable traffic control devices

The following are not to be used as traffic control devices, as they can be hazardous to personnel if hit by vehicles:-

(i) steel drums

(ii) isolated or non-continuous concrete barrier units

(iii) barrier boards parallel to and within 4 metres of the direction of traffic flow.

3.3.9 Vehicle mounted signs and devices

Vehicle mounting warning devices shall be displayed as follows:-

(a) a single rotating flashing yellow lamp for emergency or other infrequent use on a vehicle not normally used for roadworks purposes, or for use on a plant item or an inspection vehicle operating in accordance with Section 9.1.4, *Mobile inspections and slow moving vehicles*.

(b) a pair of rotating flashing yellow lamps for use on vehicles (e.g. patrol trucks) so that at least one and preferably both lamps are visible from any direction.

(c) an illuminated flashing arrow sign as specified in Section 3.2.2 for work on high-volume and/or high speed roads and for mobile works where indicated in Section 9.19, *Mobile works.*

In addition to the above, Workers (symbolic) signs (T1-5) shall be displayed on all vehicles in a mobile works convoy where workers are working on foot and should be displayed on vehicles other than mobile works where workers are working.

For linemarking operations vehicles should display **LINE MARKING**, **LINE MARKING AHEAD** and **WET PAINT ON ROAD** signs on the appropriate convoy vehicle. Whilst standard signboard sizes are specified for these signs they may be tailored to suit the positioning and mounting arrangements on the vehicle.

3.3.10 Truck mounted attenuators

Consideration should be given to installing truck mounted attenuators on vehicles used to effect lane closures on multilane roads or used as shadow vehicles on mobile works.

3.4 Sequence for erection and removal of signs and devices

3.4.1 Sequence of erection

Before work commences, signs and devices at approaches to the work area shall be erected in accordance with the adopted TCP, in the following order:

- advance warning signs
- all intermediate advance and positional signs and devices required in advance of the taper or start of the work area
- all delineating devices required to form a taper including flashing arrow signs or temporary hazard markers where required
- delineation past the work area or into a side track
- other warning signs or regulatory signs.

Delineation devices such as cones and bollards should be placed in the same sequence, i.e. those furthest in advance of the work placed first.

Where a work area is moving progressively along the road, relocation of the signs ahead should take place in the above sequence. Those behind should be relocated in the reverse sequence.

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

3.4.2 Erection of signs and devices

Always travel in the direction of normal traffic flow.

A work vehicle with a flashing arrow or flashing light(s) should be positioned between the workers and approaching traffic during placement of traffic control devices.

Long-term or recurring short-term sites:- Consider marking the desired location of each sign or device on the road pavement for easy future placement.

Multi-lane roads:- the placement of traffic control signs and devices on central medians or concrete barriers on multi lane roads requires special consideration (i.e. a site specific TCP, or use of a mobile convoy etc).

3.4.3 Removal of signs and devices

Removal of traffic control signs and devices should be undertaken in the reverse order of erection, progressing from the work area out toward the approaches.

Lane closures delineated by cones and bollards:- a work vehicle should be positioned between the workers and approaching traffic and should generally slowly reverse along the closed roadway allowing workers to remove the traffic control devices. However, subject to the approval of the works supervisor the work vehicle may proceed in a forward direction towards approaching traffic along the closed roadway.

Lane closures using barrier boards:- an “advanced warning vehicle” placed between the workers and approaching traffic should be considered as an option when removing barrier boards from lane and road closures.

Once the lane closure traffic control devices have been removed, the work vehicle should return to the approaches to the work area and, subject to the vehicle being able to move clear of the travel lane, remove all signs in the reverse sequence they were erected before the commencement of work. Special consideration should be given for the removal of signs on central medians and barriers on multi lane divided carriageways.

3.4.4 Difficult sites

At sites where it is difficult to install and remove control signs and devices due to traffic conditions, volumes, shoulder width or road alignment, special arrangements (incorporating a site specific TCP and appropriate safe procedures) to compliment the above general principles should be given consideration to maintain worker safety. This may mean that signs are removed in the same order that they were erected to allow the work vehicle to move in the direction of normal traffic flow when use of the travel lane is the only alternative.

3.5 Broad safety principles

3.5.1 Advertising in advance of works

Advertising of proposed roadworks and any expected delays should always be considered. This could be undertaken through media advertising (press, television, radio, internet etc), specially erected signs on the approaches to the proposed work or letter box drops and personal contact.

3.5.2 Instruct and guide road users

Where standard TCPs are not appropriate new ones need to be carefully designed to adequately instruct and guide road users safely around, past or through the work site, giving particular attention to:

- preparing a separate TCP for each stage of the work
- separating the work area from the route of vehicles wherever possible
- the need for using traffic controllers or portable traffic signals to regulate traffic conflicts and to slow and stop traffic if necessary
- using approved high visibility external clothing, as specified in RTA's *Occupational Health and Safety Policy Manual, Wearing of High Visibility Vests and Garments* so that work personnel can be easily seen both during the day and at night.

3.5.3 Maintaining temporary signs and devices

Work sites need to be carefully maintained with particular attention to:

- checking that the signs and devices displayed remain appropriate for changing circumstances during the work
- regularly checking that signs and devices are always maintained in good condition. Signs can easily be damaged or disfigured in the work environment and they shall be replaced if the warnings displayed are not clear
- removing or covering the signs and devices as soon as they are not needed for instance when the work is completed, or at the end of the day or when there is no site activity, i.e. during meal breaks.

3.5.4 Special safety guidelines

Traffic control arrangements at work sites should comply with the following special safety guidelines:

- traffic should not be temporarily diverted so that two lanes operate in the same direction on opposite sides of a median in areas where there are pedestrians. Doing so would leave the pedestrians at risk from forgetting to look in both directions when using a median as a refuge. See Section 9.3, *Pedestrians*.
- it is essential to keep pedestrians clear of work sites. This can be achieved by erecting containment fencing around the work site. See Section 9.3, *Pedestrians*.
- remember that some drivers may take longer to react to changed circumstances in the road environment
- when a detour requires traffic to travel in the wrong direction on an existing carriageway, the trailing ends of existing safety barriers will become the leading ends and may require modification
- consider the use of reverse coloured signs (yellow on black) for night-time works. See Section 9.2.8, *Signs for night work*
- be particularly conscious of visibility to the end of a queue that may develop and extend from a temporary closure or delay to traffic. Use additional signs (such as **PREPARE TO STOP** (T1-18)) and warning devices where queues or delays are long (see Section 3.5.7, *Avoiding end of queue collisions*)

- avoid undue delay to traffic as this may result in drivers speeding or taking unnecessary risks to make up time in the rest of their journey
- consider the use of truck mounted attenuators on work vehicles protecting workers in exposed situations .

3.5.5 Traffic signal site issues

Consider the following when making traffic control arrangements at work sites with traffic signals:-

- adjust the operation of adjacent traffic signals where necessary during roadworks
- maintain effective traffic signal operation and coordination with other traffic signals, if traffic signals are part of a coordinated signal system
- if turn restrictions are necessary, check that alternative routes are available and satisfactory
- seek Police assistance at difficult work sites
- inform road users in advance of proposed works by advertising i.e. roadside advertising, letter drops or press releases
- ensure that adequate provision is made for pedestrians if it is necessary to turn off pedestrian signals or the pedestrian mode of traffic signals.

3.5.6 Emergency incidents

Emergency incidents include lane blockages due to accidents, oil spillages from vehicles, fallen trees etc. When encountering such conditions the following general procedure is to be adopted:-

- initially stop the crew truck in the travel lane with **ALL flashing lights on AND** immediately begin warning (with safety) approaching traffic to slow down. Where possible the crew truck and workers should be located to achieve a minimum sight distance of 2.5Dm to approaching traffic.
- set up appropriate TCP to use traffic controllers to stop traffic (advance signs to be carried to appropriate locations).
- set up advanced warning signs (i.e. Traffic Accident Ahead, Prepare To Stop) in advance of the anticipated end of the traffic queues, to provide adequate warning to approaching traffic that a traffic queue ahead may exist. The length of the traffic queue and the location of appropriate warning signs will require periodic monitoring.

3.5.7 Avoiding end of queue collisions

(a) General

At an active traffic control position, where road traffic may be stopped for a period of time, there is an increased risk of rear end collisions occurring. These collisions may occur:-

- where queues are unexpected and may be short, for instance on rural highways, and may be due to the inattention of road users
- where queue lengths are long and may vary considerably, for instance on urban roads, and may be due to queue ends extending beyond advance warning signs and devices.

Depending on approach speeds and sight distance to the end of a queue, additional advance warning may be required to be given to advancing motorists to avoid end-of-queue collisions. **This may include extending the length of a sign posted roadwork speed zone where the queue length extends beyond the originally established zone.**

(The principles outlined in this Section may also be applied at the approach to a roadwork speed zone. See Section 8.2, *Roadwork speed zones*.)

Devices or techniques which may assist in this and which should be considered include:-

- additional and/or oversized signs
- variable message signs
- narrowing of lanes using bollards or cones
- chicanes
- electronic speed display signs
- flashing lights on signs
- thermoplastic tape or similar laid either longitudinally in zig zags or transversely to act as gentle “speed humps”.

At the present time portable speed humps, which are usually supplied with a rise of 70mm or greater, are not considered satisfactory where the speed of approaching traffic exceeds 50 km/h, as they could be hazardous to motor cycles and the method of fixing might cause damage to road pavements. Their use, however, is being examined further and their use would be subject to individual site conditions and recommendations.

(b) Assessment of expected queue length

Whilst it may not be possible to determine accurately the queue lengths expected, consideration of the relevant factors should give a close approximation. These factors include:-

- the expected hourly traffic volumes at the time of the work
- the expected delays at each phase of the work
- the number of traffic lanes closed or affected
- the percentage of heavy vehicles
- the terrain at the site
- the site alignment i.e. horizontal curves

At all times during the course of the work traffic queues shall be monitored to ensure that queue lengths do not extend back beyond the limits of the advance warning signs. Where this occurs use the procedure outlined in 3.5.7 (c) below.

At work sites where longer than normal delays may be expected (such as the laying of bridge beams which may delay traffic for 20 or more minutes) extra planning may be required which is beyond the scope of this Manual.

(c) Procedure for reducing end of queue collisions

End-of-queue protection shall be provided whenever a stationary queue is likely to extend to a point less than Dm beyond (on the work side of) the **PREPARE TO STOP** sign associated with the active control and either or both of the following apply:-

(a) Approach speeds are greater than 80 km/h.

(b) Sight distance to the end of the queue for approaching traffic is likely to be less than 2Dm (rural) or 1.5Dm (urban).

The following are recommended options for end-of-queue protection:-

(i) Where the maximum queue length can be predicted in advance, the advance sign distances including that to the **PREPARE TO STOP** sign can be increased so that the distance from this sign to the end of the queue is never likely to be less than Dm, see Figure 3.1. The size C **PREPARE TO STOP** sign should be used in this application.

The distance may need to be adjusted if the queue length proves to have been underestimated. If the **PREPARE TO STOP** sign needs to be placed more than 4 Dm (approximately 15 s of travel time) from the control point, repeater **PREPARE TO STOP** signs at intervals of not more than 4 Dm should be provided between that point and the control point to provide for conditions after the queue has dispersed.

(ii) A second traffic controller can be employed to move the **PREPARE TO STOP** 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.

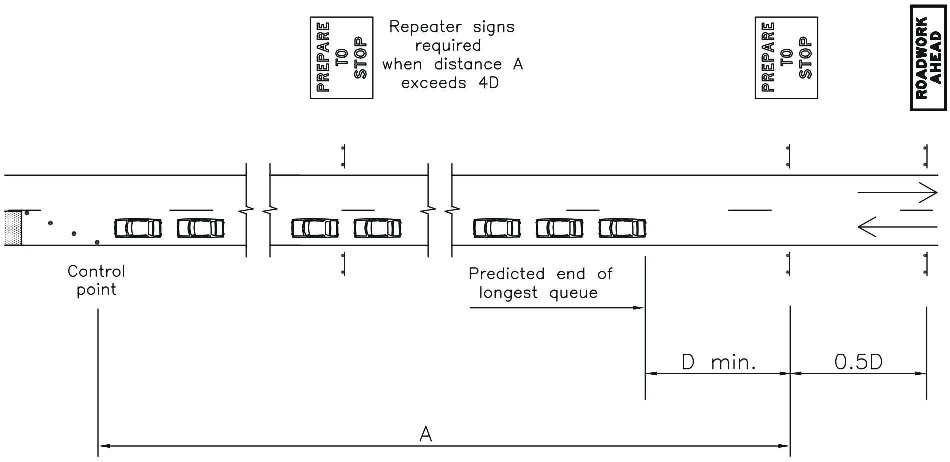

Figure 3.1 Avoiding end of queue collisions

A distant advance warning using a variable message sign should also be used where practicable.

3.5.8 Tolerances on positioning of signs and devices

Where this Manual gives a specific distance for the longitudinal positioning of signs or devices with respect to other items or features, for the spacing of delineating devices or for the length of tapers or markings, the following tolerances may be applied: -

(a) Positioning of signs, length of tapers or markings:

(i) Minimum, 10% less than the distances or lengths given.

(ii) Maximum, 25% more than the distances or lengths given.

(b) Spacing of delineating devices:

(i) Maximum, 10% more than the spacing shown.

(ii) No minimum.

These tolerances shall not apply where a distance, length or spacing is already given in the text or a figure as a maximum, a minimum or a range.

3.6 Safe clearances between workers and through traffic

There is an obligation on both organizations 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 works site, the protection of workers from oncoming or passing traffic, and the protection of road users from hazards within the work site.

Requirements and recommendations for protecting workers from oncoming or passing traffic and road users from hazards within the site at a static works site are as shown below. Very short-term and low-impact works and mobile works are exempted from these requirements.

These requirements also apply to pedestrians affected by works.

3.6.1 Clearance 3 metres or more from traffic (Option 1)

If no part of the road shoulder, parking or auxiliary lane has been closed and 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 signing or traffic delineation of the work area will be required other than a Worker (symbolic) (T1-5) sign in advance of the work area and a vehicle mounted warning device (see Section 3.3.9, *Vehicle mounted signs and devices*) on each vehicle or item of mobile plant when workers or plant are present on site.

If there is closure or partial closure of the roadway, shoulder, parking lane or auxiliary lane but the work area is located a minimum of 3 m from the nearest edge of a lane carrying traffic, all of the signs and delineation specified in Section 3.6.2 (ii) are required except that there will be no requirement to reduce traffic speeds for the protection of workers.

In each of the above cases the use of a containment fence (see Section 3.3.2, *Plastic mesh containment fencing*) should be considered to delineate the clearance line for workers if the work area clearance is close to the 3 m minimum.

3.6.2 Clearance within 3 metres of 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 safety barrier (Option 2)

If the work area is protected by a safety barrier (see Section 9.6, *Safety barriers*) 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. The use of a containment fence behind the barrier should be considered as in Section 3.3.2, *Plastic mesh containment fencing* or Section 3.3.7, *Plastic water filled delineation fences*.

(ii) Clearance within 1.2 and 3 metres of traffic (Option 3)

If there is no physical barrier 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 are on site, in addition to the requirements for other works site management devices specified in this Manual:-

(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.

(C) Separate delineation of the edge of the work area by means of a containment fence.

(D) The speed of passing traffic shall be reduced to 60 km/h or less through:-

(1) The use of appropriate traffic control devices such as signs, flashing lights, traffic controllers, tapers etc; or

(2) Imposing a temporary road work speed zone; or

(3) A combination of both of the above.

This action is not required if traffic speeds past the site are already 60 km/h or less or the site is within a 60 km/h or lower speed zone.

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

If the clearance requirement of 1.2 m in Section 3.6.2 (ii) above cannot be achieved or workers or plant, or both, are working within the trafficked area, all of the requirements of Section 3.6.2 (ii) shall apply except that traffic speeds shall be reduced to 40 km/h or less using the methods specified in Section 3.6.2 (ii) (D). Use of a containment fence may be omitted if its use would not be practicable.

3.6.4 Protection of traffic controller

Traffic controllers are not subject to the requirements of Section 3.6.2 above, but shall be allowed to operate only in an area where traffic speeds have been reduced to 60 km/h or less as set out in Section 3.6.2 (ii) (D).

3.6.5 Clearance requirements shown on TCPs

It is essential when selecting or modifying standard TCPs or designing new ones that the clearance requirements, including the positioning of any road work speed signs, are clearly shown on the TCPs.

4.1 Components of the work site

The work site is that length of road or bridge which includes the area where the work is being undertaken and any additional length of road or bridge required for traffic control including signs, tapers, traffic lights and other devices. This work site is made up of five smaller areas as shown in Figure 4.1:-

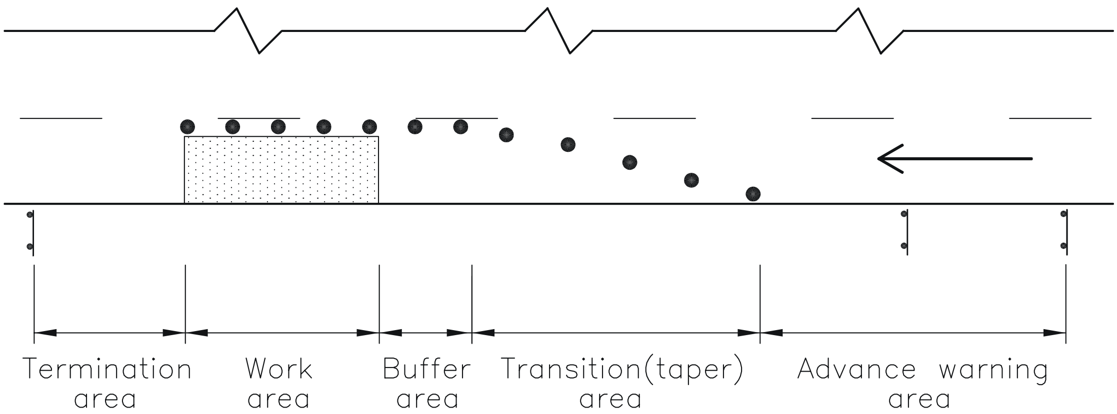

Figure 4.1 Components of a typical work site

Descriptions and requirements for each of the areas are as follows:-

- **advance warning area** - where the advance warning sign or signs are erected to warn and inform of changes to traffic conditions ahead and to give motorists time to adjust their driving patterns
- **transition area** - where traffic is guided past the work area, usually by means of cones or bollards set out in a taper
- **buffer (or clearance) area** - the **unoccupied** space between the transition and work areas to allow space for an out of control vehicle to pull up before reaching the work area. Generally a length of 20 to 30 metres is sufficient.
- **work area** - where the work is being undertaken and is closed to through traffic and occupied by workers, plant and materials
- **termination area** - where traffic has cleared the work area and where normal traffic conditions resume.

These areas can be clearly seen in TCPs such as 83, 96 and 101.

4.2 Selecting standard TCPs

4.2.1 Standard TCPs

Tables are provided in Appendix A, *Typical uses of TCPs*, to provide assistance in selecting a suitable TCP. Standard TCPs are detailed in Appendix D, *Traffic control plans*. Extreme care should be exercised in selecting a Standard TCP to ensure that it accurately reflects the conditions on site. Refer also to Section 9, *Specific situations*. If a standard TCP does not exist for the type of work proposed and one cannot be produced through minor modification of a standard TCP then a new TCP can be designed by referring to Section 5, *Designing new TCPs*. (For guidance on minor modification of TCPs see Section 4.4, *Minor modification of TCPs*.)

4.2.2 What the works supervisor shall do

Before works requiring traffic control begin the works supervisor shall:

- determine the category of the work to be undertaken
- refer to Appendix A, *Typical uses of TCPs*, to select the most appropriate standard TCP detailed in Appendix D, *Traffic control plans,* with minor modifications if necessary
- consult with the Engineer, if necessary, to confirm that the proposed TCP is appropriate.

NOTE: The requirements in this Section relate generally to longer term, planned works or to situations where works supervisors have frequent contact with work crews. Where the works supervisor is not available, perhaps because of the remoteness of sites, personnel (i.e. team leaders, site supervisors (technicians) and others) who have successfully undertaken the Traffic Control at Worksite (TCAW) Planning training course may be authorised to select and implement standard TCPs.

4.2.3 What the engineer shall do

The engineer shall:

- when requested by the works supervisor determine whether the TCP proposed by the works supervisor is appropriate, or is the most appropriate TCP, with or without minor modification
- determine whether it is necessary to design a new TCP (i.e. if the standard ones are inappropriate)
- ensure that new TCPs are designed in accordance with Section 5, *Designing new TCPs*.

4.2.4 Verification

The choice of TCP to be used shall be signed and recorded by the works supervisor.

4.3 Implementing TCPs

4.3.1 What the works supervisor shall do

Before work begins, the works supervisor shall:

- determine sign sizes and whether duplication of signs is required
- ensure that all signs and devices required by the TCP are available and are in good condition
- ensure that the locations and types of devices displayed are recorded in the diary
- ensure that approvals have been given for the use of:
    - ♦ a roadwork speed limit
    - ♦ portable traffic signals
- ensure that, where flashing arrow signs are specified, only type–approved equipment complying with Specification FAS/4A is used in accordance with Section 11, *Flashing arrow signs*
- ensure that the TCP is implemented as approved, certify this and keep a copy available on site.

4.3.2 What the team leader shall do

The team leader shall implement the approved TCP before physical work commences and ensure that a copy of the TCP is kept on site. The Location Risk Assessment form at the front of Appendix D shall be completed on site to determine whether or not the TCP needs to be modified. The team leader shall also drive through the site before work begins to ensure that the TCP has been implemented correctly and that it will warn, instruct and guide road users as designed. Any variations made to the plan must be marked on the plan and initialled by the team leader.

The team leader shall ensure that, in conforming with the approved TCP, by way of initial and regular inspections:

- there are no contradictory signs
- there are no surplus, obstructing or distracting signs
- the TCP fits with other traffic control in the area which may or may not be under the control of the one organisation

- signs are suitably placed, by considering:
  - ♦ line of sight and sight distances
  - ♦ road user approach speeds
  - ♦ expected queue lengths
  - ♦ visibility, shady or high glare areas
  - ♦ the effects of sun rise and sun set
- only trained, certified and authorised Traffic Controllers are used and are suitably positioned
- signs and devices are in place at appropriate times, **and removed or covered when not needed**
- covered signs are inspected during windy periods to ensure that the covering has not been disturbed
- damaged or defective signs are replaced or repaired as soon as practicable
- signs required for night guidance are as specified in Section 9.2.8, *Signs for night work*
- a trafficable travel path for vehicles is maintained and clearly defined.

The team leader shall also report any anomalies or inconsistencies found in the TCPs being used.

4.3.3 What the engineer shall do

For contracts where Specification RTA G10 is applicable:

- Submit to the Principal a Traffic Management Plan in accordance with RTA G10 and this Manual, including the relevant TCP's.
- Submit to the Principal a request for approval for the use of regulatory traffic control devices.
- Ensure approval has been given for the Traffic Management Plan and traffic control devices before the relevant work commences and ensure they are implemented.

For contracts where Specification RTA G11 is applicable:

- Submit to the Principal a Traffic Management and Safety Plan and new TCP's in accordance with RTA G11 and this Manual.
- Submit to the Principal a request for approval for the use of regulatory traffic control devices
- Ensure approval has been given for the new TCP's and traffic control devices before the relevant work commences and ensure they and the Traffic Management and Safety Plan are implemented.

For road and bridge work the engineer shall also:

- if required by the TCP, seek or ensure that approval for a roadwork speed limit has been given in accordance with Section 8.2, *Roadwork speed zones*
    - ♦ if the speed limit is approved by the RTA provide a copy of the approval to the works supervisor
    - ♦ if the speed limit is not approved, reconsider the TCP
- ensure that where portable traffic signals are specified formal approval is obtained from the relevant RTA office or Local Council for their installation, and that only type–approved equipment complying with Specification PTS/3A is used in accordance with Section 10, *Portable traffic signals*
    - ♦ if the use of portable traffic signals is approved, provide a copy of the approval to the works supervisor
    - ♦ if the use of portable traffic signals is not approved, reconsider the TCP

For longer duration works:-

- personally inspect the traffic control arrangements at least once every four weeks and record the date and time, any deficiencies noted and any corrective action taken or specified
- give a signed copy of the inspection report to the Works Supervisor.

For all road and bridge works, the Engineer shall ensure that a system is in place and operating to:-

- arrange advice through local media of the works in progress or planned, where required in accordance with local procedures or RTA's *Commitment to Service* brochure
- advise the Police of the traffic arrangements including any expected delays or extended times of work
- advise the emergency services of any major disruptions or special circumstances.

4.4 Minor modifications to TCPs

If a standard TCP does not exist for the work being planned, a decision will need to be made on whether minor modification of a standard TCP, using the principles listed below, will produce a TCP to suit the work being planned.

Attainment of the Traffic Control at Worksite (TCAW) Planning certificate enables a person to effect minor modifications to TCPs. It does not allow the person to design new TCPs nor to audit TCPs at work sites.

Minor modification of standard TCPs would include the following:-

- varying the size of signs in accordance with Section 3.2.2, *Sign sizes*
- varying the spacing of signs and including additional signs in accordance with Section 3.2.3, *Spacing between signs*
- duplicating signs in accordance with Section 3.2.4, *Duplication of signs*
- including the position of any variable message signs used in addition to all other signs shown on the TCP
- placing additional signs if it is felt that expected queue lengths might require them in accordance with Section 3.5.7, *Avoiding end of queue collisions*
- varying the positioning of signs and devices in accordance with Section 3.5.8, *Tolerances on positioning of signs and devices*
- detailing the location of signs required for a posted roadwork speed limit in accordance with Section 8.2, *Roadwork speed zones* and TCP 57
- including the location of signs indicating workers are on site for TCPs showing traffic arrangements when workers are not on site
- adding additional signs where it is considered they are required for safety reasons i.e. on the approaches to crests or sharp bends
- adding additional signs where a minor side street joins a work site.

Care needs to be exercised to ensure that any additional signs are only included on a needs basis as it is possible to place too many signs in a scheme such that they become ineffective.

Any TCPs modified using the principles above shall be marked or numbered to show that they are a modification and which standard TCP they are a modification of.

It is not acceptable to modify a previously modified TCP.

4.5 New or major modifications to TCPs

If a standard TCP does not exist for the work being planned, and it is not possible to make minor modifications to a standard TCP to suit the work being planned, then either a standard TCP will need to receive major modifications or a new TCP will need to be designed for the work. Modifications to a TCP outside those listed in Section 4.4 will result in major modifications.

Only people who have attained the Design and Audit Traffic Control Plans Certificate are able to design new TCPs or make major modifications to standard TCPs.

See Section 5, Designing new TCPs.

5.1 New TCPs

5.1.1 What the works supervisor shall do

Having determined that a standard TCP does not exist for the work proposed and that minor modification of a standard TCP will not suit the work, or having some doubt about the appropriateness of a standard TCP, the works supervisor shall consult with the engineer.

5.1.2 What the engineer shall do

The engineer shall:-

- determine the appropriateness of the standard TCP and arrange modification if necessary
- arrange for additional requirements to be specified or for a new TCP to be designed using the guiding principles listed in Section 5.2, *Principles for designing TCPs*
- ensure that the new TCP is approved before issue and use
- add the new TCP to the list of local TCPs and forward a copy to the GM, Traffic Management Branch for consideration as a standard TCP in this Manual
- arrange for a customised TCP to be designed and approved using the guiding principles listed in Section 5.2, *Principles for designing TCPs*, where a site specific TCP is required
- give a controlled copy of the approved TCP to the works supervisor for implementation in accordance with Section 4.3, *Implementing TCPs*.

5.1.3 Verification and approval

All new TCPs shall be approved prior to use. The engineer can give approval only if all the guidance in Section 5.2, *Principles for designing TCPs*, has been observed. The engineer shall seek authorisation from the relevant Manager if the TCP:-

- includes a non–standard or unapproved sign or device
- contravenes one or more of the principles in Section 5.2, *Principles for designing TCPs*.
- is for carrying out work using Specification G10 or G11.

The engineer shall sign and date the TCP before handing it to the works supervisor.

5.2 Principles for designing TCPs

5.2.1 General

The TCP shall be designed on the basis that:

- as much protection as practicable shall be given to all people on the work site, consistent with minimising disruption and risk to road users and minimising the number of signs and devices used to achieve this
- only approved signs and devices shall be used
- fixed work areas shall be marked by barrier boards or delineation devices spaced appropriately
- the use of a pilot vehicle shall be considered, to lead and control the speed of vehicle platoons, if traffic speed through a work site needs to be very carefully controlled
- condition signs shall be used where the road surface at the work area is sufficiently different from the approach roads to be hazardous to traffic
- the TCP is to be implemented in accordance with Section 4.3, *Implementing TCPs.*

5.2.2 Spacing of signs, cones and bollards

Signs shall be spaced in accordance with the broad principles of Section 3.2.3, *Spacing between signs.*

Cones and bollards are used to define the traffic path through or past work areas and shall have retroreflective bands if required for night use. The following types of approach tapers may be used:

- *traffic control at beginning of tapers* - used where there is a traffic controller or portable traffic signals just prior to the lateral shift (see TCP 59). Consideration may be given to placing additional cones or bollards at 5 metres spacing along the centreline in advance of the taper
- *lateral shift taper* - where traffic is required to shift laterally without conflict with another traffic stream (see TCP 41)
- *merge taper* - where one lane of traffic is required to merge into another (see TCP 80).

Recommended maximum spacing of cones and bollards is shown in Table 5.1, *Recommended maximum spacing of cones and bollards*. Consideration should be given to reducing the spacing of cones to as little as 1m to prevent traffic taking a wrong turn or opening through cones or bollards, where traffic volumes are high or other conditions warrant it.

Recommended taper lengths are shown in Table 5.2, *Recommended taper lengths*. Taper lengths should be increased where warranted such as locations with poor sight distances or in foggy areas.

Purpose and usage	Approach speed	Recommended maximum spacing, m
All purposes on residential or commercial streets	< 60 km/h	4
Outer edge of traffic lane - i.e. working on shoulder	60 - 80 km/h > 80 km/h	15 24
Separating opposing traffic on 2 lane 2 way road	60 - 80 km/h > 80 km/h	12 15
Separating opposing traffic on a multilane undivided road	60 - 80 km/h > 80 km/h	12 15
Adjacent to a closed lane on a multilane road	60 - 80 km/h > 80 km/h	15 24
On centreline in advance of taper with traffic control	All	5
Merge tapers	60 - 80 km/h > 80 km/h	9 12
Lateral shift tapers	60 - 80 km/h > 80 km/h	12 15

Table 5.1, Recommended maximum spacing of cones and bollards

	Recommended taper length, m		
Approximate approach speed km/h	Traffic control at beginning of taper	Lateral shift taper	Merge taper
Less than 45	30	30	65
45 - 54	30	30	80
55 – 64	30	60	95
65 - 74	30 (at signals)	70	115
75 - 84	30 (at signals)	80	130
85 - 94	N/A	90	145
95 - 105	N/A	100	160
Greater than 105	N/A	110	180

Table 5.2, Recommended taper lengths

5.2.3 Requirements for specific signs

The following signs are to be used where the stated conditions apply.

- **ROADWORK AHEAD** (T1–1) or **BRIDGEWORK AHEAD** (T1-2) advance warning signs shall be used at:-
  - ♦ all long-term work sites
  - ♦ short-term works where additional advance warning is considered necessary
  - ♦ short-term works where approach sight distance is less than 2Dm.
- **ROADWORK XKM AHEAD** (T1–16) or **BRIDGEWORK XKM AHEAD** advance warning signs should be used X km in advance of road or bridge works where additional advance warning is considered to be necessary, such as where one or more of the following occur:-
  - ♦ the approach speed (D) exceeds 80 km/h
  - ♦ sight distance is less than 150 metres
  - ♦ ADT is greater than 6,000 vehicles per day for roads with one lane in the direction of obstructed flow
  - ♦ ADT is greater than 10,000 vehicles per day for roads with two or more lanes in the direction of obstructed flow.

  In urban situations the siting of these signs needs careful consideration to ensure that any road users entering from side roads are given adequate warning.
- The Workers (symbolic) (T1-5) sign shall be used to give warning of personnel engaged in short-term and long-term works on or adjacent to the travelled path. These signs shall be covered or removed when workers are no longer on site or are not visible to road users such as during meal breaks.
- The **PREPARE TO STOP** (T1-18) sign shall be used to give advance warning where traffic may be required to stop in compliance with portable or temporary fixed traffic signals, or the directions of a Traffic Controller. Where used in advance of traffic signals the sign shall be used in conjunction with the **SIGNALS AHEAD** (W3-3) sign.
- an **END ROADWORK** (T2–16) sign shall be used when **ROADWORK AHEAD** (T1-1) and **ROADWORK XKM AHEAD** (T1-16) signs are specified and are used to indicate that normal traffic conditions have resumed.
- the **NEXT 2km** (T1-28) sign may be used in conjunction with the Worker (symbolic) (T1-5), the **ROAD PLANT AHEAD** (T1-3-1 or T1-3-2) or the **GRADER AHEAD** (T1-4) signs where they are used to warn of frequently changing work areas (Section 9.1.8, *Frequently changing work areas*)

- the **TRAFFIC HAZARD AHEAD** (T1–10) sign shall only be used in emergencies and for a maximum of 24 hours.
- where the TCP involves closing a traffic lane, a minimum of two **temporary hazard markers** (T5–4 or T5–5) per closed lane may be used, in addition to cones, bollards etc, if traffic is to be merged into an adjacent lane, or directed by a Traffic Controller or traffic signals around the work area. If temporary delineation is required on both sides of the vehicle path at a taper, hazard markers shall only be used on the side primarily guiding traffic away from the obstruction as use on both sides of a traffic path may cause confusing patterns of delineation. Cones or bollards should be used on the other side. **On high speed roads consideration shall be given to using a flashing arrow sign with or in place of the temporary hazard markers.**
- the Trucks (crossing or entering) (W5-22) (L or R) and Trucks (crossing or entering) (T2-25) (L or R) signs shall be used in accordance with Section 7.7, *Signs for depots, stockpiles, quarries, gravel pits etc.*
- the **GIVE WAY** (R1-2) sign shall be used to assign priority to one direction of travel past the work area where the travelled way is reduced to less than that required for two lanes of traffic. It is appropriate for works when:-
  - (i) the road is a low volume road
  - (ii) each entry to the work area is visible from the other
  - (iii) the work area is less than 100m long
  - (iv) there is sight distance to opposing traffic of at least 200m beyond the far end of the work area for traffic facing the **GIVE WAY** sign.

5.2.4 Traffic controllers

When a Traffic Controller is required:-

- traffic controller ahead (T1–200-1/2/3) (on RTA sites) and **PREPARE TO STOP** (T1-18) signs shall be used
- where possible the **PREPARE TO STOP** (T1–18) sign should also be visible to the Traffic Controller
- a Traffic Controller should only manage traffic in one lane and in one direction (except as described in Section 8.1.3)
- Traffic Controllers shall only be used where approach speeds of traffic are reduced to a maximum of 60km/h through the use of appropriate devices and signs including, as necessary, a road work speed limit
- in conjunction with the above point consider using a rotating or flashing yellow light adjacent to the **PREPARE TO STOP** (T1–18) sign especially on high volume, high speed roads.

5.2.5 Stopping or merging traffic

If it is planned to stop traffic, the TCP designer shall:-

- assess the likely queue length through a consideration of:
  - expected delay in minutes
  - hourly traffic volumes at the time of the work
  - type or mix of traffic i.e. allow more queue length for heavy vehicles
- ensure that signs and spacings specified on the TCP are appropriate for all queue lengths up to the maximum design queue length plus 10% to allow for some greater demand. This may require duplicate signs to be erected such that approaching road users will generally have 2Dm sight distance to the end of expected queues.

5.2.6 Mobile works

Where continuously or progressively moving vehicles or plant are used, signs and devices shall be mounted on the vehicles or road plant so that they are visible and conspicuous at all times. Refer to Section 9.19, *Mobile work.*

5.2.7 Pilot vehicle

A pilot vehicle may be used to guide traffic through a work site when:-

(a) part of the length of the work site is out of view of the supervisor, work gang and the traffic controller

(b) traffic speed is required to be kept low to minimise damage to the work i.e. a newly laid seal

(c) traffic needs to follow a particular path through the site which may not be obvious without a pilot vehicle.

The pilot vehicle shall display at least one rotating flashing yellow lamp and may also display a special sign instructing traffic to follow it but not pass it. It may also be necessary to advise road users orally to follow but not pass the pilot vehicle. Care shall also be exercised to ensure that the pilot vehicle is not obscured by large trucks to the extent that other road users have difficulty following the pilot vehicle. In such cases it may be necessary to use more than one pilot vehicle.

5.2.8 Urban works

Where the work site is in an urban area the TCP shall accommodate local traffic, cyclists, pedestrians, local businesses, parking and driveway access.

Pedestrians

In relation to pedestrians, refer to Section 9.3, *Pedestrians.*

Local streets

Only detour traffic via local streets as a last resort, and with the concurrence of the Local Council and Police. Where possible local residents should be informed beforehand of a detour proposal.

Closing the road

When a temporary road closure is necessary, careful pre–planning is necessary involving consultation with the Local Council and Police.

5.2.9 Dual carriageway and multilane roads

Generally, where workers are on foot and are working on a central lane an adjacent lane should also be closed.

Where a traffic lane is to be closed, the TCP shall specify:

- that appropriate lane status (T2–6–1 or T2–6–2) signs shall be used
- a minimum of two temporary hazard markers (T5–4 or T5–5) or a flashing arrow sign shall be used if traffic is merged into an adjacent lane without a Traffic Controller.

Where work is undertaken on a dual carriageway:

- all signs and devices (except pavement arrows) shall be placed on the left and right hand sides of the carriageway, if there is room on the median
- if that carriageway has three or more lanes and two lanes are to be closed then this should be done one lane at a time with two tapers, with the distance between tapers at least twice the distance given in the "Lateral shift taper" column of Table 5.2 as shown in TCP 100, or, if traffic volumes and speeds permit, as one long taper of length at least twice the distance given in the "Lateral shift taper" column of Table 5.2.

5.2.10 High volume and high speed roads

For roads with an ADT greater than 1,500 vehicles and works lasting longer than two weeks, the TCP shall specify that:-

- all redundant line marking shall be removed and appropriate edge and lane lines marked, and
- the advance warning sign(s) shall be duplicated on the right hand side.

If normal approach speeds are likely to be greater than 100 km/h, the designer shall consider:-

- specifying larger signs, and
- implementing a roadworks speed zone, especially if traffic is likely to be stopped.

5.2.11 Very low volume roads

A TCP need not specify temporary signs and devices if:-

- ADT is less than 200 vehicles per day, and
- sight distance is greater than 2.5D m, and
- the work vehicle is fitted with an operating rotating flashing yellow light, and
- the work vehicle is parked clear of the travelled path, and
- an employee is given the primary task of being a spotter, that is watching for, and warning of approaching traffic.

5.2.12 Night works

See Section 9.2, *Working at night*.

The TCP shall specify that:

- all signs are retroreflective and designed for night use
- **NIGHT ROADWORK AHEAD** (T1–223), **WORKERS AHEAD** (T1–224) and **TRAFFIC CONTROLLER AHEAD** (T1–200-3) are used instead of day time **ROADWORK AHEAD** (T1–1), **WORKERS AHEAD** (T1–5) and **TRAFFIC CONTROLLER AHEAD** (T1–200) signs
- all personnel on the site wear approved high visibility clothing
- the work site has appropriate flood lighting, Section 9.2.5, *Lighting*
- additional signs and devices may be used where there is reduced visibility.

5.3 Checklist for new signs, devices and TCPs

Proposals for new or modified signs, devices and standard TCPs should include consideration of:

- **feasibility** – the level of technology involved
- **useability** – the ease of use by workers as related to their level of education, experience and physical abilities
- **applicability** – how well they address the problems, by comparing their function and capabilities to the operating conditions of the problem area
- **effectiveness** – the ability to mitigate injuries and deaths of workers and lessen the hazard and inconvenience to road users
- **trade–offs** – the level of undesirable side effects produced
- **cost** – life–cycle cost including development, fabrication and maintenance.

5.4 New signs, devices and TCPs

Any proposal for a new sign, device or TCP for inclusion in this manual is to be submitted, in the first instance, to the RTA's General Manager, Traffic Management Branch. Proposals will be evaluated in a consultative manner as described in Section 2.8, *Evaluation and review*. Where RTA favours a new sign, device or TCP which departs significantly from AS 1742.3, Standards Australia will be consulted and efforts made to introduce the practice on a broader basis.

In some cases, it may be necessary to limit the initial use of new signs and devices to enable field assessment before they can be adopted for general use.

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6.1 Inspections and record keeping

Examples of traffic control safety audit and checklist forms are located in Appendix E, *Audit and checklist forms*.

6.1.1 What the works supervisor shall do

For all long-term work sites the works supervisor shall:-

- inspect the traffic control layout on the day before the work begins and at least once per week during the duration of the work
- inspect the traffic control layout between shifts at least once during the first week of operation and at least once every two months for the duration of the work
- provide after hours contact to local police for the duration of the work
- inspect the site on the final day to ensure that unnecessary signs and devices are removed
- record results of these inspections noting date, time, deficiencies and any corrective action taken or specified
- ensure that any corrective action specified is taken.

6.1.2 What the team leader shall do

For all works, the team leader (or site supervisor) shall:-

- keep a record of the TCP that was used
- have on site a copy of the TCP used
- record start and finish times of the works
- record location reference of the work
- carry out inspections before work starts, during the works and pre-closedown of the site using the nominated checklist, noting:-
    - ♦ date and time of inspection
    - ♦ deficiencies identified and corrective action taken
    - ♦ changes or modifications made to the site
- periodically check that all signs and devices are satisfactory and in their correct position
- attend to minor problems as they occur
- make these records available to authorised staff.

6.1.3 What the engineer shall do

The engineer shall:-

- ensure that a traffic control safety audit is carried out at least once per month on a selected short-term and long-term work site under his or her control and that the date, time and deficiencies are recorded
- ensure that any corrective action specified is taken and recorded.

This information may be critical should legal proceedings follow an accident.

Note: In the case of accidents, either witnessed or reported, involving the public or from which legal proceedings might arise, the actual type, size and location of signs, and devices in use at the time of the accident should be recorded and the sign arrangement photographed for subsequent reporting. (Photographic film might be more acceptable as evidence than digital images.) The actual travelled path width and condition and weather conditions should also be recorded, as well as personal injury, extent of vehicle damage and vehicle details such as registration.

6.2 Reporting incidents to WorkCover

6.2.1 What to report

By law employers and/or occupiers are required to report work-related incidents to WorkCover NSW and/or the relevant workers compensation insurers.

An occupier (of premises or workplace) is someone who manages or has responsibility for a workplace or a particular operation at a workplace, even though they may not be the employer.

Serious incidents shall be notified to WorkCover NSW immediately as an urgent investigation may need to be undertaken. Serious incidents include:-

- an incident where there has been a fatality
- an incident where there has been a serious injury or illness such as when a person:-
    - is placed on a life support system
    - loses consciousness
    - is trapped in machinery or a confined space
    - has serious burns
- an incident where there is an immediate threat to life such as major damage to machinery or buildings.

Up to 36 hours after the serious incident has been reported, the immediate area around the incident must not be disturbed, except to assist any injured persons and to avoid further injuries and problems, or where WorkCover has authorised work to continue.

6.2.2 Reporting procedure for RTA staff

The following reporting procedure is to be followed by RTA staff on RTA works.

- **Injury or illness to RTA employees.**
    - ♦ All workplace incidents involving a workers compensation claim for injury or illness to an RTA employee must be reported to Injury Management Services using Form 575 (Notification of Injury/Illness) immediately the injury or illness is known. Injury Management Services will notify WorkCover.
    - ♦ **These incidents must also be reported immediately to the OH&S Incident Helpdesk.**
- **Incidents involving non-RTA employees on RTA works.**
    - ♦ All workplace incidents, including any serious incident involving a fatality or life threatening event or incident that involves injury to a non-RTA employee including contractors, visitors and members of the public, must be reported immediately to the OH&S Incident Helpdesk by the RTA site personnel.

6.2.3 Reporting procedure for non-RTA works

For other organisations undertaking works and using this Manual the WorkCover reporting procedures must be followed. It is suggested that those in positions of responsibility should make themselves aware of those procedures.

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7.1 Responsibilities of drivers

Drivers of vehicles working in conjunction with roadworks are responsible for driving safely and in accordance with the road rules, exercising care and working in accordance with Vehicle Movement Plans (VMPs) where they are provided.

Special driving care is necessary when entering and leaving traffic streams and turning in conjunction with works on roads. This is even more important for loaded trucks because longer time and distance is needed to accelerate and decelerate compared with lighter vehicles.

Lorry owner drivers and fleet operators shall have fitted and maintain both reversing alarms and reversing lights on all vehicles. Vehicles which are not fitted with reversing alarms may deliver materials to work sites and consequently can present a hazard when reversing. Procedures should be put into place to warn all workers of the potential hazard and to establish appropriate on site traffic control procedures. Such procedures could include the requirement for truck drivers to report to a suitably signposted area on the work site and for a designated worker to walk beside the reversing truck to act as an observer to ensure all workers are clear of the reversing vehicle.

Contractors and agents to the RTA are strongly encouraged to adopt the principles contained in the RTA's *Safe Driving Policy*. This may be obtained from the RTA.

7.2 Site entry and exit

When entering or leaving work areas trucks shall be able to decelerate and accelerate outside the through traffic lanes, i.e. under traffic control or on shoulder areas. Under motorway conditions deceleration and acceleration lanes shall be provided. Under all other conditions if the sight distance is less than 500 m, then deceleration and acceleration lanes shall be considered or the entry and exit points relocated.

7.3 Hazardous movements

U–turns – single movement U–turns are not to be made across lanes carrying traffic, without traffic control by Traffic Controllers or traffic signals, unless clear sight distance in both directions exceeds 2D m (5D m for 3–point U–turns). U–turns on divided roads from one carriageway to the other are to be made only at established median crossovers or in accordance with an approved TCP or VMP. Note, U–turns are illegal across unbroken centrelines (barrier line or painted median).

Reversing movements – there is to be no reversing, including 3–point U–turns, in lanes carrying traffic unless traffic is being controlled by Traffic Controllers or traffic signals, or approach sight distance exceeds 5D m (20 seconds of travel time). Vehicles reversing in the work area are subject to the conditions outlined in Section 7.1, *Responsibilities of drivers*.

Stopping – work vehicles shall not remain stationary in lanes carrying through traffic unless broken down, in a traffic queue, or protected by Traffic Controllers, traffic signals or a lane closure.

7.4 Planning for movements of work vehicles

When planning roadworks, attention shall be given to ensuring that traffic associated with the works can safely manoeuvre to and from traffic streams, turn at work areas, depots, stockpile sites, quarries, gravel pits, etc and turn around. This includes:

- trucks delivering materials or equipment
- trucks taking materials or equipment from the work area and associated depots, storage areas, gravel pits, etc
- gang trucks
- works supervisors' vehicles, etc.

The standard TCPs in this manual show arrangements necessary to ensure that the general public can travel safely around, past or through work sites on roads.

It is also essential that satisfactory arrangements are planned and implemented for vehicles associated with roadworks. This mainly involves entering and leaving the traffic stream at work areas, accesses and side roads, or turning around.

On roads with approach speeds of 100 km/h or more work vehicles should normally enter and leave the through traffic stream using the same ramps or side roads as the travelling public. Where this cannot be reasonably achieved, refer to Tables 7.1 and 7.2 to determine the type of treatment to be adopted, based on ADT, truck movements per shift and sight distance.

Locations for turning across lanes carrying traffic and for entry and exit to and from work areas for vehicles associated with the work should be restricted to well defined points selected after considering relevant factors including sight distance, grades, volumes and approach speeds of through traffic, areas clear of traffic lanes for accelerating and decelerating, etc.

7.5 Vehicle movement plans

For approach speeds less than 100 km/h, the need for vehicle movement plans (VMPs) is to be considered at work sites and truck turning areas where there are 20 or more work vehicle movements per shift, to or from the traffic stream. Written VMPs may be used in circumstances as required by the engineer, Superintendent or Principal's Representative.

For approach speeds of 100 km/h or more, where trucks are required to enter or leave the traffic stream either at or remote from the work site, written VMPs shall be prepared and used in accordance with:-

- Table 7.1 – sight distance is less than 2D m
- Table 7.2 – sight distance is more than 2D m.

For a particular work site, more than one VMP may be necessary to reflect changes in preferred routes as the work progresses.

The approach speed of traffic is to be reduced to at least 60 km/h when using Traffic Controllers and 80 km/h with traffic signals.

7.6 Responsibilities

The **engineer** is responsible for:

- ensuring that satisfactory arrangements are planned and implemented for vehicles associated with roadworks
- considering the need for VMPs at work sites and truck turning areas where approach speeds are less than 100 km/h and movements per shift are 20 or more
- where a VMP is required, making it available before work begins.

The **works supervisor** is responsible for:

- planning arrangements for vehicles associated with roadworks, and
- where a written VMP is required by Tables 7.1 or 7.2 or specified by the engineer, confirming that the VMP is relevant for the work and the site.

The **team leader** is responsible for:

- ensuring that drivers of work vehicles are familiar with arrangements for traffic control, and
- ensuring that RTA's *Safe Driving Policy*, Section 7.1, *Responsibilities of drivers*, Section 7.2, *Site entry and exit* and Section 7.3, *Hazardous movements* are available to drivers, and
- instructing drivers how to enter and exit work areas safely and the routes to follow between work areas and depots, material sources, dumping areas, etc, and
- implementing written VMPs where they are provided.

ADT	300 – 1,500		More than 1,500	
Number of truck movements per shift	Less than 20	More than 20	Less than 20	More than 20
TCP with Traffic Controllers or traffic signals		Yes$^{\alpha}$	Yes$^{\alpha}$	Yes$^{\alpha}$
VMP required	Yes$^{\alpha}$	Yes$^{\alpha}$	Yes$^{\alpha}$	Yes$^{\alpha}$
Warning signs required during shifts (TCP 195)		Yes$^{\alpha}$		Yes$^{\alpha}$

Table 7.1 Providing for truck movements where approach speed is 100 km/h or more and sight distance is LESS than 2D m

α Every effort should be made to choose turning locations for work vehicles, especially trucks, where sight distance exceeds 2D m.

ADT	300 – 1,500		More than 1,500	
Number of truck movements per shift	Less than 20	More than 20	Less than 20	More than 20
TCP with Traffic Controllers or traffic signals				If acceleration and deceleration cannot occur on shoulders
VMP required		Yes		Yes
Warning signs required during shifts (TCP 195)		If sight distance is less than 5D m		If sight distance is less than 5D m

Table 7.2 Providing for truck movements where approach speed is 100 km/h or more and sight distance is MORE than 2D m

7.7 Signs for depots, stockpiles, quarries, gravel pits, etc

Where roadworks generate truck turning movements remote from work sites, temporary warning signs are to be considered at the approaches to the points of access on through roads. This is particularly important where there may be little or no other indication of likely vehicle turning movements, i.e. at roadside stockpile sites, accesses to private property, and median crossovers on high speed roads.

The appropriate signs are trucks entering or turning (W5–22) (L or R) (or T2-25 (L or R) for short term use) and **TRUCKS TURNING** (W5-205). A typical arrangement is shown in TCP 195 which should be used where:-

- the turning movements are not in a built up area, and
- ADT is more than 1,500 vehicles per day, and
- there are more than 20 truck movements per shift, and
- the approach sight distance is less than 6D m or 20 seconds of travel time.

These signs should be displayed before the haulage operation begins, and removed or covered at the end of each shift.

Where traffic volumes are low and truck movements are less than 20 per shift the W5-22 sign may be used by itself provided that the left and right versions of the sign are correctly placed to indicate the direction from which trucks will be entering.

7.8 Median crossovers

The main purpose of median crossovers on Freeways and similar high speed divided roads is to allow access for emergency vehicles (i.e. Police Service, Ambulance Service and Fire Brigade) and roadworks vehicles. Other drivers on Freeways and similar high speed divided roads are mostly unaware of median crossovers and do not expect to encounter turning traffic.

Emergency vehicles are generally more recognisable than roadworks vehicles. Drivers respond more defensively in the vicinity of emergency vehicles than roadworks vehicles.

The location of vehicle crossovers is therefore critical. In planning works on Freeways and other high speed roads, it is necessary to check median crossovers likely to be used by works vehicles.

The relevant requirements are:-

- the desirable minimum sight distance to a median crossover is 1km
- the absolute minimum sight distance to a median crossover is 500m
- median crossovers should be located well clear of entry and exit ramps to ensure short weaving manoeuvres do not occur.

Where these requirements cannot be met, either provide for turning movements at a different location, or use a TCP to close one or more lanes so that deceleration, turning and acceleration takes place outside the traffic stream.

See Section 7.7, *Signs for depots, stockpiles, quarries, gravel pits, etc* to determine the need for signs.

7.9 Haul roads crossing public roads

Special care is necessary in designing traffic control where haul roads cross public roads. Traffic control may take the form either of Traffic Controllers, **STOP** (R1–1) signs or traffic signals depending upon sight distances and traffic volume.

Traffic signals at haul road crossings may be:-

- temporary, i.e. fixed signals designed in accordance with current RTA specifications, or
- portable (with one or two sets), in accordance with Section 10 of this manual.

A typical arrangement using traffic signals is shown in TCP 44.

Care shall also be taken when vehicles are leaving work areas to ensure that gravel or mud is not deposited on the through road. If conditions on the work area are such that this might happen then consideration shall be given to hosing clean the tyres of vehicles before they enter or cross the through road.

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8.1 Traffic Controllers

8.1.1 General

(a) Training

Traffic Controllers are to be appropriately trained in their duties and certified as competent. The minimum requirement is to have satisfactorily completed RTA's training package – *Traffic Control Using a STOP/SLOW Bat*. The RTA package comprises a video, written notes on traffic control, and an examination.

(b) Authorisation

The following authorisations are required where work is being carried out on behalf of a road authority. RTA Traffic Controllers, or Traffic Controllers working for RTA contractors, shall wear approved yellow high visibility safety clothing displaying the RTA logo and the words "Authorised Traffic Controller". Local Government Traffic Controllers or Traffic Controllers working for Local Government contractors shall wear high visibility clothing meeting the requirements of AS4602, displaying the logo or name of the Local Government organisation and the words "Authorised Traffic Controller".

(c) Approach speed

Where Traffic Controllers are used, approach speeds of traffic shall be restricted to 60 km/h or less through the use of appropriate devices and signs including, as necessary, a roadwork speed limit. **The spacing of any signs and devices, as related to the distance Dm, shall be based on the greater of the approach speed or existing road speed limit.**

(d) Visibility

Traffic Controllers shall not be located in positions where the sight distance between them and oncoming traffic is less than 1.5Dm.

(e) Positioning

A Traffic Controller's normal duty is to remain at the head of the traffic queue while traffic is stopped. If there is a possibility of vehicles colliding with the end of the queue because of restricted sight distance, or of drivers queue jumping because they cannot see the Traffic Controller at the head of the queue, then an additional Traffic Controller and/or additional warning signs shall be placed at the end of the queue or other appropriate location.

(f) Communication

Where Traffic Controllers cannot see or hear each other, additional Traffic Controllers, placed within sight of the original Traffic Controllers, or portable two way radios shall be used for communication between them.

Additional radios in the middle of the work or with the site workers may be useful to ensure that the control is suitable for the work situation.

(f) Relief

Traffic Controllers shall be relieved after two hours work and may be either rested or placed on other duties for a period of at least 15 minutes before being returned to traffic control duties.

8.1.2 Where are Traffic Controllers required

Traffic Controllers are required on both short- and long-term work where traffic needs to be periodically stopped in approach to the work site.

Traffic Controllers may also be necessary in some circumstances on mobile work on single carriageway roads (2 lane/2 way and 3 lane/2 way), particularly for mobile work with a slow rate of progression along the road. Refer to Standard TCPs 68, 71, 116, 451, and 452.

A Traffic Controller can control traffic in only one lane and, usually (see Section 8.1.3, *How many traffic controllers)* in only one direction. When manual traffic control is required on multi-lane carriageways, a merge or merges shall be introduced upstream of the Traffic Controller so that all traffic in the affected lanes reaches the Traffic Controller in one lane.

8.1.3 How many traffic controllers

For manual traffic control using STOP/SLOW signs with traffic flow in opposite directions, either one Traffic Controller shall assess gaps in oncoming traffic or two Traffic Controllers are required – one on each approach to the work area.

Suitable gaps are likely to be too infrequent where the ADT exceeds 1,500 vehicles per day. To assess gaps in oncoming traffic, a Traffic Controller shall be able to see at least 300 m (400 m where approach speeds exceed 100 km/h) or, for long work areas, 250 m (350 m where approach speeds exceed 100 km/h) plus the length of the work area. This is illustrated in Figure 8.1. **Approach speeds shall be reduced to comply with the clearance to workers requirements of Section 3.6.**

Clear sight distance for a Traffic Controller may be restricted by road curvature, crests, roadside vegetation, road plant etc. Sight distance may also be restricted by conditions such as fog, rain, or mirages in hot weather on even grades.

For work at night see Sections 8.1.5, *Night work* and 9.2, *Working at night.*

A Traffic Controller will also be required on the other approach if:

- the Traffic Controller shown in Figure 8.1 cannot see clearly the minimum distance shown to oncoming traffic, or
- length of work area L (Figure 8.1 and Table 8.1) is greater than 250 m, or
- ADT exceeds 1,500 vehicles per day.

2 lane/2 way roads

One Traffic Controller is required where it is necessary to periodically stop traffic in one direction provided traffic in the opposing direction is not affected. **Approach speeds shall be reduced to comply with the clearance to workers requirements of Section 3.6.**

Where the work closes or restricts one travel lane, and both directions of traffic use the other travel lane which remains unobstructed:

- No Traffic Controllers are required where:
  - ♦ ADT is less than 100 vehicles per day, and
  - ♦ each entry to the work site is visible from the other end, and
  - ♦ the work area is shorter than 100 m.
- One Traffic Controller is required where:
  - ♦ ADT is 1,500 vehicles or less, and
  - ♦ sight distance from the Traffic Controller exceeds the minimum in Table 8.1.

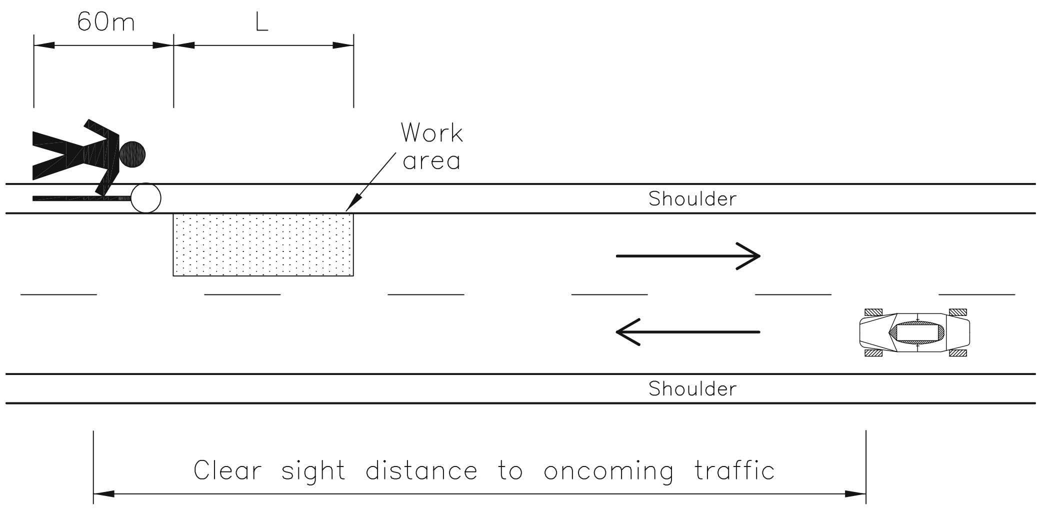

Figure 8.1 Traffic Controller minimum sight distance

Approach Speed	Length of Work Area (L)	Minimum clear sight distance to oncoming traffic
Up to 100 km/h	Less than 60 m	300 m
	60 m to 250 m	L + 250 m
More than 100 km/h	Less than 60 m	400 m
	60 m to 250 m	L + 350 m

Table 8.1 Traffic Controller minimum sight distance

- Two Traffic Controllers are required where:
  - ADT is greater than 1,500 vehicles per day, or
  - the work area is longer than 250 m, or
  - sight distance from the Traffic Controller in the obstructed lane to the other approach is less than the minimum in Table 8.1.

3 lane/2 way roads

Where the work closes or restricts one of the lanes in the direction with two lanes, a choice is available depending on the circumstances of the site and the work. Either all traffic in that direction can be channelled to the unaffected lane or both lanes can be closed. See TCPs 80, 86, 88 and 89.

Where the work closes or restricts both lanes in the direction with two lanes, so that both directions of traffic use the single lane, the requirements are the same as for a 2 lane/2 way road. See TCP 90.

Where traffic is stopped intermittently in the single lane and allowed to proceed in the same lane, and the opposing 2 lane flow is not affected, one Traffic Controller is required. See TCP 71.

Where the work closes or restricts the single travel lane, and the centre lane remains unobstructed and available to both directions of traffic, the requirements are:

- One Traffic Controller is required where:
  - ADT is less than 1,500 vehicles per day, and
  - sight distance from the Traffic Controller exceeds the minimum in Table 8.1.

- Two Traffic Controllers are required and the slow lane closed where:
  - ♦ ADT is greater than 1,500 vehicles per day, or
  - ♦ the work area is longer than 250 m, or
  - ♦ sight distance from the Traffic Controller in the obstructed lane to the other approach is less than the minimum in Table 8.1.

This arrangement is shown in TCP 91.

Roads with 4 or more lanes

On single carriageway roads with 4 or more lanes and on divided roads, lane closures can usually be set up so that Traffic Controllers are not required during the work. However a Traffic Controller will be required where intermittent closure of a lane is necessary, for example to allow plant to manoeuvre or to enable trucks to deliver materials. See Section 7, *Providing for works traffic*. Remember that a Traffic Controller shall control only one lane, and merges upstream of the work area may be necessary.

Typical situations with Traffic Controllers on divided roads are shown in standard TCPs 82, 93 and 96.

8.1.4 Instructions for traffic controllers

A Traffic Controller shall:

- wear the approved high visibility external clothing at all times
- ensure that **PREPARE TO STOP** (T1-18) (and Traffic controller ahead (T1-200-1/2/3) sign on RTA work) are in place and located in accordance with the TCP
- stand, if possible, where he or she can see the end of the work and the other Traffic Controller and where the sight distance to oncoming traffic is at least 1.5Dm. If the Traffic Controllers cannot signal each other, other means of contact (two way radio, or an intermediate person) shall be used. All radios shall be checked before going to the work site.
- stand facing the traffic, but just outside the travel path so that he or she can be seen for a minimum of 1.5Dm in advance by oncoming traffic
- not obstruct the motorists view of other signs and devices or be hidden by them
- always stand so that a clear escape path is available
- once the first vehicle has stopped, change position if necessary, in order to be clearly visible to following traffic. The Traffic Controller should stay at the head of the traffic queue and stand alone, never permitting people to group around.

- give definite and clear signals to:

  stop traffic – turn the **STOP/SLOW** bat (R6-8/T7–1) to **STOP** and raise the free arm into the stop signal position with the palm of the hand towards the traffic

  allow traffic to proceed – check that all traffic from the other end of the work site has passed, then turn the **STOP/SLOW** bat to **SLOW** and with the other hand give the **GO** signal

  slow traffic – show the **SLOW** side of the **STOP/SLOW** bat, extend the free arm and wave arm up and down.

- stand clear of traffic when allowing it to proceed
- not leave his or her post until directed by the Works Supervisor or Team Leader, or relieved by another Traffic Controller
- be courteous at all times in dealing with the public. If requested, inform the driver of the reason for, and possible length of the delay, but be brief. If provoked by unreasonable behaviour, exercise restraint.
- remove or cover Traffic Controller ahead (T1–200) signs when traffic control is discontinued or during brief breaks such as lunch
- report irresponsible motorists immediately. The Police will deal with them if you can report quickly.

NOTE:
There are three types of traffic controller ahead signs, namely:

- **day use only** (T1–200-1) – black symbol on fluorescent/retroreflective red background
- **day and night use** (T1–200-2) – black symbol and border on Class 1 reflectorised yellow background for works which continue day and night
- **night use only** (T1–200-3) – Class 1 reflectorised yellow symbol and border on black background.

8.1.5 Night work

See Section 9.2, *Working at night*. Be sure to:-

- wear approved, high visibility garments such as white overalls with reflective tapes or vests
- consider use of a lighted red hand–held wand to supplement the **STOP/SLOW** bat (T7–1)
- try to locate the Traffic Controller at a spot on the road that is lit. For planned night work there should be good light on the Traffic Controllers.
- use two way radio control. It is desirable in most cases and essential if clear sight between operators is not available.

8.2 Roadwork speed zones

It is essential:-

- **that the procedures outlined in this Section are followed to provide consistency of speed zone operations in NSW**
- **that all speed zone signs are adequately covered or removed from site when not required**
- **that pre-existing speed zones are reinstated as soon as possible after passing the work site.**

Failure to follow these three basic principles will lessen the credibility of roadwork speed zones and may lead to motorists not obeying signs correctly displayed.

Consideration may also be given on the approach to a roadwork speed zone to providing additional advance warning of the zone by using the techniques mentioned in Section 3.5.7, *Avoiding end of queue collisions.*

8.2.1 General

Temporary speed zones at work sites may be implemented to assist in controlling the speed of traffic through roadworks. In general, devices such as temporary warning signs, lights and devices have been more effective than speed limits in drawing attention to the need for caution at work sites. Furthermore, experience has shown that temporary speed zones at work sites will be significantly more effective if they appear reasonable to drivers.

Roadwork speed zones:-

(i) shall only be used where they are self-enforcing or will be enforced

(ii) shall not be used alone but used with other signs or devices required by the site specific conditions

(iii) are not to be used in the place of more effective means of traffic control, but to compliment such controls

(iv) shall only be used while work is being undertaken or temporary road conditions exist which are prejudicial to safety.

8.2.2 Location

Roadwork speed zones may be used where any of the following situations occur:-

(i) at accident or emergency sites

(ii) traffic travels through the work site

(iii) workers are endangered by high speed traffic

(iv) dust or smoke reduces visibility

(v) loose material or stones are on the road surface (i.e. during spray sealing works)

(vi) there is a reduction at the work site in road surface condition or vertical or horizontal alignment which is inconsistent with the adjacent length of road

(vii) detours or sidetracks are of a lower standard than the approaches

(viii) excavations are adjacent to the travel path of vehicles

(ix) bridges, which for reasons of structural safety, require a reduction in the impact loading caused by traffic.

(x) diversion of traffic onto the opposing travel lanes or carriageway.

It is generally not necessary to implement roadworks speed zones at works sites of less than 2 hours duration. Also roadworks speed zones are not generally required for traffic signals maintenance or construction work.

8.2.3 Speed limit selection

The speed limit selected shall not exceed the maximum safe speed of travel for that work area. This safe speed is dependent on the degree of vehicular and pedestrian conflicts, the type and extent of the work in progress, the characteristics of the road and the proximity of workers to passing traffic. As a general guide it is desirable to reduce the speed of passing traffic to the following speeds, using appropriate signs and devices together with, if considered necessary, a roadwork speed limit :

a) 80km/h:

(i) where there are changed traffic conditions on the site such as high speed, high standard detours, reduction in the number of lanes, varying surfaces

(ii) where there are work vehicles entering or leaving the carriageway

(iii) as a transition zone in 110km/h zones where a 40km/h roadworks zone is required at the site of the work and the use of a 40km/h ahead sign is considered inadequate

(iv) on approaches to temporary or portable traffic signals

b) 60 km/h:

(i) where workers on foot are within 1.2 to 3 metres of traffic with no intervening physical barrier

(ii) on approach to a traffic controller

(iii) there is significant interaction between work vehicles and through traffic

(iv) there is a significantly reduced standard of alignment

(v) there is a loose surface such as gravel or a newly sprayed bitumen seal

(vi) plant is operating near through traffic

(vii) dust or smoke may reduce visibility

(viii) traffic is adjacent to an excavation.

c) 40 km/h :

(i) where workers on foot or in plant, or both, are within 1.2 metres of traffic with no intervening physical barrier or are working within the trafficked area

(ii) there is a severe change in the alignment considering the surrounding speed environment

(iii) on bridgework where the deck has an inconsistent surface.

NOTE: for bridges where the impact loading caused by traffic threatens the structural safety of the bridge the temporary speed limit may be 20km/h, 40km/h or 60km/h, as determined by the engineer.

8.2.4 Guidelines

(a) Duration

Signs showing roadwork speed limits (R4-212) are to be displayed only while the restriction applies and for the duration of the need. Hence the signs may be displayed on a:-

(i) full-time basis for the duration of the roadworks or;

(ii) part-time basis only while workers and plant are working, and a higher speed limit is more suitable between work shifts. The higher limit may be the normal speed limit or a different roadwork speed limit.

(b) Minimum length of zones

Roadwork speed zones shall be the minimum length required for the protection of workers and the travelling public. Drivers will not adhere to limits where there is no obvious roadworks or bridgework activity.

40km/h and 60km/h roadwork speed zones are to be located so that the zone commences 100m before the start of the work. In general 40km/h zones are only to be erected over the length where people are working or the other conditions listed in 8.2.3(c) exist. Except that the roadwork zone shall end at least 50m past the site where people are working.

Where traffic controllers or temporary traffic signals are remote from the location of the work because of sight distance or other restrictions it is not necessary for the roadwork zone to extend to the area where the traffic control is located. It may be appropriate to implement a 60km/h roadworks zone at traffic controllers in this circumstance.

The minimum lengths of roadworks speed zones are:-

40km/h	150m
60km/h	200m
80km/h	500m
80km/h transition zones	300m

Roadworks speed zones may be staggered so that there is a different speed restriction for opposing directions of traffic. Examples where staggering may be applicable include:-

(i) To reduce the length of speed restriction to traffic leaving the work site.

(ii) Where a speed zone is extended to protect the end of a queue.

(iii) On a divided road where roadworks affect traffic conditions on one side of the median only.

(iv) Where a roadworks speed zone is used in a transition zone to reduce traffic speeds in approach to a traffic controller but is not required for traffic flow in the opposite direction.

(v) Where work is underway on the shoulder and does not affect traffic in the opposing traffic lane.

(c) Advanced warning signs

Advanced warning signs shall be erected where there is a differential exceeding 20km/h between the existing or transition speed zone and the roadworks zone. Advanced warning signs shall be the Speed Restriction Ahead (R4-225) sign located 2Dm in advance of the roadworks speed zone.

For the purposes of sign spacing the value of Dm shall be the greatest of the existing or transition speed limit or the approach speed of traffic, and not the value of any roadwork speed limit as indicated on a Speed Restriction Ahead (R4-225) sign.

At the start of zones

At the start of a roadworks speed zone the Roadwork Speed Limit (R4-212) signs shall be erected on both sides of the carriageway. Where this is not possible a second sign is to be erected ½Dm from the start of the zone.

Repeater signs

Repeater signs (R4-212) are to be erected on one side of the carriageway at intervals from the start of the zone of 250m for the first 1km, 500m for the next 2km and thereafter at 1km intervals to the end of the work. Additional repeater signs are required where traffic enters from a side road within a roadworks speed zone if there is no repeater sign within Dm of the intersection facing the entering traffic.

End of Zone

At the end of the roadworks speed zone, a speed restriction sign shall be erected showing the permanent speed limit on the road.

Conflict with other signs

When a roadworks speed zone is introduced, speed restriction signs or markings and advisory speed signs in the zone which show conflicting speeds are to be covered or removed.

(d) Sign Size

Signs used on all roads where the existing limit is 60km/h or more are to be at least “B” size. On higher speed roads “C” size signs may be erected.

(e) Erection of signs

Roadwork speed restriction signs and advanced warning signs are to be erected:

i) within 5m of the edge of the outer travel lane
ii) at least 600mm above the ground
iii) so as to be clearly visible to traffic. In urban areas the location of the zone may be adjusted so that signs can be erected clear from parked vehicles, other signs or obstructions.

(f) Multiple work crews

Where there are multiple work crews within a job site or over a length of road, separate zones may be required for each work area in order to avoid an excessively long and restrictive speed zone. The minimum lengths stated in 8.2.4(b) may be used as a guide when designing the TCP in this instance.

(g) Speed Restriction Road Pavement Markings

For long-term work the existing speed limit pavement numerals should be blacked out or ground off i.e. usually removing the first numeral will suffice '1' for 100kph, '8' for 80kph. It is not normally necessary to provide pavement markings for roadworks speed zones.

(h) SPEED ZONES ARE ENFORCEABLE signs

On long-term roadwork sites where a speed restriction is to be used for an extended period (in excess of 4 weeks) and compliance with the roadwork speed restriction is expected to be a problem, **SPEED ZONES ARE ENFORCEABLE** (T4-211) signs shall be erected.

If used these signs should be located 100m after each roadwork speed limit sign for speed limits of 60km/h or less and 125m for speed limits greater than 60km/h. These signs may also be used if compliance becomes a problem during shorter periods of work.

(i) Seeking Police co-operation

Where considered necessary the co-operation of local Police is to be sought to enforce roadwork speed zones.

8.2.5 Delegations and documentation

Procedures in this Section are currently under review and will be issued as an electronic amendment in due course.

(a) RTA works on Classified Roads

Authorisation by a traffic related RTA Unit Manager (Level 4 Officer) or a Unit Manager (Level 4) who holds a current Work Site Traffic Control Certificate or a Traffic Control at Worksites (TCAW) Planning Certificate is required before a roadwork speed limit sign can be installed, displayed, altered or removed on any Classified Road. This requires completion of an appropriate form (see end of this Section) to cover a roadwork speed restriction that may be applied for any section of any Classified Road. Copies of the forms shall be forwarded to the police station nearest to the appropriate sections of road.

This authorisation will enable supervisors or team leaders to erect roadwork speed limit signs (R4-212) at the specified location

Records shall be kept detailing the date and time, the speed displayed and the location of speed zone signs, repeater signs, advanced warning signs and any other relevant information. Such information shall be kept for at least seven years, as it may be required as evidence for litigation purposes including speeding prosecutions or accident compensation claims.

For work undertaken on Classified Roads, councils (whether Single Invitee Contactors (SIC) or not) and private contractors shall seek the approval of the RTA to erect roadwork speed limit (R4-212) signs.

(b) Works on Unclassified roads

Authorisation shall be carried out in accordance with Item 12 of the RTA's *Delegation to Councils – Regulation of Traffic*.

When the installation period for a 'Roadwork Speed Limit' (R4-212) sign is to be for 6 working days or less:-

(i) authorisation of the use of the 'Roadwork Speed Limit' (R4-212) sign shall be carried out by council or a sub-delegate who holds a current Traffic Control Worksite (TCAW) Planning Certificate issued by the RTA ; and

(ii) the appropriate Regional Office of the RTA is to be notified in writing of council's intention to implement a roadwork speed limit prior to works commencing; and

(iii) the nearest Police Station is to be notified by council in writing of council's intention to implement a roadwork speed limit prior to works commencing.

When the installation period for a 'Roadwork Speed Limit' (R4-212) sign is to be for more than 6 working days:-

(i) authorisation of the use of the 'Roadwork Speed Limit' (R4-212) sign shall be carried out by council or a sub-delegate who holds a current Traffic Control Worksite Planning (TCAW) Certificate issued by the RTA ; and

(ii) the appropriate Regional Office of the RTA is to be notified in writing of council's intention to implement a roadwork speed limit 7 days prior to works commencing; and

(iii) the nearest Police Station is to be notified by council in writing of council's intention to implement a roadwork speed limit 7 days prior to works commencing.

8.2.6 Records

Records shall be maintained of all roadwork speed zones. Records shall include:-

(i) RTA's or council's (or its sub-delegate's) written authorisation of the installation. [The sub-delegate's Traffic Control Worksite Planning Certificate number shall be shown.]

(ii) the location

(iii) the installation time and date, and

(iv) the removal time and date

The 'Roadwork Speed Limit' (R4-212) sign is to be removed as soon as practicable after the roadworks have been completed.

Roadwork speed limit Authorisation and Notification forms are included at the end of this Section.

All records shall be kept for a minimum of 7 years.

8.2.7 Inspection and Audit

The team leader or appropriate person is to ensure that speed restriction signs are properly erected, conflicting signs are covered and advance signs are in place when inspecting the traffic control on the site. Consideration should also be given to keeping photographic records of signs and their locations.

Roadwork speed zones and associated documentation are to be audited on a regular basis.

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ROADWORKS SPEED LIMIT SIGN AUTHORISATION FORM

RTA/Council Ref No______________

Authorisation is given under Section 51 of the Road Transport (Safety & Traffic Management) Act 1999 and in accordance with the RTA Delegation Manual to install, display, alter or remove a _____ km/h roadworks speed limit sign as described below.

Location

Road No & Name ____

Town/Suburb
(where applicable) ____

Start Point ____

End Point ____

Commencement

Date _______________________ Time___________________

Signed _______________________________ Date ________________

Name _______________________________

Designation _______________________________

Traffic Control at
Work Sites Certificate No ______________________

Councils

This form should be faxed to the nearest Regional Office of the RTA and the nearest Police Station as required under clause 12(1) or clause 12(2) of the *Delegations to Councils Regulation of Traffic* document.

ROADWORKS SPEED LIMIT SIGN NOTIFICATION FORM

Council Ref No______________

_____________________________ Council intends to install a ___________ km/h roadworks speed limit sign as described below.

Location

Road No & Name ____

Town/Suburb
(where applicable) ____

Start Point ____

End Point ____

Proposed Commencement **Date** ____________**Time**__________

Proposed Completion **Date** ____________**Time**__________

Daily Operating Times **Date** ____________**Time**__________
(where applicable)

Signed ________________________________ Date ________________

Name ________________________________

Designation ________________________________

Traffic Control at
Work Sites Certificate No _______________________

This form should be faxed to the nearest Regional Office of the RTA and the nearest Police Station as required under clause 12(1) or clause 12(2) of the *Delegations to Councils Regulation of Traffic* document.

9.1 Intermittent work and mobile inspections

9.1.1 General

Work is classified as intermittent if it is undertaken without obstructing traffic and without compromising the safety of workers and may be either planned or unplanned (emergency) and may involve frequently changing work sites. Some examples of work included under this category are pot hole patching, edge repair, seal or patch spotting, road inspections, vegetation control, removal of dead animals or debris, litter collection, shoulder grading etc.

9.1.2 Planned work

For planned intermittent work ensure the following conditions are met:-

- approved high visibility external clothing, as specified in RTA's *Occupational Health and Safety Policy Manual, Wearing of High Visibility Vests and Garments* is worn by all workers
- a contingency plan is in place so that work in progress can be abandoned immediately without risk to workers or traffic
- where a spotter is used, there is no approaching traffic for at least a minimum distance as shown in Table 9.1 for the designated approach speed (approximately equivalent to 10 seconds travel time or 3Dm)
- where used the spotter shall remain within sight and hearing distance of the worker(s) (generally within 2 metres), and an advance spotter may be required if the distances shown in Table 9.1 cannot be achieved. This advance spotter should be within sight distance of the first spotter or within radio contact if sight distance is not possible.
- where a spotter is not used, there is no approaching traffic for at least a minimum distance as shown in Table 9.1 for the designated approach speed (approximately equivalent to 20 seconds travel time or 6D m) and the work shall be expected to be completed in less than 10 seconds
- there is at least one operating rotating yellow light on the work vehicle when parked adjacent to the carriageway.
- where the work is repetitive and is undertaken within a designated length of up to 2km, signs such as worker symbolic (T1-5) with **NEXT 2KM** (T1-28) or **GRADER AHEAD** (T1-4) with **NEXT 2KM** (T1-28) or similar are to be placed in advance of the work. Where this work is undertaken as a frequently changing work area the advance signs shall be progressively relocated so that for opposing directions they are never more than 2 km apart.

9.1.3 Unplanned work

For unplanned intermittent work ensure the following conditions are met:-

- approved high visibility external clothing, as specified in RTA's *Occupational Health and Safety Policy Manual, Wearing of High Visibility Vests and Garments* is worn by all workers
- work can be abandoned immediately without risk to workers or traffic
- where a spotter is used, there is no approaching traffic for at least a minimum distance as shown in Table 9.1 for the designated approach speed (approximately equivalent to 10 seconds travel time or 3Dm) especially if the work vehicle is parked on the roadway
- where used the spotter shall remain within sight and hearing distance of the worker(s) (generally within 2 metres), and an advance spotter may be required if the distances shown in Table 9.1 cannot be achieved. This advance spotter should be within sight distance of the first spotter or within radio contact if sight distance is not possible.
- where a spotter is not used, there is no approaching traffic for at least a minimum distance as shown in Table 9.1 for the designated approach speed (approximately equivalent to 20 seconds travel time or 6Dm) and the work shall be expected to be completed in less than 10 seconds
- there is at least one operating rotating yellow light on the work vehicle when parked adjacent to the carriageway.
- personnel undertaking unplanned intermittent work are able to substantiate that the work was unplanned and required urgently.

Approach speed (D) km/h	Minimum sight distance (m)	
	With a spotter	Without a spotter
10 & 20	60	120
30	90	180
40	120	240
50	150	300
60	180	360
70	210	420
80	240	480
90	270	540
100	300	600
110	330	660

Table 9.1 Safe traffic gaps for intermittent work

If vehicles in the traffic stream are randomly distributed and with an ADT less than 1,500 vehicles per carriageway then suitable gaps in traffic will generally occur every minute. But at an ADT of 3,000 vehicles per carriageway, it may be very difficult to get suitable gaps without waiting many minutes. However, in many places factors as diverse as traffic signals and slow vehicles often bundle traffic into platoons, and suitable gaps may occur more frequently.

9.1.4 Mobile inspections and slow moving vehicles

Where it is necessary for work vehicles (other than vehicles engaged in mobile works, see Section 9.19, *Mobile work*) to travel at speeds below that of other traffic, such as during routine patrol works or road inspections, they shall only travel at or above the minimum slow speed shown in Table 9.2 and ensure the following conditions are met:-

- vehicles travel wholly within the traffic lane and do not straddle lane lines or edge lines
- vehicles have at least one rotating yellow light operating
- where fitted, flashing arrow signs are only used to direct traffic to one side of the vehicle if it is safe to do so. In situations where it is not safe to pass or overtake the work vehicle only the warning mode of the arrow should be flashed.

Vehicles may travel at speeds below those shown in Table 9.2 if they travel on the road shoulder or verge using gaps in traffic to pass obstructions and shall not straddle the edge line.

Normal traffic speed	Minimum slow speed
60 km/h	40 km/h
70 km/h	50 km/h
80 km/h	60 km/h
90 km/h	70 km/h
100 km/h	80 km/h
110 km/h	90 km/h

Table 9.2 Slow speed range for work vehicles

9.1.5 Slow moving plant

Plant items may be travelled on the road provided that the travel speeds indicated in Table 9.2 are complied with. The plant items shall have (where they are fitted) headlights and tail lights switched on and shall have at least one yellow rotating light operating. Plant items shall travel wholly within the traffic lane and shall not straddle lane or edge lines. It shall also pull over from time to time to allow traffic to pass.

Where plant items are not capable of travelling at the minimum speeds shown in Table 9.2 one of the following actions shall be taken in order to travel plant on the carriageway:-

- A TCP put in place to stop traffic whilst the plant is moved. It would normally be necessary to stop traffic only in the direction the plant item is travelling.
- An escort vehicle or vehicles provided in accordance with Section 9.1.6.
- The plant item may travel on the road shoulder or verge using gaps in traffic to pass obstructions and shall not straddle the edge line.
- The plant item is floated from site to site.

9.1.6 Escorting plant items

At times it may be necessary to escort slow moving plant items travelling on the road. The following procedure shall be used:-

- At least one escort vehicle shall travel behind the plant item.
- At locations where a minimum sight distance of 2Dm is available the escort is to travel at the same speed as the plant item, at a distance of approximately 2Dm behind the plant item.
- Where sight distance is less than 2Dm the escort is to stop on the shoulder, off the travel lane until the plant item has moved a maximum of 6Dm ahead. The escort is then to travel at normal speeds to a point near the plant item and stop on the shoulder again.
- Where sight distance is less than 1Dm a second escort vehicle shall be used, travelling at varying distances behind the plant item. The second vehicle will vary speed to ensure as far as possible that maximum sight distance is maintained for traffic approaching from behind. For example the escort would travel more quickly through a bend and then slow down on a straight where sight distance is increased. This vehicle should occasionally pull over to allow traffic to pass. The first escort vehicle shall continue to operate as in the point above.
- All escort vehicles are to be equipped with at least one operating rotating yellow light and a sign **ROAD PLANT AHEAD**. Similarly all the plant items shall be equipped with at least one operating rotating yellow light. The escort vehicles and the plant items shall have (where they are fitted) headlights and tail lights switched on. Escort vehicles and at least one of the plant items are to be equipped with effective two-way radios.
- The plant items shall pull over periodically to allow traffic to pass so that the queue of traffic following generally does not exceed 12 vehicles.
- Escort vehicles may be cars, utilities or trucks, however trucks used as escorts shall not be heavily loaded and are not to be towing trailers.

- Up to three plant items may be escorted in the one group using one or two escort vehicles as prescribed above. In this case a distance of 60m to 80m shall be maintained between the plant items.

9.1.7 Work taking 5 minutes maximum

When the roadway is occupied for less than 5 min other than within a frequently changing work area (see Section 9.1.8) by workers with a vehicle or item of plant equipped with a vehicle-mounted warning device, 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

the vehicle-mounted device shall not be obscured, e.g. by overhanging vegetation or a raised truck body, and the work shall not reduce the:-

(i) overall width to less than that required for safe passage for two-way traffic; or

(ii) lane width adjacent to a barrier line to less than that needed for vehicles to proceed without crossing the line.

A spotter shall be posted to warn workers on foot 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.

9.1.8 Frequently changing work areas

For activities such as shoulder grading or maintenance, pedestrian type linemarking or pavement marker laying (excluding work on separation lines on 2-way roadways), minor pavement 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 Section 9.1.7 shall be observed:-

(i) Work vehicle positioning.

(ii) Display of the vehicle mounted rotating yellow light.

(iii) Sight distance to the work vehicle for approaching traffic.

(iv) The need for a spotter 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; or

(ii) **GRADER AHEAD** (T1-4) where a grader only will be encountered; or

(iii) **ROAD PLANT AHEAD** (T1-3-1) where another kind of road plant item will be encountered.

The sign **NEXT 2 KM** (T1-28) shall be placed beside whichever of the above signs is used.

(d) If any of the requirements of Item (a) cannot be met at a particular location, i.e. sight distance is substandard, that site shall be set up as a fully protected short-term work site with advance signs as required.

9.2 Working at night

9.2.1 General

As well as during night work the requirements of this Section should be considered when working in any poorly lit situations such as during periods of fog or working in tunnels.

9.2.2 Clothing

All personnel working at night, not just Traffic Controllers, are to wear approved high visibility external clothing in accordance with RTA's current occupational health and safety policies, and are to keep all night gear clean and bright. Wet weather clothing requirements are also described in RTA's current occupational health and safety policies.

Note that these requirements are based on considerations of traffic safety. Other requirements for personal protection equipment such as hearing protectors (earmuffs, ear plugs, etc.) and safety footwear are also described in RTA's current occupational health and safety policies.

9.2.3 Cones and bollards

Take special care in placing and maintaining cones and bollards. In particular:-

- consider decreasing their spacing from that shown in Table 5.1 if this will improve their visibility, and
- they shall have retroreflective bands or sleeves of Class 1 material
- ensure employees are on site to reinstate any dislodged devices.

9.2.4 Flashing arrow signs

They are essential at night for lane closures on high volume and high speed roads and on busy urban roads. Care needs to be taken to ensure that the dimming facility is operating correctly at night. It is very desirable that back–up units are available on critical works.

Only type approved flashing arrow signs are to be used in New South Wales. For information and approval requirements see Section 11.2, *Approvals and specifications*. A list of type approvals is maintained by RTA, Manager, Traffic Asset Services, Blacktown.

9.2.5 Lighting

Where possible the work site is to be fully lit by floodlighting. If power is not available use portable generators. Floodlighting of night work is particularly necessary in rural areas where there is no street lighting.

Traffic Controllers and their Stop/Slow signs at the approaches to a night time work area shall be clearly visible to road users. Where it is not practical to floodlight the whole work site consider floodlighting the Traffic Controllers and the Stop/Slow signs.

The works supervisor is to check floodlighting at work sites to ensure that floodlights do not adversely affect road users or adjacent dwellings or businesses. These checks are to be made by driving around, past or through the work site in all directions of travel. On divided carriageway roads, these checks are necessary from all carriageways, even if the work area is only on one carriageway.

Any floodlighting or security lighting at depots or compounds is also to be inspected to ensure that it does not adversely affect road users or adjacent dwellings or businesses.

9.2.6 Motorists behaviour

Important points to remember at night are:-

- motorists tend to drive with vehicles further apart
- obstacles are less conspicuous and peripheral vision is reduced
- motorists tend to drive faster on major arterial roads
- motorists may to be more fatigued or alcohol–impaired
- sight distance is significantly reduced even on high beam and on low beam is only of the order of 100 m.

9.2.7 Pavement markings

Line marking is generally not visible on lit roads on wet nights and on dry nights is not as conspicuous as during normal daytime even with streetlights or floodlights.

Raised reflective pavement markers can be used to assist delineation through work sites.

In some circumstances retroreflective cones can provide the continuity to guide motorists through the work site effectively. Delineators on guide posts or temporary stakes are useful, and care is needed to achieve standard spacings particularly on winding rural roads.

9.2.8 Signs for night work

Signs at the work site are essential and advance signs are also required. These RTA signs are **NIGHT ROADWORK AHEAD** (T1-223), **WORKERS AHEAD** (T1-224) and **TRAFFIC CONTROLLER AHEAD** (T1-200-3) which are used in lieu of **ROADWORK AHEAD** (T1-1), **WORKERS AHEAD** (T1-5) **and TRAFFIC CONTROLLER AHEAD** (T1-200) signs.

Signs shall be made of Class 1 (retroreflective) yellow sheeting on a Class 2 (non–retroreflective) black background. If headlights strike a large area of Class 1 (retroreflective) sheeting, it is difficult to read sign legends and for this reason reverse image signs have been designed for the key signs used for planned night roadworks.

Other matters to consider are:-

- yellow is better than red at night
- externally lit signs are preferred to unlit retroreflective signs
- messages on signs should be brief and clear
- use standard signs and avoid *home–made* signs
- use standard sizes of signs for ease of storage and installation
- ensure that accurate records of the locations and types of devices displayed are entered in the works supervisor's diary, as detailed in Section 4.3, *Implementing TCPs.*

9.3 Pedestrians

9.3.1 General

In planning temporary arrangements for pedestrians consider:-

- the expected numbers of pedestrians
- where they will want to travel from and to
- the needs of older pedestrians and pedestrians with disabilities such as vision impairment or mobility impairment
- the needs of school children and others who may be temporarily impaired such as those with shopping trolleys or prams.

The safety and convenience of pedestrians requires paths and crossings to be maintained in acceptable condition at all times. Apart from concern for safety of the community, attention to this matter is essential to protect the organisation from injury or damage claims arising from accidents to pedestrians occurring as a result of the temporary arrangements.

Pedestrians shall be separated from any trenches cut into paths or the trenches covered with steel plates until backfilled.

9.3.2 Defining the work area

It is essential that the work area is clearly defined by using:-

- generally, plastic pedestrian fencing to the standard described in Section 3.3.2, *Plastic containment fences,* or
- in very busy urban areas, such as shopping areas, more substantial fencing such as rolled–top 'weldmesh' or pool fencing.

Where pedestrians have been diverted onto an existing roadway the pedestrian path may be separated from vehicular traffic by a mesh fence provided that:-

(i) the clearance to the delineated edge of the traffic lane is at least 1.2m and the speed of traffic is 60 km/h or less; or

(ii) the clearance to the delineated edge of traffic is less than 1.2m and the speed of traffic is 40 km/h or less.

Where these conditions cannot be met a safety barrier shall be provided or an alternative pedestrian path provided.

9.3.3 Footpaths

Temporary footpaths shall provide a clear path of travel and need to be:-

- adequately signposted to indicate the direction of the footway
- of all weather standard
- of equivalent material and performance to the adjacent footpaths
- the unobstructed width at local constrictions shall not be less than 1m. Elsewhere a width of at least 2m shall be provided

Give care to maintaining good conditions at points of concentration of pedestrians such as in front of shops, schools and at bus stops.

9.3.4 Pedestrian crossings

Give special care to maintaining pedestrian crossing facilities and associated signs during works. If access to existing crossings cannot be provided, provide alternative facilities as near as possible to the established crossing and at least the same standard. In some cases, on long-term works, pedestrian bridges that span both the work area and the travel lanes may be appropriate.

Pedestrians should be prevented from crossing, where:-

- traffic is flowing temporarily in the opposite direction from normal
- medians, refuges or other physical devices separate lanes of traffic flowing in the same direction.

In these circumstances active control is necessary such as:-

- pedestrian actuated traffic signals, or
- supervisors (eg. Traffic Controllers, Police Officers or Civilian School Crossing Supervisors) or
- at the least, a race to direct pedestrians in a zig–zag so that they face the direction of oncoming traffic before stepping on to the traffic lanes.

9.3.5 Monitoring pedestrian movements

At work areas where it has been necessary to introduce temporary arrangements for pedestrians, the works supervisor and site ganger shall, during the first week, observe movement patterns of pedestrians and make any changes necessary to ensure that pedestrians are able to move safely.

9.3.6 Street lighting

Where it is necessary to temporarily divert pedestrians, the works supervisor is:-

- to check that the temporary pedestrian route is at least as well lit as the permanent route
- to assess the need to floodlight pedestrian crossings, especially those replacing permanent crossings that are or were
- to consider the need for street lighting to aid security for pedestrians in otherwise dark areas.

9.4 Cyclists

9.4.1 Policy

Recognising the considerable environmental benefits, the RTA is committed to the use of cycling as a transport mode and to the provision of safe and convenient cycling facilities.

9.4.2 ADT less than 3,000

On roads with ADT less than 3,000 vehicles, motor vehicles and cyclists can be expected to share the available road space through work sites.

9.4.3 ADT more than 3,000

For works affecting a cycle route and/or on roads with ADT more than 3,000 vehicles, temporary arrangements will be necessary for cyclists, unless a Traffic Controller is on duty for the duration of the works. Where a Traffic Controller is on duty cyclists may share traffic lanes with motor vehicles, without the need for any special provision.

Where there is no Traffic Controller, the arrangement will depend on:-

- existing usage (the number of cyclists)
- available width and alignments
- traffic speeds and volumes
- duration of work
- surface material and condition
- environmental impacts
- costs.

As a principle objective of provision for cyclists adjacent to the work site, the pavement surface should be maintained in a clean, smooth state. This may necessitate sweeping of the riding surface regularly.

At work sites without a Traffic Controller (eg. between shifts at long term works), consider the circumstances and provide one of the following:-

- separate bicycle paths, 1.2 m wide for one–way and 2 m wide for two–way flow
- paths shared with pedestrians, 2.0m wide for one-way and 3.0m wide for two-way flow
- a smooth shoulder, minimum width 1.2 m (2 m required if adjacent to traffic lane with speeds above 60 km/h)
- a lane shared with motor vehicles, not wider than 4.5 m and at least:-
  3.5 m wide in a 40 km/h zone
  4.0 m wide in a 60 km/h zone
  4.5 m wide in a 80 km/h or faster zone.

9.4.4 Grooved roads

Milling of roads prior to re-surfacing may present a hazard for cyclists. Where road surfaces are grooved, cyclists should be warned by the display of **CYCLE HAZARD GROOVED ROAD** (T2–207) signs on all approaches.

9.4.5 Lighting of work sites

Where works affecting cycleways are carried out for a period exceeding one day, the works should be made sufficiently visible for night time travel. That is, cyclists shall be able to observe site conditions under low ambient light, including temporary access paths, and take appropriate action.

In addition, as a general principle, lighting on temporary access paths should not be less than the existing level on the original path.

9.4.6 Broad principles

For works affecting cyclists consider also the following:-

- on down grades cyclists may travel at speeds of up to 50 km/h and surfaces shall be able to be ridden on safely at this speed
- many cycles have no suspension making rough surfaces unpleasant and potentially dangerous to travel on
- provision should be made to “feather” the edges of temporary surfaces to remove any hazardous edges
- roadworks signs should be placed above the head height of cyclists
- barrier boards and signs should not be placed such that they force cyclists away from space allocated to cyclists.

9.5 Working adjacent to traffic

9.5.1 General

This Section is to be read in conjunction with Section 3.6, *Safe clearances between workers and through traffic*.

Consider the following safety factors where work is being carried out on areas adjacent to or close to traffic:-

- the type of traffic, its speed and volume
- mutual sighting between the workers and road users
- the duration and extent of the work
- the proximity of the work area to moving traffic.

9.5.2 Clearances

It is a requirement to reduce the speed of passing traffic to the following speeds, using appropriate signs, techniques, devices and temporary roadwork speed zones, where there are no intervening physical barriers between workers and traffic:-

- 60 km/h for workers between 3 and 1.2 metres of traffic
- 40 km/h for workers within 1.2 metres of traffic.

Suitable signs, techniques and devices to be considered include:-

- portable traffic signals
- additional traffic controllers
- stopping all traffic
- narrowing lanes
- directing traffic onto sealed shoulders
- pilot vehicles
- plastic barriers to exaggerate narrowing of lanes
- chicanes.

If it is considered that a roadwork speed zone should be installed, refer to Section 8.2, *Roadwork speed zones.*

9.5.3 Principles

For **intermittent work** see Section 9.1, *Intermittent work*, for sight distance requirements to check whether a spotter will be required.

For **short-term work**, Traffic Controllers and associated signs are usually adequate to ensure that traffic proceeds slowly around, past or through the work area.

For **long-term work,** where the work area is adjacent to the edgeline or travel path of vehicles and personnel are working (unless having any other protection, such as safety barriers or operating major plant items), plastic mesh fencing supported on posts with delineators should be used to define the work area. The clearance between this fencing and the edge of the adjacent traffic lane should be at least 1.2 m.

In general, a safety barrier should be considered for isolating a work area if one or more of the following apply:-

- the requirements of Section 3.6, *Safe clearances between workers and through traffic*, cannot be met
- the location will continue to be a work area for longer than two weeks
- traffic speeds are likely to be greater than 80 km/h or

- ADT exceeds 10,000 vehicles (or 5,000 vehicles for the carriageway nearer the work area) or
- personnel do not have other protection, such as operating plant.

It is also essential to ensure that if used the safety barrier does not create greater additional hazards, such as presenting unprotected ends, unacceptably narrow travel path, etc.

9.6 Safety barriers

9.6.1 General

Safety barriers, such as precast concrete barriers, some water filled plastic barriers (see Section 3.3.7, *Plastic water filled containment fences*) and steel guardfence, are used at work sites to prevent vehicles encroaching on work areas and to ensure the safety of the workers. They shall conform to the requirements of AS3845.

However, barriers at work sites can present many problems including:-

- sight distance restrictions
- end treatment requirements
- night or adverse weather visibility problems
- the need to provide gaps for local access and access for road plant etc.

Sight distance restrictions may occur where safety barriers or end treatments obstruct the vision of motorists entering the main road from a side road, perpendicular to the safety barrier. The requirements of the work area often prevent the barrier from being tapered away from the main road in the vicinity of a driveway access or a side road intersection. Sight restrictions also occur when barriers are erected on sections of road with tight horizontal curves and the barrier needs to be located close to traffic lanes.

Driveways, intersections and crossovers greatly increase the exposure of barrier ends in most urban areas. In high speed zones where there are limitations on methods of end treatment that protect both motorists and workers, consider imposing a lower speed limit and utilising an end treatment suitable for that lower speed.

Flashing lights may be used to highlight barrier end treatments.

Care is necessary to install and maintain the correct coloured reflectors and lights on barriers so that they can be seen at night. In adverse weather both barriers and reflectors need cleaning so that dirt accumulations do not negate their delineating effect.

9.6.2 Safety barrier systems for temporary works

RTA's Road Design Guide, Section 6 - Safety Barriers for Roads and Bridges, gives details of the attributes of all currently approved barrier systems and terminal treatments. Safety barrier styles are classified as rigid, and non-rigid. See Section 9.6.4, *Warrants*.

The following temporary safety barrier systems are available. They are listed in order of rigidity with the most rigid first:-

- Precast Concrete Type F safety shape units connected longitudinally by cast spigot and socket joints with a top connector plate and not fixed to the road surface. Because of the very small dynamic deflection of these connected units they are most suitable for areas where workers are close to existing traffic lanes. Rigid barriers should be used with care for speeds over 80km/h due to the increased severity of crashes with these compared with non-rigid barriers.
- Precast Concrete Tric Bloc™ units connected with steel pins is a non-rigid system with a small dynamic deflection. They are especially useful where drainage runoff needs to pass beneath the units. Acceptable terminal treatments are to taper the end of the Tric Bloc™ beyond the clear zone or to install a Quadguard CZ™, or an array of either ENERGITE III™ or FITCH™ sand barrels in speed zones above 70 km/h. In the 70km/h speed zone or lower the 5.5m slant end can be used. Rated for speed zones up to 110km/h.
- Steel Thrie beam guardfence (also known as G9) with driven posts. The rigidity of this system can be increased with closer post spacing and or nesting the rails inside each other. Rated for speeds up to 110 km/h.
- Steel W beam guardfence (also known as G4) with driven posts. The rigidity of this system can be increased with closer post spacing and or nesting the rails inside each other. Rated for speeds up to 110 km/h
- Triton™ Barrier, Guardian™ with 350 Highway™ kit and Roadliner 2000 ST™ are presently the only three acceptable plastic water filled safety barriers. Other plastic water filled devices available are to be used for delineation purposes only. These systems are the most flexible barrier with dynamic deflections in the order of 2.6m at 70km/h and 25 degrees. Due to the large dynamic deflection of these connected they are not suitable for use where workers are situated immediately behind. Their structural performance depends on units being installed to the appropriate minimum length, filled with water (maintained at the prescribed level) and sand and each unit being soundly connected to the next. Minimum length and terminal setout vary with each system and the appropriate manufacturer's manuals should be consulted. Rated for speed zones up to 70km/h; further testing in the USA to be concluded for 100 km/h.

- ENERGITE III™ and FITCH™ are sand filled crash barrels. Various arrays of these barrels are suitable for use as protective devices of steel and concrete safety barrier ends and isolated rigid objects in work zones. They are not suitable to be used as a longitudinal barrier due to the number of layers that would be required to stop side penetration. . Rated for speed zones up to 110km/h.

Terminal treatments for the various safety barrier systems can vary from using proprietary products to tapering the barrier treatment out of the clear zone. Proprietary terminals include the NEAT™ for 70km/h zones and Quadguard CZ™ and REACT 350™ for 100 km/h zones. Other terminals include arrays of sand barrels (mentioned above), parallel sections of Triton™ barrier arranged in advance of the longitudinal barrier end. Manufacturers manuals provide details of all these systems.

9.6.3 Side tracks and detours

The appropriate safety barriers shall be considered on all temporary embankments on side tracks or detours where the vertical height between the edge of the shoulder and the intersection of the batter and the existing surface exceeds 2 m.

9.6.4 Warrants

The types of safety barriers listed in Section 9.6.2, S*afety barrier systems for temporary works*, are systems or devices which have passed crash testing to NCHRP 350 (or equivalent) and are classified as operational in their country of origin. Other systems can only be regarded as delineation fences defining the work areas and not as safety barriers.

Safety barriers are an expensive means of protection for temporary works. Risk analysis techniques are to be used as the basis for making decisions on the use of safety barriers unless required by other sections of this manual. RTA's *Road Design Guide*, Section 6, *Safety Barriers for Roads and Bridges* gives detailed guidelines for analysing risks, severity and design of safety barriers on temporary roads and detours as well as for the protection of workers in defined work areas adjacent to traffic.

9.6.5 Working behind safety barriers

Of the two types of safety barrier systems, rigid and non–rigid, the non-rigid barriers are designed to deflect significantly during a vehicle impact. For a given safety barrier the amount of deflection depends on the speed and angle of impact and the mass of the errant vehicle. This may be a significant aspect in choosing a safety barrier for a work site, and the Engineer should refer to RTA's *Road Design Guide,* Section 6, *Safety Barriers for Roads and Bridges* which gives details of predicted deflections for approved barrier types.

9.7 Access to adjoining properties

9.7.1 General

It is highly desirable to maintain both pedestrian and vehicle access to adjoining properties at all times. This not only helps to maintain good relations with property owners, lessees and the residents in the area but is essential for safety reasons in the case of urgent access such as a medical emergency. Pedestrian and vehicle access shall therefore be continuously available unless clear agreement has been reached with the occupants for a temporary restriction.

9.7.2 Standard of access

Temporary access to adjacent side streets and properties shall be trafficable under all normal weather conditions and shall be constructed to reasonable standards matching the side streets and property driveways.

9.7.3 Communication

Effective communication with residents is essential for the work to be carried out safely and efficiently. Changes to access arrangements during works are best advised in writing in the first instance with follow up action in person if possible before the changes are introduced. Written notices may need to be prepared in a number of languages.

9.8 Working at intersections

9.8.1 General

Intersections vary greatly in type, number of legs, number of traffic lanes and forms of traffic control. For this reason, it is difficult to cover all situations in this Manual. Therefore, most roadworks at intersections require a site specific TCP to be designed.

Where there is sufficient distance between intersections, use standard treatments for the signs and tapers on the approaches. Within the intersection the work usually needs to be staged so that sufficient lanes are kept open to handle the traffic flows. Very clearly define these stages of the work using closely spaced traffic cones or temporary barriers.

9.8.2 Principles

The following principles are particularly important when working at intersections:-

- ensure that sufficient traffic capacity is available and delays are kept to an acceptable level (but avoid excess capacity which may encourage high speeds)

- avoid blockages at the intersection or from downstream queuing as much as possible
- maintain effective control using signs, Traffic Controllers or signals
- make provision for alternative routes if right hand turns or other movements are temporarily banned at the intersection
- clearly define work areas so that road users can easily identify paths available for traffic within the intersection
- ensure that guide signs are clearly visible and not obstructed by road plant or temporary signs (if necessary relocate)
- restrict work to periods outside peak traffic flows if the intersection is a critical one within the road network.

9.8.3 Examples

For the reasons given in Section 9.8.1, *General*, it is difficult to provide standard TCPs at intersections. One such example for long-term work is given in this manual as standard TCP 60.

More examples will be considered for inclusion in later revisions of this manual but working at intersections will always require some additional specification at least in the form of individual job instructions. Traffic control at traffic signals is specifically covered in Section 9.9, *Working at traffic signals.*

9.9 Working at traffic signals

9.9.1 General

This section deals with how traffic should be controlled in the vicinity of traffic signals whilst maintenance or re–construction work is in progress. In most cases, traffic signals work involves only short duration traffic controls that can be quickly set up and dismantled, but are still effective in directing traffic around work areas.

At certain defined sites police control is essential or may be desirable and arrangements should be made with the relevant police station in advance.

9.9.2 Procedures to be followed

When closing off a lane, always work in the direction of traffic flow, starting at the farthest point from the job. Where possible, the vehicle (with warning lights and hazard flashers operating) should be stopped at the start of the layout (i.e. beginning of the taper). Both the vehicle and the person placing the layout can then move cautiously in the direction of traffic flow until the taper is completed.

The taper is the most important part of any layout and care should be taken when placing it. For work carried out clear of traffic the length of tapers should be 30 m for 60 km/h zones and 50 m for 80 km/h zones. Where possible for installation of a new site or major reconstruction the lengths should be increased to D m (i.e. 60 m for the former and 80 m for the latter) if plant or labour is required to work on the roadway. The cones should be spaced 3 – 5 m apart.

If the work area is beyond a crest or curve with limited visibility to the approaching motorist (less than 100 m) then the layout should be extended in advance of the crest or curve, if possible.

While work is proceeding, the work vehicle should be parked between the layout and the job where possible, with hazard warning lights operating at all times. This is to prevent injury to personnel if a vehicle runs through the layout.

If a work vehicle is not parked in the closed–off lane, an extra (approximately 10 m to 15 m) length should be added between the end of the taper and the work area. Cones should be placed on the lane line between the end of the taper and the work area.

The layout should be dismantled only after all materials and equipment have been removed, so that the lane can be re–opened quickly (i.e. the layout should not be removed before the vehicle is ready to move). The layout should be picked up by personnel walking against the traffic flow. Two persons should remove the taper, one picking up the cones and the other picking up the signs and guiding the traffic. Vehicles should not be driven against the flow of traffic when picking up layout equipment.

Care should always be taken with pedestrian traffic. Sufficient clear space should be provided during the work to permit pedestrians to cross safely. Where excavations are left unattended, sufficient barriers and warning lights shall be provided so that the area is safe for both vehicles and pedestrians.

It is important to check the site at the end of the work to ensure that no potential hazards to pedestrians and vehicles remain.

9.9.3 Examples

Standard TCP 60 is a general TCP which shows some of the controls that can be used at urban intersections for long-term work such as a new site or major reconstruction.

Standard TCPs covering typical situations are described in Table A–15, *TCPs for traffic signal works* (Appendix A) and Appendix D, *Traffic control plans*. These standard TCPs show traffic control devices close to the work. If further advance warning is required then such signs should be erected in accordance with standard TCP 60. It should be noted that it is very difficult to cover all possible situations. The standard TCPs should be used to formulate layouts for other situations. In this regard the good judgement of the site supervisor will be invaluable.

9.9.4 Signs and warning devices

The following are special signs which may be used in conjunction with other warning signs to highlight the work:-

- **SIGNALS OUT OF SERVICE** (T1–220)
- **MERGE** (T1–221)

Portable **NO STOPPING** (R5–420(L OR R)) signs, correctly approved, may be used to restrict stopping or parking in the kerbside lane where other lane/s are blocked.

All signs and warning devices shall be checked regularly to ensure they remain in their correct positions and that flashing lamps (if used) are operating.

9.10 Working on medians

Access to medians is potentially hazardous because it is likely to involve unexpected manoeuvres to and from a fast lane. Therefore, work vehicles (including those driven by works supervisors) are to use deceleration bays, median crossovers and any other wide areas of pavement for access to and from medians.

See Section 7.8, *Median crossovers*, for detailed requirements.

Although work areas on medians are clear of traffic, workers shall realise that they are working close to traffic and often adjacent to high speed lanes. Requirements under Section 9.5, *Working adjacent to traffic* apply to work on medians except for very wide medians.

On narrow medians (width less than 3 m), special arrangements are necessary and an adjacent lane may need to be closed.

For short term work on wide medians where the whole work area is more than 3 m from the edge line or travel path, traffic control would normally not be necessary.

9.11 Working on roadsides

Although work on roadsides means that the work area is clear of traffic, workers shall realise that they may still be working close to traffic and adjacent to shoulders or parking lanes. Take the following precautions when attending work vehicles parked on the shoulder or kerbside lane:-

- take all tools and stores from the rear or passenger side of the vehicle to limit close exposure to traffic on the road
- where possible, park work vehicles to shield workers from the path of errant vehicles.

See Section 9.5, *Working adjacent to traffic* for guidance when working on roadsides.

For long term work, where personnel are working close to the edgeline or travel path of vehicles (unless they have other protection, such as operating major plant items) plastic mesh fencing supported on posts with delineators should be used to define the work area. This fencing should be located such that the clearance between it and the edge of the adjacent traffic lane is at least 1.2 metres.

In general, a safety barrier should be considered if any of the conditions exist as described in Section 9.5.3, *Working adjacent to traffic*.

9.12 Excavations

Special consideration of the safety of both workers and traffic is needed while traffic flow is adjacent to excavations. In planning and carrying out works, priority is to be given to backfilling all excavations near traffic.

Excavations shallower than 0.5 m and within 3 m of the travel path or edgeline should be defined by plastic mesh fencing, barrier boards perpendicular to the traffic flow, cones, bollards or similar delineation while the adjacent lane is not under traffic control.

A safety barrier shall be erected where traffic flows without a Traffic Controller beside an open excavation, deeper than 0.5 m and within 3 m of the travel path or edgeline.

An appropriate safety barrier shall be used for isolating work areas with excavations, irrespective of their depth, if:-

- the excavation remains open longer than two weeks, and
- the excavation is closer to the travel path or edgeline than
  3 m for 60 km/h approach speed
  6 m for 80 km/h approach speed
  9 m for 100 km/h or faster approach speed.

If the engineer considers that compliance with these requirements is not practical or warranted, a more thorough risk analysis should be made based on RTA's *Road Design Guide,* Section 6, *Safety Barriers for Roads and Bridges*.

9.13 Bituminous works

Bituminous works or other pavement surfacing works may be conducted under traffic or the work area may be clear of traffic. In most cases there will be some interruption to traffic either from the work or from plant and vehicles associated with the work. Keep this interruption to traffic to a minimum by careful planning and execution of the work. Such planning and control of the work will also assist in the safe completion of the work.

It is good practice to advise the local community in advance of planned bitumen sealing works especially on busy roads.

The Engineer shall ensure that risks in the bituminous works are taken into account in planning the work so that traffic delay does not exceed a maximum of 15 minutes. This suggests an operations cycle of not longer than 10 minutes, and involves determining the following:-

- widths and lengths of area to be treated
- timing to avoid peak traffic periods
- whether to introduce side tracks or detours
- temporary closure of intersecting roads.

In the case of bituminous spraying works take care to ensure that wet bitumen or loose stones do not cause a hazard to traffic. For this reason, monitor the works for some days, and adjust signs or temporary speed zones to suit the road conditions.

For signs at sprayed sealing works, the four stages to consider are:-

- before sealing begins
- during the sealing operations
- until the last loose stones are removed
- until the appropriate line marking and road markings are fully restored.

Where sealing works are undertaken in areas where the posted speed limit is greater than 60 km/h then a 60 km/h roadwork speed zone shall be installed and shall remain in place until the number of loose aggregate particles remaining in place falls to the specified level.

Where road condition signs (such as slippery surface (T3-3), **LOOSE STONES** (T3-9) etc) are installed they shall remain in place until the above requirements are met. Signs warning of the absence of linemarking are not to be removed until all linemarking is reinstated.

9.14 Surveying

The Survey Party Leader is responsible for the safety of the survey party.

The traffic control arrangements for long-term work (such as construction sites) should have been put in place by the personnel responsible for the work. If so, the Survey Party Leader will:-

- determine who is the Works Supervisor
- satisfy himself or herself that the procedures in place have been approved
- satisfy himself or herself that the procedures will accommodate the type of survey work that the party intends to do
- discuss with the works supervisor any changes considered essential and ensure that approval to the changes is obtained.

Where there is no TCP in place, the Survey Party Leader will choose and implement or ensure that a trained person chooses and implements the plan which best fits the work site.

Thus in applying relevant sections of this manual, the Survey Party Leader selects competent people to assume the responsibilities of both the team leader and the works supervisor.

Survey work can be mobile, intermittent or short-term work, depending on the circumstances. Traffic control requirements should be assessed accordingly.

Survey work in travelled lanes can be performed as planned intermittent work or under lane closure using the appropriate TCP.

For survey work on the roadside, that is areas between the reserve boundary and the nearest road shoulder, all survey party members shall wear high visibility garments in accordance with RTA Policy contained in the OH&S Manual. Roadside signs will not generally be required for such work, but if movements from one side of the road to the other are required these shall be undertaken with extreme caution.

Surveying on a busy urban road at an approach to traffic signals while traffic is stopped for a red signal is acceptable as intermittent work provided a spotter is on duty to observe signals and traffic while accompanying the person carrying the survey reflector.

9.15 Vehicle inspections

9.15.1 General

RTA Inspector Vehicle Regulation (IVRs) carries out inspections of vehicles to determine compliance with the various Acts and Regulations administered by the RTA.

The objectives of inspections are to ensure that:-

- Vehicles are roadworthy
- Vehicles are not overloaded
- Loads are properly secured
- Vehicles are within vehicle construction limits
- Vehicles are registered.

Drivers of heavy vehicles must also be properly licenced and not exceed driving hour limits.

The objectives of the checks are road safety, asset protection and regulatory compliance.

9.15.2 Stopping vehicles

Inspector Vehicle Regulation carries out inspections on vehicles by day and night. These inspections are carried out at:-

- **Fixed Sites** are specially designed facilities constructed off the carriageway to undertake all or some Vehicle Regulation tasks. In most cases the site has permanently fixed signage identifying RTA inspection facility however portable signage is acceptable. Normal traffic goes around sites and the site is located off the carriageway and the maximum approach speed is 80km/h and at times speed restrictions apply. Some permanent fixed sites may be used for other activities such as driver reviver when not used for inspection purposes. Many sites have lighting and other facilities such as toilets. TCPs VR101 &102 refer.
- **Planned Sites** are not specifically constructed for Vehicle Regulation tasks and are often identified to passing traffic via portable traffic control devices. Normally, traffic goes around sites and the site is located off the carriageway. Principally, planned sites are used for static intercepts and are suitable for all or some Vehicle Regulation tasks. Some planned sites are used for other activities such as driver reviver when not used for inspection purposes. TCPs VR201 &202 refer.
- **Mobile Intercept Sites** are used where there are concerns about the target vehicle. Often there is limited or no advanced warning to other traffic and normal traffic may pass through or around the site. The RTA and target vehicles are mobile prior to interception and often the site is not selected by the intercepting officer. Limited Vehicle Regulation tasks are conducted according to TCP activity checklist and minimal time spent on site. It may be necessary to redirect the target vehicle to a more appropriate site if tasks other than those identified prior to intercept are to be conducted. Tasks are restricted to a single vehicle. TCP VR401 refers.
- **Static Intercept** is only conducted at a Fixed, Planned or Temporary site where traffic can pass through the work site without crossing the adjacent traffic lane. The enforcement vehicle is stationary and the target vehicle is mobile. There is limited or no advance warning to traffic. The intercepting officer directs the driver of the target vehicle with an approved sign and must stand in the marked safe work zone as outlined in the site vehicle movement plan. Vehicle Regulation tasks are conducted according to TCP activity check list. TCP VR402 refers.

- **Temporary Site** is often used where there are immediate road safety concerns in respect of the target vehicle. These sites are only used where no Fixed or Planned sites are available or target vehicle movement is impractical. The target vehicle may be redirected from an intercept site to a temporary site where limited checks can be carried out. Temporary sites are selected by the intercepting officer and there is limited or no advance warning to other traffic. Tasks are restricted to a single target vehicle and are conducted according to TCP activity list. Temporary sites can be used for conducting inspections during Authorised Inspection Station Audits and Authorised Unregistered Vehicle Inspection Station Audits. Normal traffic may pass through or around the site. TCPs VR301 - 311 refer.
- **Accident/Incident Sites** are where one or more damaged vehicles and or debris are on the site. The site is normally under the control of a site commander, often from another agency. Due to the nature of the work limited or no advanced warning is given to other traffic and advanced warning may be removed when other agency personnel depart site. The site is never chosen by the IVR and normal traffic may pass through or around the site. Detailed inspections and observations are often carried out on site however it is preferred that the vehicle is recovered and transported to a secure facility for inspection. Incident observations often occur outside controlled areas. A safe work method statement identifies critical steps and potential risks.

9.15.3 Site risk assessment

To determine the appropriate TCP, an assessment must be made to determine the average daily traffic flow (ADT) for all Temporary Sites.

Fixed and Planned Sites will be determined by annual average daily traffic AADT figures as these activities may be carried out over one or more days. Any TCP implemented must cater for the greatest traffic volume likely.

To determine an appropriate TCP for Temporary Sites the following steps shall be used, in order of preference:-

1. Use Table 9.3 to estimate current traffic flow by counting traffic passing in both directions for five minutes and converting this data to approximate the ADT. In practice, most traffic is within the period of 6:00am to 10:00pm, a 16 hour period. Hence a 5 minute count of 5 vehicles may better equate to the following calculation of 16 hrs x 60 vehicles = ADT 960.
2. If no Traffic Volume Data is available and there is insufficient time to do the 5 minute count – an ADT figure of > 1500 must be used in TCP determinations.
3. Determine the appropriate TCP from the *Traffic Control at Vehicle Regulation Work Sites Manual.* Contact Vehicle Regulation Manager, telephone (02) 9218 3921.

NUMBER OF VEHICLES PASSING IN 5 MINUTES	CALCULATION	ESTIMATED ADT
8 or more vehicles	16hrs x 96 vehicles = 1536	> 1500
7 vehicles	16hrs x 84 vehicles = 1344	> 1000 but ≤ 1500
6 vehicles	16hrs x 72 vehicles = 1152	> 1000 but ≤ 1500
5 vehicles	16hrs x 60 vehicles = 960	> 300 but ≤ 1000
4 vehicles	16hrs x 48 vehicles = 768	> 300 but ≤ 1000
3 vehicles	16hrs x 36 vehicles = 576	> 300 but ≤ 1000
2 vehicles	16hrs x 24 vehicles = 384	> 300 but ≤ 1000
≤ 1 vehicle	16hrs x 12 vehicles = 192	< 300

Table 9.3 Calculating estimated ADT

NOTE: Traffic must be counted in both directions to determine the total traffic volume per 5 minutes

9.16 Traffic counting

9.16.1 Training

Field traffic counting requires traffic counters to be installed near roads with rubber tubes or other detectors on the road. Before such traffic data collection activities can be undertaken an officer shall be thoroughly trained in all aspects of the job including traffic control and safety.

The contents of this specific procedure will be explained, discussed and reviewed for the Traffic Counting Officer (TCO) by the Supervisor. The Supervisor will explain the reasons for and instruct the TCO in the use of the safety equipment and procedures used in traffic data collection.

Once all the office based instruction is complete, on–site instruction shall be given. The Supervisor shall determine the extent of on–site instruction. One proven method is that the TCO undertakes a period of "apprenticeship" with a number of TCOs. Each TCO explains the methods used in carrying out the work and on how the safety guidelines are applied to minimise the risk to both workers and traffic.

This method gives the TCO a broad based training and safely exposes the officer to the unpredictable nature of vehicular traffic, giving him or her the skills required to do the work safely.

9.16.2 Selecting a traffic counting site

Selecting an appropriate site to install counting sensors or tubes is the first step in reducing the risk to staff. A site that is safe will also be more likely to yield quality traffic counting data.

The location is usually designated by road name, compass direction and distance from a cross street or other feature. Apply the following criteria when selecting sites to install counting sensors:-

- **sight distance** – if all other factors are satisfied by more than one site, choose the site with the best sight distance
- **traffic speed** – a site within the lowest speed zone should be chosen eg. 60 km/h zone instead of 80 km/h zone
- **proximity to speed reduction facility** – a site downstream of a set of traffic signals or a roundabout is preferable. Such a feature can also create breaks in the traffic flow to facilitate safe installation and servicing of traffic counting equipment.
- **number of lanes** – a site with more than one lane or a wide shoulder in the direction of traffic flow is preferable, as it enables traffic to be channelled around the work site instead of being stopped. Otherwise a site with the lesser number of lanes is preferred because it reduces road exposure due to fewer flaps, nails etc.
- **road surface** – the road surface should be free from wheel ruts and be sound in the area where the tube(s) is (are) to be placed
- **roadside furniture/objects** – the site shall have a pole or tree to secure the recording equipment. In urban areas, proximity to a street light is desirable.
- **parking** – if the site is in a built up area, it is preferable to choose a site where no on–street parking is allowed. This allows traffic to safely flow around the work area and also improves the quality of the data.

9.16.3 Weather conditions

If work is to be carried out at traffic counters during wet weather then extra care needs to be taken with longer sight distances.

No work should be undertaken in fog unless the appropriate sight distance is clear. If weather conditions create a hazard, the TCO should defer the work until the weather clears or seek urgent support from a district office or works depot for the purposes of positive traffic control to eliminate the work hazard. In the case of contract work such arrangements shall be made with the RTA representative supervising the contract.

9.16.4 Time of day

Work is generally carried out during normal working hours. However for sites that cannot be worked on during these hours, because of high traffic flows, arrangements should be made to work during times of low traffic flow.

If night–time work is required then adequate street lighting is required and approved night–time high visibility clothing is to be worn, as set out in RTA's *Occupational Health and Safety Manual,* Section 5.4, *Wearing of High Visibility Vests and Garments*.

In built up areas where traffic standing restrictions apply, work should not proceed if it would obstruct traffic during the restricted hours.

9.16.5 Intermittent work

See Section 9.1, *Intermittent work*.

Traffic surveying equipment may be installed as intermittent work on travel lanes without using temporary advance signs, if:-

- staff wear approved high visibility external clothing, and
- the work can be abandoned immediately without risk to staff or traffic, and
- the work vehicle is parked on the side of the road near the work, with its hazard lights switched on, with a rotating yellow light on the roof or raised boot lid (whichever is higher) switched on, and a double sided, vehicle mounted sign displayed, and
- sight distance meets the criteria in Table 9.1, depending on whether a spotter is available. Abandon the work and leave the road when approaching traffic is within these distances of the work area.

The minimum acceptable sight distance should be determined according to the estimated approach speed of vehicles. Where traffic control devices such as traffic signals or roundabouts slow the traffic, approach speeds may be well below the speed limit. In some areas, they may be well above the speed limit.

The TCO should assess the traffic conditions to see if the gaps in the traffic are large enough to carry out the activity. The assessment of a suitable gap is based on the time it would take to carry out the planned activity and return to the road side. Sight distance is the criterion to use in this situation, as it is difficult to estimate the time it takes for an approaching vehicle to reach the work area.

9.16.6 Responsibilities

The TCO is responsible for assessing where and when traffic counting can be undertaken with safety. Training is to be supplemented with field experience to develop the necessary skills to make such assessments.

Prior to undertaking physical work within travel lanes, the TCO shall first determine if acceptable sight distance and gaps between vehicles are available. Consideration should be given to selecting days and hours of minimum traffic flow.

For a TCO operating either alone or with a spotter minimum sight distances are to be selected from those listed in Table 9.1.

Where acceptable sight distance or traffic gaps are not available, the TCO shall request a higher level of traffic control. This may include the presence of one or more spotters suitably positioned to provide the requisite 10 seconds warning. Equipment such as two way radios will ensure effective communication between spotters and TCOs if required. In other cases, Traffic Controllers may be needed to stop traffic during the work.

If any of the above conditions cannot be met, arrangements shall be made with the district office or works depot to provide full traffic control or, in the case of contract work, with the RTA representative supervising the contract.

9.17 Roadside traffic surveys

9.17.1 General

During a roadside traffic survey a Traffic Controller, assisted by the Police stops a number of vehicles at a time and directs them to a safe roadside area where traffic survey staff interview them, usually with a brief structured questionnaire. If traffic volumes are high, a second Traffic Controller may be necessary to control vehicles re–entering the traffic stream.

Motorists shall not be kept waiting. Therefore the Traffic Controller should direct vehicles in groups to the roadside bay, with a group containing one vehicle for each member of the survey team.

It is preferable to conduct traffic surveys during dry weather. Reasons include traffic safety, comfort levels for motorists and survey staff, and the potential for variations to normal traffic patterns during wet weather.

Where traffic volumes are high and the logistics of the survey are complex, it may be beneficial to conduct a brief trial run a few days in advance.

The arrangement for signs in advance of a roadside traffic survey site on a two lane two way road is shown on TCP 385.

9.17.2 Selecting a site for a traffic survey

Early and careful planning is the key to a successful roadside survey. The location for the roadside survey should be selected well before the actual time of the survey. Established roadside vehicle inspection bays and rest areas are generally ideal places for surveys. If an established roadside area is not available, the following criteria are to be used to select a survey site:-

- ample sight distance to the entry and re-entry of the survey site, preferably 5V m and at least 2.5V m.

- a wide shoulder, preferably sealed, to enable safe re–entry to the traffic flow after participating in the survey.
- relatively level grade with the entry well away from a downhill run and the re-entry well away from an uphill run, to enable easy and safe deceleration and acceleration.
- ample area, preferably dust free, in the roadside bay, well clear of through traffic.

In addition, it is generally easier to manage a given traffic flow in a 60 km/h or 80 km/h speed zone than in faster speed zones. Provided the objectives of the survey can be satisfied, a lower speed zone should be selected in favour of a higher speed zone.

9.17.3 Community relations

Experience indicates that it is also helpful to advise the public in advance of the survey. Prior advice should be framed to stress benefits to the community from improved knowledge of travel patterns. Before advising local media, factors to consider include:-

- the importance of a normal traffic distribution during the survey, and
- the possibility of inconvenience and surprise to motorists.

A decision can then be made on the basis of current local circumstances.

A media release after the survey with preliminary findings and acknowledging the cooperation of motorists may also be helpful in maintaining good community relations.

9.17.4 Participation is voluntary

Experience indicates that almost all motorists are willing to participate. However, participation in the survey is voluntary, and those who are unwilling shall be allowed to proceed whatever their reason. Note that a Traffic Controllers direction shall be obeyed.

Signs on standard TCP 385 do not indicate that participation is voluntary because traffic safety would be reduced if some motorists interpreted signs as allowing them to proceed regardless of the Traffic Controllers direction.

In addition, data obtained from the survey is likely to be biased if it is too easy for drivers to avoid the survey.

The following approach to motorists is suggested:-

“Good morning/afternoon. We are doing a survey for the RTA. We would like you to answer a few quick questions about you journey today. It will only take ...... minutes”.

Leave it to the driver to take any initiative to not participate.

9.17.5 Clothing

Roadside survey staff and Traffic Controllers shall wear appropriate high visibility external clothing as specified in RTA's *Occupational Health and Safety Manual,* Section 5.4, *Wearing of High Visibility Vests and Garments*.

9.17.6 Records

As with other situations requiring traffic control, records shall be kept of the details of the sign arrangement and the starting and finishing times.

9.17.7 Who is responsible?

The officer responsible for organising the survey is responsible for selecting the site, obtaining Police approval and ensuring that local road maintenance staff are advised. The officer should seek advice of the local road maintenance works supervisor on the need for a second Traffic Controller.

The officer responsible for organising the survey should also advise the relevant community relations officer who is responsible for advice to local media.

The officer on–site full time leading the survey team is responsible for ensuring that the signs are monitored frequently throughout the survey, and that any deficiencies are promptly corrected. He is also responsible for keeping records of the traffic control system used.

Where traffic volumes are high and the survey has a high profile, a project team or task force approach has proved successful in ensuring that all aspects of the survey are well planned and coordinated.

9.18 Testing road condition

9.18.1 General

This section covers traffic control for some of the more common forms of condition testing and monitoring of roads under traffic. Two distinct work crews often work together when testing work is being carried out, with one crew responsible for the testing and another for traffic control. It is essential that:-

- all members of the testing crew clearly understand who is responsible for traffic control, and
- all members of the traffic control crew are familiar with the testing process.

9.18.2 Benkelman Beam

Benkelman Beam tests give an indication of pavement strength. The test comprises a rigid truck with standard load and tyres on the rear axle, and a Benkelman Beam apparatus placed on the road immediately behind the rear axle of the truck. The truck driver remains in the truck which moves slowly forward 9 m for each test and then proceeds to the next test site. Test sites are typically 10 m to 50 m apart. Typically the average speed of progression for Benkelman Beam testing is unlikely to exceed about 3 km/h, and the operation is virtually stationary. One or more testing operators walk behind the truck taking readings and carrying the apparatus forward from one test site to the next.

Traffic control for Benkelman Beam testing may be set up either as short-term work or mobile work, depending on the number of lanes available for traffic and the spacing between tests.

As short-term work, the traffic control system consists of roadside signs and, if necessary, Traffic Controllers. As mobile work, the traffic control system comprises a Shadow Vehicle and an Advance Warning Vehicle, with traffic control devices mounted on these vehicles.

On divided roads and undivided roads with 4 or more lanes, a mobile arrangement will generally be more suitable.

Table A–8, *TCPs for Benkleman Beam testing* (Appendix A)*,* shows a number of standard TCPs which should be considered when planning Benkelman Beam testing. Standard TCPs 104 and 453 have been prepared specifically for Benkelman Beam testing. They show a Work Vehicle which is the truck with the standard axle load. The Benkelman Beam and operator will be immediately behind the Work Vehicle. The other TCPs mentioned in Table A–8, *TCPs for Benkleman Beam testing* (Appendix A) have been prepared for a wider range of work and show a work area distinct from the Work Vehicle. When these TCPs are used for traffic control for Benkelman Beam testing, the Work Vehicle and the work area are at the same location.

9.18.3 Deflectograph

A Deflectograph gives an indication of pavement strength by measuring the deflection of a pavement under a standard load. It is mounted on a rigid truck which has two crew members – the driver and the operator. The driver occupies the normal driving position, and the operator occupies a separate cabin behind the driver.

During testing, the truck moves at a very low uniform speed (typically up to 4 km/h), pulling a sled along the pavement beneath the truck and within the wheelbase area. There are no workers outside the vehicle.

Traffic control for Deflectograph testing should be set up as mobile work with an Advance Warning Vehicle and where necessary a Lead Vehicle and Traffic Controllers. A Shadow Vehicle is not needed for Deflectograph testing.

At traffic signals the Deflectograph stops when it arrives at the stop line and moves forward at the start of the next green phase. This ensures that the Deflectograph does not get caught within an intersection against a red signal.

Table A–10, *TCPs for Deflectograph and Falling Weight Deflectometer (FWD) testing* (Appendix A) shows the TCPs for Deflectograph testing. These TCPs are also suitable for other forms of testing where all testing personnel remain inside vehicles during the work, and the work progresses slowly along a traffic lane.

9.18.4 Profilometer

A profilometer is generally used to measure the longitudinal and transverse profile of a pavement. The host vehicle is mounted with a bank of lasers and a data recording system inside the vehicle. There are two crew members – a driver and an operator. The driver occupies the normal driving position, and the operator occupies the front passenger seat during testing.

Testing is conducted at speeds between 20 km/h and 100 km/h, depending on the speed limit at the test site. Speed may vary during the testing, and generally the test vehicle travels with the traffic flow. There are no workers outside the vehicle.

The driver is able to pay full attention to and respond to normal traffic conditions without affecting the testing process. If necessary the driver can readily take evasive action in an emergency, aborting the testing process. The testing normally presents no obstruction to traffic. The only forms of traffic control necessary are a rotating yellow light and a warning sign mounted on the road testing vehicle, and clearly visible from the rear.

Where traffic conditions do not allow operation at speeds between 20 km/h and 100 km/h (eg., at busy intersections and pedestrian areas), separate traffic control will be necessary possibly using a site specific TCP or arranging with traffic signals staff to modify signal operation temporarily. The officer responsible for organising the testing should seek advice or assistance from the local road maintenance works supervisor in this regard.

9.18.5 NAASRA Roughness Vehicle

A NAASRA Roughness Vehicle is used to test the riding quality of a pavement. It consists of a station wagon (eg. Holden Commodore) with a device known as a NAASRA Roughness Tower connected to the rear axle and a data recording system which measures the roughness value of the road. The roughness device and the data recording system are inside the vehicle. There are normally two crew members – a driver and an operator. The driver occupies the normal driving position, and the operator occupies the front passenger seat during testing.

Testing is conducted at either of the two standard speeds – 50 km/h and 80 km/h, depending on the speed limit at the test site. There are no workers outside the vehicle.

The driver is able to pay full attention to traffic conditions without affecting the testing process, and the testing normally presents no obstruction to traffic. If necessary the driver can readily take evasive action in an emergency, aborting the testing process. The only forms of traffic control necessary are a rotating yellow light and a warning sign mounted on the vehicle, and clearly visible from the rear.

Where traffic conditions do not allow operation at a constant standard speed of 50 km/h or 80 km/h (eg., at busy intersections and pedestrian areas), and a continuous survey is required through an intersection a separate traffic control may be necessary possibly using a site specific TCP or arranging with traffic signals staff to modify phasing temporarily. The officer responsible for organising the testing should seek advice or assistance from the local road maintenance works supervisor in this regard.

9.18.6 SCRIM

A SCRIM measures the skid resistance of a pavement at constant speeds. It is self contained and consists of a tank to hold water to wet the pavement, and equipment capable of measuring and recording the skid resistance. There are two crew members – a driver and an operator. The driver occupies the normal driving position, and the operator occupies the front passenger seat during testing.

During testing, the road in front of the test wheels is kept wet by a regulated flow of water from the tank and the vehicle travels at a constant speed of 50 km/h. Alternative speeds can be used for specific sites such as roundabouts. There are no workers outside the vehicle.

The driver is able to pay full attention to traffic conditions without affecting the testing process and the testing normally presents no obstruction to traffic. If necessary the driver can readily take evasive action in an emergency, aborting the testing process. The only forms of traffic devices necessary are a rotating yellow light and a warning sign mounted on the vehicle, and clearly visible from the rear.

Where traffic conditions do not allow operation at a constant standard speed of 50 km/h or the alternative speed of 20 km/h, (eg., at busy intersections and pedestrian areas), and a continuous survey is required through an intersection, a separate traffic control may be necessary, possibly using a site specific TCP or arranging with traffic signals staff to modify phasing temporarily. The officer responsible for organising the testing should seek advice or assistance from the local road maintenance works supervisor in this regard.

9.18.7 Falling Weight Deflectometer

A Falling Weight Deflectometer (FWD) is a trailer mounted device for measuring pavement strength. During transport between sites it is towed behind a light commercial vehicle, and can travel at normal road speeds. Typically there is one crew member – a driver/operator. There are no workers outside the vehicle.

During a test the FWD is stationary. A test takes about a minute (from 45 seconds to 1 minute 30 seconds), and the spacing of tests varies typically from 20 m to 100 m. During testing the FWD progresses at an average rate of between 0.5 km/h and 3 km/h. The speed of progression for 50 m test spacing is about 2 km/h.

Traffic control for FWD testing should normally be set up as mobile work with an Advance Warning Vehicle and where necessary a Lead Vehicle and Traffic Controllers. A Shadow Vehicle is not needed for FWD testing. Traffic control as short term work may be suitable in some circumstances.

Table A–10, *TCPs for Deflectograph and FWD testing* (Appendix A) shows TCPs suitable for FWD testing.

9.18.8 ROADCRACK ™

The ROADCRACK ™ equipment detects, measures, and classifies road cracking in real time and at highway speeds of up to 100 km / h.. The equipment consists of specialised digital image technology which is mounted on a truck. There are two crew members – a driver and an operator. The driver occupies the normal driving position, and the operator occupies the front passenger seat during testing.

Testing is conducted at speeds of up to 100 km/h, depending on the speed limit at the test site. Speed may vary during the testing, and generally the test vehicle travels with the traffic flow. There are no workers outside the vehicle.

The driver is able to pay full attention to and respond to normal traffic conditions without affecting the testing process. If necessary the driver can readily take evasive action in an emergency, aborting the testing process. The testing normally presents no obstruction to traffic.

The only forms of traffic control necessary are a rotating yellow light and a warning sign mounted on the road testing vehicle, and clearly visible from the rear.

9.18.9 GIPSICAM

The GIPSICAM van is a special-purpose vehicle for taking road survey videos whilst measuring position and geometry as it drives along the road at speeds up to 80 km/h. It is a light panel-van fitted with special equipment within the van and on the roof.

There are two crew members – a driver and an operator. The driver occupies the normal driving position, and the operator occupies the front passenger seat during surveys. Setting up for a survey run is done at a safe parked position, at which the driver and operator shall wear approved high visibility external clothing whilst working outside of the van in the vicinity of traffic.

Surveys are conducted at speeds of up to 80 km/h, subject to the local speed limits. Speed may vary during the survey, but the van generally travels with the traffic flow up to 80 km/h. There are no workers outside the vehicle during a survey run.

The driver is able to pay full attention to and respond to normal traffic conditions without affecting the surveying operation. If necessary the driver can readily take evasive action in an emergency, which may involve aborting the survey. Safety overrides technical operation at all times and the driver is fully responsible in this regard.

The surveys normally present no obstruction to traffic, but the van will pull over if there is any unreasonable impediment to other road users. The only forms of traffic control necessary are rotating yellow lights and warning signs mounted on the van, and clearly visible from the rear. The rear facing signs are "CAUTION – ROAD SURVEY VEHICLE" (black on red), "CAUTION VAN MAY SLOW" (black on red) and "PASS WHEN SAFE" (black on yellow).

9.18.10 ROCOND

Road condition (ROCOND) monitoring (also known as ROCOND rating) is a manual method of assessing and recording the overall condition at a point in time of a section of road.

ROCOND monitoring is carried out by visual observation of road features. ROCOND rating involves two people (ROCOND raters) travelling in a light vehicle and stopping intermittently to walk on the road.

Only one of the ROCOND raters is to be on the road pavement when outside their vehicle. The other ROCOND rater is to act as a lookout. The spotter is to be positioned off the pavement adjacent to the rater who is on the pavement.

For traffic control purposes, ROCOND rating is usually intermittent work, as described in Section 9.1, *Intermittent work, Planned work, where a spotter shall be used.*. Where requirements for planned intermittent work cannot be met, then work is to be abandoned and a mobile work traffic control system put in place.

in a mobile work traffic control system Shadow Vehicles and Advance Warning Vehicles are necessary. A Lead Vehicle may also be necessary on a two–way carriageway. The raters light vehicle may be used as the Shadow Vehicle provided it is fitted with appropriate signs.

9.19 Mobile work

Mobile work is defined as work which entails vehicles moving along the roadway continually and at a speed significantly lower than other traffic. Signs and devices are either vehicle mounted or are regularly moved along the road. Examples of mobile works are linemarking, placing of raised pavement markers and pavement testing. The following sections describe the vehicles used for mobile work, their purpose and positioning.

9.19.1 Definitions and purposes

A mobile works convoy is composed of Lead Vehicles, Work Vehicles, Shadow Vehicles, Tail Vehicles and Advance Warning Vehicles.

A **Lead Vehicle** precedes a work area and has four main purposes:-

- it warns oncoming traffic of the work, and
- it can divert oncoming traffic around the work area, and
- the driver can alert following workers early to any impending danger from oncoming traffic, and
- it can shield workers from approaching traffic.

A **Work Vehicle** is the vehicle or item of plant which undertakes the work (eg a linemarking machine) or supports the workers on foot behind it.

A **Shadow Vehicle** follows closely behind the work area as the work progresses. Its main purpose is to shield from traffic those workers who are not in vehicles but are working on foot behind the work vehicle. This vehicle travels a clear distance of 20 to 40 metres behind the Work Vehicle.

A **Tail Vehicle** follows some distance behind the work area. The main purposes of a Tail Vehicle are:-

- it warns following traffic of the work, and
- it diverts traffic around the work area, and
- the driver can alert workers to any impending danger
- to pick up any cones placed on the wet paint.

An **Advance Warning Vehicle** is positioned about 1 km in advance of the work convoy to give advance warning to approaching traffic.

9.19.2 Operating principles

Lead vehicle

This vehicle is not required:-

(i) on very low volume rural roads where speeds are generally below 80 km/h and sight distance is at least 2Dm

(ii) on urban residential, collector or commercial streets where speeds are generally below 60 km/h.

Advance warning

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

I. Where sight distance is good:-

   a. Lead vehicles travel200 m to 400 m in rural areas or 30 m to 100 m in urban areas in advance of the work vehicle

   b. Tail vehicles travel 500 m to 700 m in rural areas or 200 m to 300 m in urban areas behind the work vehicle or shadow vehicle if one is being used.

II. Where sight distance is poor:-

   a. The lead vehicle shall move as necessary beyond the distances given in (i) above 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.

Work on two way roads

(i) Wherever practicable, following traffic shall be directed to pass to the left of the work convoy by flashing the left barb of the flashing arrow sign.

(ii) Where it is not possible for traffic to pass to the left and opportunities to pass to the right do not exist the work shall be stopped periodically by pulling off the traffic lane and allowing following traffic to pass. In this case the warning mode of the flashing arrow sign is to be displayed.

Work on freeways

A second tail vehicle shall be considered for work on freeways. The two vehicles shall be arranged to form a mobile taper with the first vehicle travelling to the left or the right of the occupied lane and the second (nearer the work vehicle) travelling in the occupied lane.

Supplementary vehicle-mounted signs

Additional signs, such as **LINE MARKING** or **ROAD PLANT AHEAD**, may be used on vehicles displaying a flashing arrow sign. If necessary, these signs may be non-standard in size being tailored to suit mounting arrangements. They shall, however, have legends of sufficient size to be able to be read by road users at a distance of at least Dm.

9.19.3 Workers on foot

To give maximum protection to workers on foot, work vehicles and shadow vehicles should be positioned in line with the right or left boundary of work area, depending on which is more exposed to traffic. In some cases the lead vehicle or shadow vehicle or both may be partly within the lane of oncoming traffic.

Advance warning Vehicles should mostly be positioned in the same lane or straddle the same line as the work vehicle. However for work near the centre of a multi–lane undivided road and near the median on a divided road, the Advance Warning Vehicle should be to the right of the carriageway to divert traffic around the left of the work area.

When using Flashing Arrow Signs in conjunction with works on two lane, two way roads, or in short overtaking or climbing lanes ensure that the arrow is turned off and that the warning mode is turned on. On multilane roads the arrow can be flashed to the direction where it is safe to pass.

9.20 Working in the vicinity of railway lines

To ensure compliance with Rail Safety Act 2003 and duty of care under the Occupational Health and Safety Act 2000. The safety procedures outlined here are to be applied whenever work is carried out in the Rail Corridor.

9.20.1 Definitions

- **Rail Infrastructure Corporation (RIC) -** The owner and Maintainer of the rail Network
- **Rail Corridor -** The area within rail boundary fence lines, or if there are no fences, everywhere within 15 metres of the outer most rails.
- **Rail traffic -** Trains and all other on track vehicles
- **Protection Officer -** The RIC authorised qualified worker responsible for protection, and to ensure safe interaction of work at the site, and the RIC Network.
- **Danger Zone -** Everywhere within 3 metres horizontally from the nearest rail and any distance above or below this 3 metres.

9.20.2 Working within the rail corridor

If the situation is such that either employees, contractors, plant, equipment or materials are located within <u>or are likely to be within the </u>Rail Corridor.

Then the manager authorising the work is responsible for ensuring that:-

- The Rail Infrastructure Corporation is advised
- Where required, arrangements are made for RIC to provide a protection officer to ensure the safe interaction between the work and the RIC Network.

That the site supervisor understands that where a RIC protection officer is provided:-

- They must follow the Protection Officers instructions; and
- Work is not to be carried out if the protection Officer is not on site.

The supervisor in charge of the site is responsible for ensuring that:-

- All persons (RTA staff and contractors) on site understand the need to follow the protection officers instructions.
- Compliance with the Protection Officers instructions, and
- Work is not carried out within the Danger Zone when the Protection Officer is not present on site

The workers on site (whether RTA, council, contractors, public utility bodies) are responsible for:-

- Working in accordance with the protection Officers instructions, and
- Not entering the Danger Zone when the Protection Officer is not present on site.

9.20.3 Separated by physical barriers.

If the manager authorising the work is satisfied that there is a physical barrier of solid construction to prevent any possibility of persons or their equipment from coming into contact with rail traffic or overhead wiring. Then there is no need to notify RIC or arrange for the presence of a Protection Officer, even though it is within the Rail Corridor.

Note! High visibility plastic containment fencing, mesh or boundary tape are not physical barriers

The supervisor in charge of the worksite is responsible for ensuring that the requirements set out in section 9.20.2 are immediately applied. Should the physical barrier be dismantled or damaged in such a way as to allow the possibility of persons coming into contact with rail traffic or overhead wiring.

Persons on site are not to damage or attempt in any way to overcome a physical barrier.

9.20.4 Work outside the rail corridor

Where work is situated outside the Rail Corridor as defined above, and the manager authorising the work is satisfied that persons, plant, equipment and material are unlikely to intrude into these distances, then there is no need to notify RIC. However if the work may effect the strength of the railway line or it's structures. RIC must be notified.

9.21 Detours, sidetracks and crossovers

Where it is not possible to move traffic through or around a work area the following forms of traffic detours should be considered:-

sidetracks –a temporary roadway constructed near the existing roadway and may cater for one or both directions of travel

detours - using existing roads and may cater for one or both directions of travel

crossovers - used with divided roads where one carriageway is converted to a two way road

detours for heavy or over-dimensional vehicles - shall be able to cater for heavy, high or long vehicles.

In choosing the type of treatment to use the following points need to be considered:-

- approval shall be sought from the maintaining authority to use any detours
- the pavement on detours shall be of sufficient structural strength to carry the loads and traffic volumes expected
- the pavement on detours shall be monitored to ensure that any damage is quickly rectified
- the width of a detour and its alignment shall be adequate for the expected traffic types and volumes
- provision shall be made for pedestrians, bicycles, wheelchairs and public transport
- access shall be provided for local traffic
- adequate delineation shall be provided on sidetracks as follows:-
  - (i) 20m spacing on straights and curves greater than 200m radius
  - (ii) 6m and 12m on the outside and inside respectively of curves up to 200m radius
  - (iii) on low volume roads up to 100m on long flat straights, up to 50m on short and undulating straights and up to 25m on curves greater than 200m radius.
- delineation on detours using existing roads may require upgrading
- signposting shall be clear and adequate
- **DETOUR AHEAD (T1-6)** signs shall be used to give advance warning of any detours.

NOTE: The establishment of long-term sidetracks would normally require some detailed design input.

9.22 Works on unsealed roads

9.22.1 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 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 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.

Maintenance grading 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. In no case shall a grader be permitted to travel on the right hand side of the road in the direction of grading, leaving insufficient room for an oncoming vehicle to pass. Working without leaving a windrow is to be preferred whenever possible.

9.22.2 Working without leaving a windrow

If sight distance to the grader's vehicle mounted warning device is at least 250m throughout the length of road being graded, no advance warning signs are required. Slippery (T3-3) signs may be required if the freshly graded surface has loose material which may be a hazard.

If the sight distance falls to less than 250m at some locations along the road being graded or the grader may be hidden by dust, advance GRADER AHEAD (T1-4) and NEXT 2 km (T1-28) signs shall be used at each end of road sections covering those locations as indicated for frequently changing work areas, see Section 9.1.8.

9.22.3 Leaving a windrow

For oncoming traffic, the requirements and recommendations of Section 9.22.2 apply.

For following traffic, the sign GRADER AHEAD (T1-4) shall be placed 100m in advance of the windrow. Slippery (T3-3) signs may also be required. If the windrow is likely to be a hazard a warning shall be provided by means of a narrow temporary hazard marker (T5-5) placed on the windrow at its start, directing traffic to travel to the left of the windrow.

(**NOTE**: The NEXT 2 km sign is not required where a windrow will act as a constant reminder of the work ahead).

Where a windrow becomes too high for following traffic to cross in order 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.

9.22.4 Short term partial road closures

The following applies 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; and
- (iii) either-
  - (A) traffic volumes are very low; 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 but may be performed by a single traffic controller under the following conditions:-

- (i) there is a single lane section not exceeding 30 m in length.
- (ii) traffic volumes are not more than 400 vehicles per day.
- (iii) the traffic controller has a good view of traffic approaching from both directions when stationed at one end of the job.

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

NOTE: Extreme care shall be taken to ensure that any signs or devices left erected at night are clearly visible especially if dusty conditions can be expected.

9.23 Motorcyclists

9.23.1 General

Motorcycles travelling through work sites require additional consideration, particularly in terms of the road surface provided. Motorcycle handling characteristics are different from cars and they are less stable than other vehicles on loose and slippery surfaces. They are also unable to brake heavily on curves.

Signage for the site should adequately identify road surfaces that are different to that on the approach. Particular hazards to motorcyclists include unsealed surfaces, unexpected sections of wet roads and loose gravel, especially in areas where braking and turning is required.

9.23.2 Road surfaces

Surface changes can be critical to motorcycle stability and it is essential that the changes be signposted well in advance so that the motorcyclist is not forced to take rapid or unexpected evasive action.

Where sections of sealed roads are temporarily reduced to gravel the warning sign **GRAVEL ROAD** (T3-13) shall be erected where sight distance to the change in surface is less than 1Dm or where the surface is unusually rough or loose. Similarly, where it is necessary to water the surface of the road the road condition sign "Slippery" (**T3-3**) shall be erected where sight distance to the wet surface is less than 1Dm.

Care should be taken to ensure that potholes are patched as quickly as possible and that loose gravel and aggregates are swept from road surfaces.

9.23.3 Grooved roads

Milling of roads prior to resurfacing may present a hazard to motorcyclists. Where road surfaces are grooved warning signs **CYCLE HAZARD GROOVED ROAD** (T2-207) shall be erected on all approaches. Where grooving is carried out on roads with curved alignments it may be necessary to impose roadwork speed zones to help improve motorcycle safety.

9.23.4 Steel plates

Steel plates used to cover excavations shall be coated with a skid resistant treatment. The plates shall be of sufficient thickness to not deflect significantly under the weight of fully loaded trucks. The plates shall also overlap excavations by at least 400mm on each side.

9.23.5 Drainage

Care shall be given to the drainage of roadworks such that water does not run across traffic lanes to a depth greater than 5mm.

9.24 Field work for office based staff

The following contains broad procedures to be followed by office based staff during routine periods of field work which places them in proximity to traffic and/or mobile plant. Supervisors of office based staff engaged in such field work are to ensure that all office staff have been properly trained in these procedures and the procedures in this Manual specifically referred to below.

9.24.1 General

The purpose of this Section is to provide guidelines for safe working practices for office based staff when they are undertaking field work, which places them in proximity to traffic and/or mobile plant. The range of personnel expected to use these guidelines includes design office, laboratory, survey, property survey, general engineering and traffic engineering staff. It is to be used where personnel undertake field trips for the purpose of inspections, surveys, sampling, photographing etc.

9.24.2 Risk assessment

Prior to undertaking field trips personnel are to identify, as completely as possible, the hazards associated with the proposed work and work site and assess the risks posed by those hazards. Some hazards may only be evident on site so care is needed to ensure that these are identified before commencing work. Also conditions may vary during the course of the work or from the time of initial hazard identification, so continuous re-assessment is essential.

Whilst engaged on field work near traffic it is necessary to be aware of the unexpected. Normal behaviour must be exercised regarding road rules, and common sense must be used at all times. For instance it is unwise to cross from one side of the road to the other, mid-block, if traffic control signals are within a reasonable walking distance.

Due regard should be given to the impact field work may have on the safety of other road users including pedestrians. The safe and unambiguous passage of the public through the work site must be maintained.

The following list is not exhaustive but gives guidance to some of the issues that need to be considered:-

- will the work be done clear of traffic, adjacent to traffic, on trafficked roads, or on work sites with mobile plant
- can the work be done without obstructing traffic - if no, then traffic control is required
- what is likely to be the approach speed of traffic - obviously the higher the speed the less time there will be to work on the road between gaps for intermittent work
- what is the traffic volume likely to be at the time of the work
- how close to traffic will the work be undertaken
- what will be the sight distance
- are there any nearby intersections, driveways, bus stops etc
- the most appropriate methods to prevent the risk of injury. For example, work methods, timing of work, duration, use of available technology, appropriate personal protective equipment

- possible programming to coincide with traffic control for associated activities (eg survey).

When undertaking work where there is an impact on traffic, a TCP and specialist traffic control will be required.

9.24.3 Work clear of traffic and plant

Work is often undertaken at locations clear of road traffic and plant. Examples of such locations are:-

- within road reserves of existing trafficked roads, between the reserve boundary and the nearest shoulder or kerb
- within future road deviations.

Precautions to be taken are:-

- approved high visibility safety garments, as specified in the RTA's current occupational health and safety policies, must be worn within road reserves of existing trafficked roads
- any vehicles must be parked clear of any trafficked lanes such that the safety of all people is appropriately managed.

9.24.4 Intermittent work

Examples of work covered by this section may be

- road surface inspections
- photographing features
- taking measurements
- survey reflector holding
- spray painting chainages etc.

In undertaking intermittent work on trafficked lanes follow the guidelines in Section 9.1, *Intermittent work and mobile inspections*.

9.24.5 Work adjacent to trafficked roads

This is work, which may be of a similar nature to that covered in Section 9.24.4, but which is undertaken adjacent to traffic, either on footpaths, shoulders or medians. Approved high visibility safety garments, as specified in the RTA's current occupational health and safety policies, must be worn by all workers

Work on footpaths and wide medians (refer to Section 9.10, *Working on medians* and Section 9.11, *Working on roadsides*) may be undertaken without lookouts. Care must, of course, be exercised in crossing trafficked lanes to reach medians or opposite footpaths. Where work is on road shoulders or narrow medians consideration should be given to the use of lookouts as detailed in Section 9.1.

9.24.6 Work on trafficked roads

Where work is being undertaken on trafficked lanes, such that it obstructs traffic, full traffic control measures must be put in place. This would usually involve the engagement of suitable traffic control by an RTA certified contractor (either external or RTA) on a contract basis. The organisation supplying the traffic control is to be responsible for:-

- the selection of a standard TCP or the design and approval of a new TCP appropriate to the work and location
- the implementation of that TCP for the duration of the works including the provision of all signs and devices and control by trained and qualified personnel.

Some examples of work that may require full traffic control are:-

- pavement sampling
- road spotting for linemarking
- detailed longitudinal surveying.

9.24.7 Working adjacent to plant

Work is often required to be undertaken by office personnel on construction and maintenance sites where there is moving plant. All visits to such sites must be made with reference to the person responsible for the work at the site to ensure safety and that the planned visit will not unduly interfere with site activities. For instance, it would be unacceptable to visit a site unannounced and expect full traffic control for work to be undertaken. Procedure to follow with the person responsible:-

- determine a mutually acceptable date and time for the site visit
- indicate the nature and location of the work to be undertaken
- indicate if any site resources are required.

At the time of the agreed site visit do the following:-

- locate and report to the person in charge of the site who will advise who will provide the site induction
- confirm the reason for your presence on site
- secure any site resources that have been agreed upon
- follow all relevant site procedures and all reasonable requests of the supervisor, including vehicle movement procedures

Examples of work that might be covered by this Section are:-

- construction set-out and verification
- quarry sampling
- material testing.

9.24.8 Mobile inspections

If the inspection vehicle maintains a speed which is less than 20 km/h below the speed limit, it may travel in the traffic stream and no specific protection is required

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 at least one rotating yellow light.

If the inspection vehicle is required to block or partially block a traffic lane continuously at speeds lower than in 5.6 (a) it shall operate as a mobile works convoy. This type of work would not normally be carried out by office staff.

9.24.9 Working at night

To be read in conjunction with Section 9.2, *Working at night*. Additional to day time requirements are:-

- wearing of high visibility reflective clothing suitable for night time work
- use of night time signs as required
- appropriate lighting as required.

9.24.10 Safety equipment

Vehicles used by staff in undertaking field work in close proximity to traffic should be equipped with at least the following:-

- antiseptic wipes and a first aid kit
- approved high visibility safety garments
- safety triangles or cones
- a magnetic roof mounted rotating yellow light.

9.25 Repair and servicing of plant

9.25.1 General

The purpose of this Section is to provide guidelines for safe working practices for personnel when they are repairing, servicing, transporting, testing or refuelling plant or vehicles in the field in close proximity to traffic or mobile plant. The range of personnel expected to use these guidelines includes, plant mechanics carrying out repairs or servicing, float operators moving plant, inspectors engaged in the inspection, evaluation and or calibration of plant and refuelers.

9.25.2 Principles

Personnel listed above must remember that it is not their primary function to be traffic controllers. If the repair or servicing of plant or vehicles requires traffic control then this should be requested from and provided by the operations organisation responsible, in the form of fully qualified controllers using approved traffic control plans.

As a general principle plant personnel should:-

- wear approved high visibility protective clothing
- turn on flashing yellow lights where fitted to the repairers vehicle and item being repaired.
- ensure a suitable site is used (i.e. the site is level or if not then the plant or vehicle is immobilised by the use of park brake and chocks).

9.25.3 Work locations

The repair, servicing, testing or refuelling of plant or vehicles is generally required at one or more of the following locations. The procedures detailed are to be followed at those locations or the plant or vehicles moved to a more suitable location.

(a) Workshop

Where plant or vehicles are being repaired or serviced in designated workshops no specific procedures need be followed regarding working near traffic or mobile plant. Care must, however, be taken in moving the items into and out of the workshop and the procedures and safety guidelines applying to that workshop must be fully complied with.

(b) Depots and sub-depots

Where plant or vehicles are being repaired or serviced in designated depots or sub-depots where there is the expectation that other plant items or vehicles may from time to time be given access then the following procedures must be followed:-

- the item being worked on is to be moved to a separate part of the depot as directed by the site supervisor
- if it is not possible to move the item the site supervisor will arrange to protect the area around the worksite using the repairers' vehicle, barrier boards or other means. Plastic containment fencing may also be used to exclude pedestrians but it must be remembered that it is not a vehicle barrier device. (See Figure 9.1)

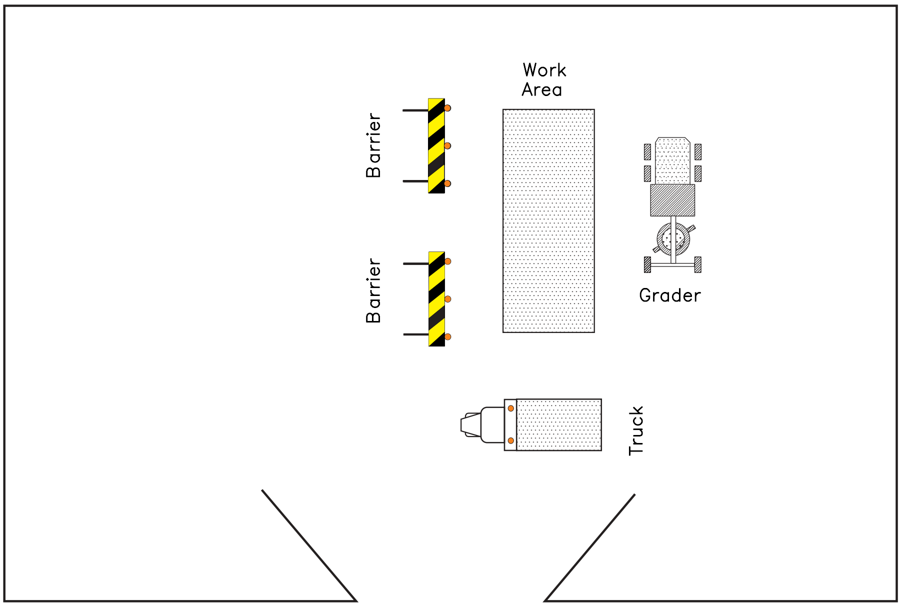

Figure 9.1 – Method of worker protection when repairing plant in depots

(c) Remote locations

Where plant or vehicles are being repaired or serviced at remote locations, such as gravel pits or stockpile sites, it is necessary to determine if that location is currently being worked. If it is then use the principles stated for depots and sub-depots as above.

If the location is not currently being worked then the following procedures need to be employed:-

- be on the alert for errant vehicles entering the site if access to them is not denied
- if the site has gates or booms close and, if possible, lock them to prevent access
- park the repairers vehicle in such a way as to provide the most protection to the workers.

(d) Locations clear of through traffic

Where plant or vehicles are being repaired or serviced at locations such as rest areas or heavy vehicle checking stations where there is the expectation that other plant items or vehicles may from time to time be given access then the following procedures must be followed:-

- the item being worked on is to be moved to a part of the site as directed by the site supervisor who will arrange any other traffic control precautions as deemed necessary
- if it is not possible to move the item the site supervisor will arrange to protect the area around the worksite using the repairers' vehicle, barrier boards or other means. Plastic

containment fencing may also be used to exclude pedestrians but it must be remembered that it is not a vehicle barrier device. (See Figure 9.1 for general principles.)

(e) Road shoulders or breakdown lanes

Extreme caution must be exercised when attending to plant items or vehicles on road shoulders or breakdown lanes. If items are capable of being moved they shall be moved to locations that are at least 3 metres clear of the through traffic. If the items are not capable of being moved then Table 9.4 gives advice, based on the distance from passing traffic and the speed of that traffic, on:-

- whether full traffic control (TC) is required to be provided by qualified traffic controllers
- the maximum length of time the item may be worked on to effect emergency repairs to move or restart the item

Approach speed of traffic km/h	Distance from edge of trafficked lane in metres		
	0 – 1.2	1.2 – 3.0	>3.0
110	TC	10 minutes	Nil
100	TC	10 minutes	Nil
90	TC	10 minutes	Nil
80	TC	10 minutes	Nil
70	TC	10 minutes	Nil
60 or less	10 minutes	Nil	Nil

Table 9.4 Conditions for work on road shoulders or breakdown lanes

Note: Visibility and conditions should be taken into consideration when using the table above.

TC Work may only proceed if a full and approved traffic control plan is implemented by trained traffic controllers.

Minutes Indicates the maximum number of minutes that may be worked under the existing conditions to effect emergency repairs

Nil No extra precautions are required under these conditions.

(f) Traffic lanes

If a plant item or vehicle has broken down in a trafficked lane and cannot be moved then repairs can only be undertaken if full traffic control is provided by qualified traffic controllers.

However, if the lane blockage is such that it presents a danger to other road users, for instance if it occurs around a bend with poor visibility, some action should be undertaken. This is dealt with in **4.8, Dangerous situations**.

(g) Construction sites

When repairing or servicing plant on construction sites you should always report initially to the site supervisor. If it is your first visit to the site you will be given a site induction. The site supervisor will provide assistance to ensure that the item of plant is either:-

- removed to a location clear of other mobile plant or vehicles
- or protected by using barrier boards or similar devices. Plastic containment fencing may be used to exclude pedestrians from the area. (See Figure 9.2 for general principles.)

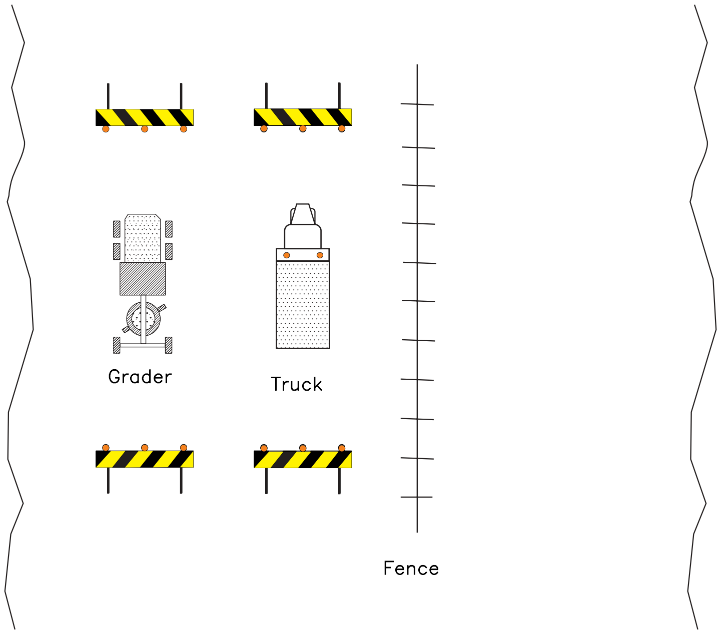

Figure 9.2 – Method of worker protection when repairing plant on construction sites.

(h) Dangerous situations

Emergency situations may arise not only as a result of lane blockages by broken down plant items or vehicles but blockages due to accidents, oil spillages from vehicles, fallen trees etc. Bearing in mind the limited traffic warning devices that you are likely to be carrying when encountering such conditions the following general procedure is to be adopted:-

- offer assistance to the person in control of the situation and follow all reasonable requests bearing in mind the level of qualification you might have in controlling traffic
- if you are the first on the scene stop your vehicle in the travel lane with all flashing lights on and immediately begin warning traffic approaching to slow down. Where possible you and your vehicle should be located to achieve a minimum sight distance to approaching traffic of 2.5 times the approach speed of the traffic in metres (2.5Dm)
- call for support from the appropriate operations area
- set up warning signs (eg. Traffic Accident Ahead, Prepare To Stop) in advance of the anticipated end of the traffic queues, to provide adequate warning to approaching traffic that a traffic queue ahead may exist. The length of the traffic queue and the location of appropriate warning signs will require periodic monitoring.

You must exercise extreme caution during any of these activities.

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10.1 Introduction

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

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

10.2 Requirements and legislation

Section 51 of the Road Transport (Safety and Traffic Management) Act 1999 states that ".....a person has appropriate authority to install or display (or the interfere with, alter or remove) a prescribed traffic control device if the person is a public authority that has been directed by the Authority to install or display (or to interfere with, alter or remove) the device". Councils have delegated authority to use portable traffic signals for some purposes. No other authority or person has been given such a direction. **This means that public utility authorities and contractors working on public streets have no delegated authority in themselves to use portable traffic signals.**

Section 50 of the Transport Administration Act 1988 allows for the RTA to delegate such functions as the use of portable traffic signals (subject to any limitations or conditions). In the case of the RTA, the existing delegation covers traffic signals and is at the Unit Manager level.

A general condition applying to all delegations will be that portable traffic signal equipment used complies with Specification PTS/3A. Specification PTS/3A requires that each set of type approved signals has an information plate indicating that approval has been obtained. A list of type approvals is held by RTA's Traffic Asset Services . In addition, the equipment is to be operated in accordance with this section and the manufacturer's instructions. A record (refer to Table 10.7) must be kept of the approval and the period of operation of the traffic signals and may be required in Court in case of an accident or traffic infringement.

The existing delegated authority to local Councils covers traffic signals. A public utility authority that wishes to use portable traffic signals will need to apply to the relevant Regional Manager of the RTA for authorisation to do so. A public utility authority or contractor would commit an offence by the use of portable traffic signals without appropriate authorisation.

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

10.3 Specifications

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

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

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

Copies of Specification No. PTS/3 are available from the RTA's Traffic Asset Services Section upon request and prior type approval of the equipment is also to be obtained separately from the:-

Manager, Traffic Asset Services
Roads and Traffic Authority NSW
Telephone (02) 8814 2350
Facsimile (02) 8814 2873

10.4 Definition of terms

See also, Section 2.3, *Definitions*.

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

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

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

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

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

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

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

Display – an aspect which is illuminated/

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

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

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

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

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

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

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

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

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

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

10.5 Approvals

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

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

10.6 General description of system

Each set of equipment will normally comprise:-

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

10.6.1 Shuttle operation

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

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

10.6.2 Heavy machinery crossing

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

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

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

10.7 Signposting and traffic arrangements

10.7.1 General

TCP’s 43, 44 and 59 illustrate the use of portable traffic signals.

Since the use of portable traffic signals may require a large proportion of vehicles to either stop or slow considerably, it is critical that the correct signs be erected in the correct sequence. Signs should be located in clear view of approaching drivers, generally on the left side of the road. However, on winding alignment it may also be necessary to erect a sign or signs on the right hand side. Consider pairs of signs, one on each side of the road, when a driver's view may be obscured by alignment, buildings or traffic. Consider the use of larger signs for high approach speeds.

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

10.7.2 Temporary speed limits

A roadwork speed limit of no higher than 80 km/h shall be imposed if the signals would otherwise be in a higher speed limit zone. Roadwork speed limits require the approval of an RTA Unit Manager. See Section 8.2, *Roadwork speed zones*.

10.7.3 Sight distance

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

10.8 Equipment installation

10.8.1 Signal lanterns

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

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

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

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

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

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

10.8.2 Signal stands

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

10.8.3 Controller

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

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

- power: ON/OFF
- master/slave selection
- mode selection:-
  - ♦ manual (shuttle operation)
  - ♦ manual (two way operation)

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

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

10.8.4 Communication

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

10.8.5 Vehicle detectors

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

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

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

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

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

It must be emphasised that the detector should be positioned in such a way that its beam axis is pointed at the centre of the target area and at a distance of approximately 25 to 35 m ahead of the unit. For single lane approaches it is suggested that the unit be aimed more towards the road edge. This will result in an increased “sensitivity” to the desired vehicular movements but at the same time decrease the sensitivity to vehicles travelling away (on the departure side of the street). Although the departing vehicle will not produce a detection output, it can cause a “swamping” or masking of a signal being reflected by an approaching vehicle.

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

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

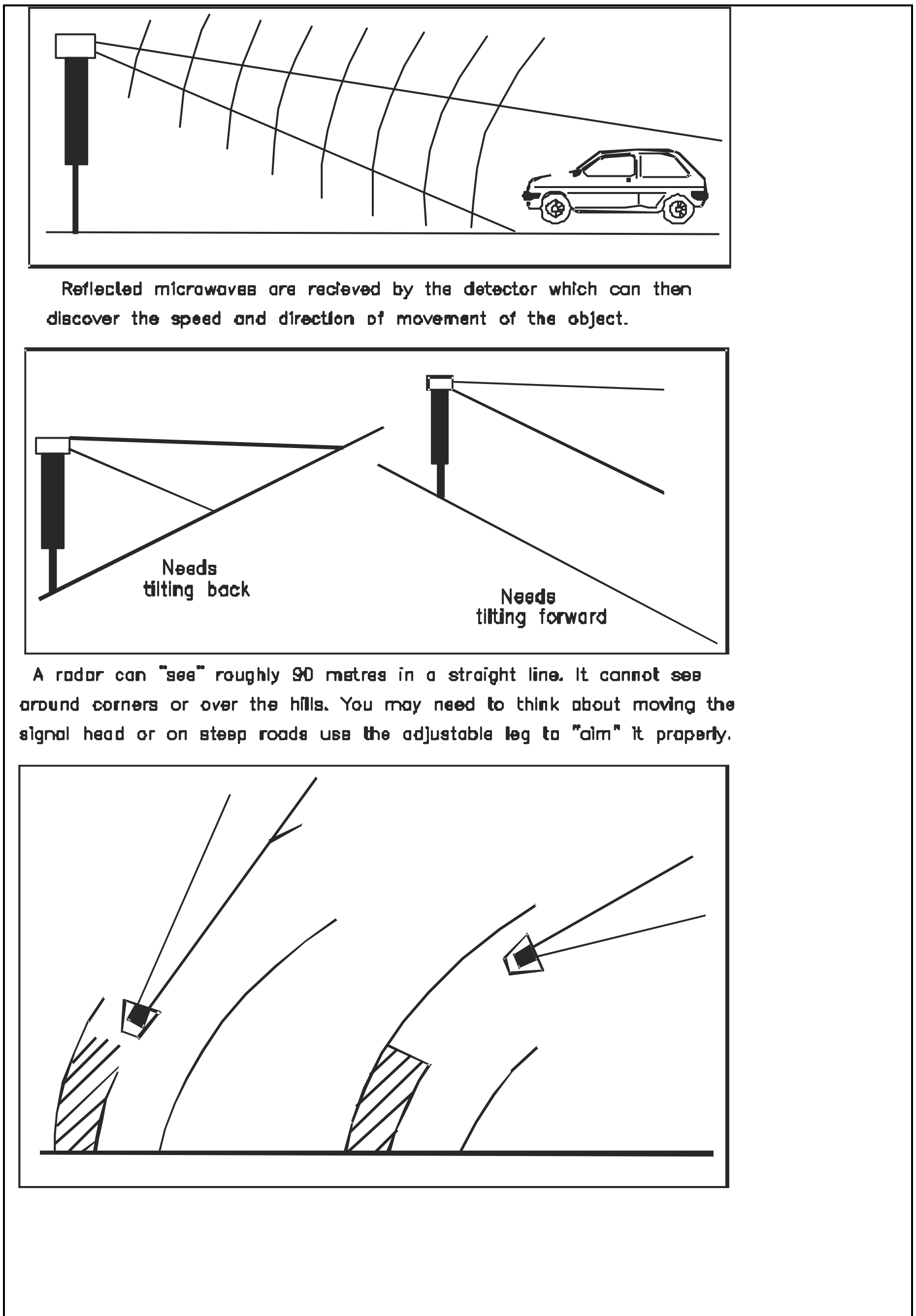

Figure 10.1 – Illustration of microwave detector operation

10.9 Manufacturer's instructions

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

Field service usually covers:-

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

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

10.10 Performance

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

10.10.1 Manual Mode (Shuttle Operation) (MAN/1)

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

Manual shuttle operation is applicable when:-

a) movement of works traffic prevents the effective use of vehicle–actuated or fixed–time operation, or

b) a detector fails, when using the vehicle– actuated mode and it is not desired to use fixed–time mode.

10.10.2 Manual Mode (Two–way operation) (MAN/2)

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

Manual two way operation is applicable when:-

a) all traffic needs to be stopped to allow the passage of traffic on a haul road

b) traffic must be kept out of the work area for an extended period, eg. during blasting, priming or full width bitumen sealing.

10.10.3 Vehicle–actuated operation (VA)

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

Vehicle–actuated operation is applicable when:-

a) automatic control is required during working hours – this allows the signals to operate unattended while still being responsive to changes in traffic flows, or

b) traffic control is required outside working hours – the signals can operate unattended provided the power supply is maintained.

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

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

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

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

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

b) after all phases have been called automatically for the first cycle, the signals will change only in response to vehicle demands

c) if vehicles approach consistently from only one direction, the controller holds the green display on that approach

d) when a vehicle is detected on another approach, the signals can change in one of two ways:-

   i) when vehicles approach the first phase as a steady stream, the phase holds for the "maximum green" time before changing to the new approach, or

   ii) when the gap between vehicles approaching the first phase is greater than 5 seconds, the signals will change to the new phase, subject to the limitations of the 15 second "minimum green" time, and after the selected yellow and all–red times.

e) In the absence of any demand, the signals will revert to "all–red" until a vehicle is detected. This feature ensures that the signals are then able to give right–of–way to the first approaching vehicle with minimum delay.

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

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

10.10.4 Fixed–time operation (FT)

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

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

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

10.10.5 Limitations on use of microwave detectors

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

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

To clear these vehicles it is necessary to either:-

a) wait until a new vehicle joins the queue and actuates the detector, or

b) change to manual operation (once traffic is running again, the controller can be returned to vehicle–actuated operation), or

c) wait until the controller (or detector) puts in an artificial demand (it is programmed to place such an artificial demand approximately 200 seconds after the phase was last demanded).

10.10.6 Flashing yellow feature

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

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

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

10.11 Operation

10.11.1 Control modes

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

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

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

10.11.2 Time settings

General

These are shown in Table 10.2

Mode	All red	Minimum green	Maximum green	Yellow
MAN/1	M	F	M	S
MAN/2	M	F	M	S
FT	S	F	S	S
VA	S	F	S	S

F Fixed at 15 seconds

M Set the manual control switch each cycle

S Needs to be selected and pre–set by the operator for each site

Table 10.2 – General time settings

Yellow time

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

Approach speed	Yellow time
Below 70 km/h	4 seconds
Above 70 km/h	5 seconds

Table 10.3 – Yellow time settings

All red time

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

Maximum green time

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

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

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

Table 10.4 – Initial signal time settings (low speed)

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

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

Table 10.5 – Initial signal time settings (high speed)

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

10.11.3 Setting up

a) Set up stands with signal aspects facing oncoming traffic.

b) Connect controller to the generator and start generator
DO NOT SWITCH CONTROLLER ON.

c) Set red & green times as required.

d) Select mode switch.

e) Ensure that the shuttle lane or haul road is clear and then switch on controller.

f) Controller will serve each phase in turn, clearing the initial demand.

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

10.11.4 Trouble shooting in VA mode

Details are shown in Table 10.6

Problem	Possible cause	Remedy
Long queues	1. Green setting too short. 2. Detector fault. 3. Road capacity exceeded.	1. Increase setting. 2. Call service. 3. Call Supervisor.
Signals do change after one stream has stopped even though traffic is waiting.	Detector fault.	Call service. Operate signals in manual or FT mode until service arrives.
Green period always same length.	1. Detector fault. 2. Green setting too short. 3. Traffic flow very light. 4. Traffic flow too heavy.	1. Call service. 2. Increase green time setting. 3. No action. 4. Call Supervisor.
Traffic still in shuttle lane at start of opposite green.	1. Traffic running the red light. 2. All–red setting too short.	1. Call police. 2. Increase all–red setting.
Long gap between last vehicle clearing shuttle lane & start of next green.	1. All–red setting too long. 2. Detector fault.	1. Decrease all–red setting. 2. Call service.
Signals do not remain on red in absence of traffic.	Detector fault.	Call service.

Table 10.6– Trouble shooting in VA mode

10.11.5 Examples

Site Details

Work area 100m long, rural highway situation:-

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

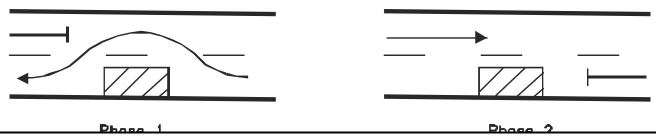

Figure 10.2 – Illustration of site layout

a) Example of selecting times for "Fixed–Time" operation

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

- Yellow 5 seconds
- All–red 25 seconds
- Max. green

  Phase 1 45 seconds

  Phase 2 45 seconds

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

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

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

- Adjust "max. green" times for the two phases:-

  Phase 1 – 15 x 3 = 45 sec

  Phase 2 – 6 x 3 = 18 sec (use the minimum setting of 20 sec)

- Check regularly that vehicles are not experiencing unnecessary delays due to incorrect settings.

b) Example of selecting times for "Vehicle Actuated" operation

(i) From Time Setting Instructions 10.11.2 and Tables 10.3 and 10.4 select initial controller settings as for FT operation.

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

- Check all–red setting as for FT operation.
- Time the green period for each phase using a stop watch. Assume the following green times were measured.

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

(iii) Try extending the max. green time for phase 1 by 5 to 10 seconds.

(iv) If Phase 1 is still running to its maximum green setting repeat Step iii.

(v) Check regularly that vehicles are not experiencing unnecessary delays due to incorrect settings.

10.12 Maintenance

10.12.1 General

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

10.12.2 RTA equipment

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

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

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

The Supervisor

Roads and Traffic Authority

Traffic Signals Workshop

129A Orchardleigh Street

Yennora 2161

Telephone (02) 8814 2677

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

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

<table>
<tr><td colspan="5">Portable Traffic Signals
Record of Approval and Use</td></tr>
<tr><td colspan="5">Approval: (To be completed by a person with delegated authority to give under Section 51 of the Road Transport (Safety and Traffic Management) Act 1999.

Approval is given to the use of portable traffic signals (which have been separately type approved to RTA specification, PTS/3– Part A, as revised 4/92) as detailed hereunder.</td></tr>
<tr><td colspan="3">Owner:..

User: ....

Project:..</td><td colspan="2">Signed:..

Title:..

Date: ....</td></tr>
<tr><td colspan="5">Use: (To be completed by the Users representative)

Job location:</td></tr>
<tr><td colspan="5">Portable signals in service</td></tr>
<tr><td>Date</td><td>Time
(24 hour)</td><td>Supervisors name, please print</td><td>Initials</td><td>Mode* of operation</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">This completed schedule should be kept by the relevant approving authority for a period of 2 years as a record of the display.

Note * MAN/1 – Manual Shuttle Operation
MAN/2 – Manual Two Way Operation
VA – Vehicle Activated Shuttle Operation
FT – Fixed Time Shuttle Operation</td></tr>
<tr><td colspan="5">Table 10.7 – Portable traffic signals, record of approval and use</td></tr>
</table>

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11.1 Introduction

This section provides the basic information to effectively use flashing arrow and warning signs to direct and warn traffic. It applies equally to both RTA and other bodies, such as councils, contractors and public utility authorities, working on roads. These signs comprise a matrix of lamps in the form of an arrow that is flashed in a cyclic manner to either the left or right, indicating the direction in which approaching vehicles are to pass. The flashing arrow sign may be vehicle or trailer mounted.

The equipment is to be operated in accordance with this section and with the manufacturer's instructions. As part of the daily routine tasks and record keeping, a log must be kept of the location and the period of display of the signs. This documentation may be required in Court in case of an accident or other incident such as a traffic infringement. Other bodies working on public roads are encouraged to follow these practices where they are applicable. Refer to Section 6, *Record keeping and reporting*, for more information.

The following section contains guidance for the use of flashing arrow signs on roads and gives a description of the operational features of the equipment. This includes details for the selection of appropriate operational modes and model situation diagrams showing the required signposting and site layout for the signs.

Flashing arrow signs are intended to be applied primarily where a lane is closed or a diversion of traffic is required typically on a multilane carriageway. They may also be adapted for mobile plant operation where only part of the road is blocked by the road plant but a clear direction to traffic is required as to which side of the plant traffic should pass through the mobile work site. An example of this is longitudinal linemarking.

Flashing warning lamps can also be used to provide additional impact to static signs and devices. The type of equipment covered by this section is generally intended for mobile and short–term traffic control applications. For sites where work will continue for longer than two or three months without the location of the work site changing and there is a need for flashing warning lamps to supplement static signs, consideration should be given to the installation of fixed flashing warning lamps if power is readily available rather than using trailer mounted flashing lamps.

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

11.2 Approvals and specifications

Before using flashing arrow signs on any public road or street in New South Wales, type approval of the equipment to RTA Specification FAS/4 (Part A) is required. Evidence that type approval has been obtained for a particular set of equipment can be made by checking that the flashing arrow sign has a prescribed marking plate as specified in clause 3.4 of FAS/4 (Part A). The format of the plate is shown in Table 11.1.

This equipment conforms to RTA – NSW TYPE APPROVAL No. ....

Table 11.1 – Type approval plate

Equipment Specification FAS/4 for flashing arrow signs is in two parts:-

- Part A – General Requirements (Issued August 1991).
- Part B – Special Requirements (Issued November 1991).

Part A of Specification FAS/4 covers the minimum requirements for traffic control and safety. These requirements apply to any user within NSW. Part B covers additional requirements for flashing arrow sign equipment used by the Authority's own personnel.

Requests for copies of Specification No. FAS/4 (Part A), *Flashing Arrow Signs,* and arrangements for type approval of the equipment should be directed to:-

Traffic Asset Services
Roads and Traffic Authority NSW
Level 1, 85 Flushcombe Road
BLACKTOWN NSW 2148
Telephone (02) 8814 2805
Facsimile (02) 8814 2873

11.3 Definitions

These definitions are specific to this section, see also, Section 2.3, *Definitions*.

Aiming distance – the distance between the flashing arrow sign and the eye of an approaching driver.

Cycle length – the time interval between the start of the lamps being switched on and off and then on again to give a complete sequence of displays.

Flashing arrow signs – flashing electronic traffic control signs and associated equipment used at work sites and operated in one of the following modes:-

Arrow right mode (AR) – the lamps are energised to display an arrow which directs traffic to move or merge to the right. It is usually used where the left lane of a two lane carriageway is closed to traffic.

Arrow left mode (AL) – the lamps are energised to display an arrow which directs traffic to move or merge to the left. It is usually used where the right lane of a two lane carriageway is closed to traffic.

Double headed arrow mode (DA) – the lamps are energised to display an arrow which directs traffic to move or merge both to the left and to the right. It is usually used where the centre lane of a three lane carriageway is closed to traffic.

Warning mode (W) – a pair of opposite diagonal lamps flash to give a strong warning or caution to approaching traffic. This mode is only used in association with other signs and devices to inform traffic of the hazard and to guide traffic through or past the work site.

Lamp matrix – an arrangement of lamps that display a message or symbol when a set or pattern of lamps is turned on or flashed.

Monitoring lamps – a set of two lamps at the rear of the sign which displays the mode of operation to the workers. Monitoring lamps are only provided on the Type C sign.

Off–time – the period of cycle time all the lamps are off. This is usually 50 to 40 percent of the cycle time.

On–time – the period of cycle time specific lamps are on. This is usually 50 to 60 percent of the cycle time.

Visibility distance – the maximum unobstructed distance the flashing displays are clearly seen under bright, daylight conditions with the specified lamps fully energised.

Visors – cylindrical matt black sleeves that are fitted around each lamp to shield them from incident light and reduce sun phantom effects.

11.4 General description of system

11.4.1 Flashing arrow sign equipment

There are three types of equipment covered under RTA Specification FAS/4A. All lamps are rated for 12 volt operation. Equipment is described in Table 11.2.

Sign type	Lamps			Target board (mm x mm)
	No. of lamps	Wattage (W)	Type	
A	13	18*	PAR36	1250 x 650
B	15	35	PAR36	1500 x 750
C	15	35	PAR46	2450 x 1200

* Specification FAS/4 Part A requires an 11 W lamp. This lamp is now unavailable and an 18 W lamp should be used.

Table 11.2 – Equipment types

Type A and Type B signs are suitable for mounting permanently on the rear of a road construction vehicle (fixed sign arrangement) or on the cab of a truck or utility vehicle (adjustable sign arrangement). Cab–mounted signs can be rotated to face either the front or the rear of the vehicle. The sign can also be rotated and locked in the face–down position for transport when the sign is not in use. They may be powered from the vehicle's electrical system or from a separate power source.

Type C signs are trailer mounted with integral generator, back–up battery supply and control equipment. Provision is made for the sign to be lowered, rotated and locked for transport or when the sign is not in use.

All signs can operate in one of four modes as detailed in Table 11.3.

Mode	Rear monitoring for Type C	Flashing lamps
Arrow right (AR)	−−−−−■	Shaft and the right side arrow head.
Arrow left (AL)	■−−−−−	Shaft and the left side arrow head.
Double arrow (DA)	■−−−−−■ synchronised flash	Shaft and both the left and the right side arrow heads.
Warning (W)	■−−−−−■ alternating flash	Pairs of diagonally opposite lamps. Gives a general message of caution or draws attention to an important traffic control sign.
Note: − Lamp off ■ Lamp on		

Table 11.3 – Modes of operation

11.4.2 Vehicle–mounted signs

Type A signs are suitable for attachment to light vehicles such as cars, panel vans or utilities or small plant items. Type B signs are suitable for attachment to heavy vehicles such as trucks and large plant items.

They are generally used on mobile works such as longitudinal linemarking, mobile survey vehicles, patrol vehicles and on shadow trucks protecting groups of workers.

11.4.3 Trailer–mounted signs

Type C signs are self contained trailer mounted units particularly designed for use on high speed roads such as rural divided roads where driver expectations are high.

They are generally used at short term or long term lane closures for work requiring one or more lanes to be closed for one or more shifts. Where the flashing arrow signs are to operate overnight or over weekends the associated signs and devices need to be either reflectorised or lit.

11.4.4 Associated signposting and traffic arrangements

Any additional or associated signposting or traffic arrangements that may be required to be used with flashing arrow signs is to conform to the requirements of this manual.

Using flashing arrow signs tends to downgrade the effectiveness of other devices at the work site so it is essential that the associated signs and devices be in very good condition and special care be taken in their erection. The visibility distance for Type A, B and C flashing arrow signs is 500, 1000 and 1500 metres respectively. Associated signs should be located in clear view of approaching drivers, generally on the left side of the road. However, on winding alignment it may also be necessary to erect a sign or signs on the right hand side for clear viewing. Duplicate signs, on the right hand side of the road, may be considered when a driver's view may be obscured by alignment, buildings or heavy traffic. The use of larger signs may be considered for high approach speeds.

TCPs using flashing arrow signs include those shown in Table 11.4, *TCPs using flashing arrow signs, general work,* Table 11.5, *TCPs using flashing arrow signs, testing work* and Table 11.6, TCPs *using flashing arrow signs, traffic signals work.*

TCP	Work	Description
58	Mobile	4 LANE, 2 WAY, LANE LINE, line marking
62	Mobile	2 LANE, DIVIDED, LEFT LANE, pavement marker maintenance
63	Mobile	2 LANE, DIVIDED, RIGHT EDGE LINE, pavement marker maintenance
64	Mobile	2 LANE, 2 WAY, LEFT EDGE LINE, line marking
65	Mobile	2 LANE DIVIDED, LANE LINE, line marking
66	Mobile	2 LANE, 2 WAY, CENTRE LINE, line marking
69	Mobile	3 LANE, 2 WAY, LEFT LANE
70	Mobile	3 LANE, 2 WAY, CENTRE LANE
72	Mobile	2 LANE, DIVIDED, LEFT LANE
73	Mobile	2 LANE, DIVIDED, RIGHT LANE (WIDE MEDIAN)
74	Mobile	4 LANE, 2 WAY, LEFT LANE
75	Mobile	4 LANE, 2 WAY, RIGHT LANE (NARROW MEDIAN)
89	Short term or long term	3 LANE, 2 WAY, FAST LANE, chicane treatment
94	Short term	2 LANE, DIVIDED, RIGHT LANE
96	Long term	2 LANE, DIVIDED, bitumen sealing
100	Short term	3 LANE, DIVIDED, CENTRE LANE
101	Short term	4 LANE, 2 WAY, LEFT LANE
102	Short term	4 LANE, 2 WAY, chicane treatment
103	Short term	4 LANE, 2 WAY, CENTRE LANE
107	Mobile	3 LANE, DIVIDED, MIDDLE LANE
110	Mobile	3 LANE, 2 WAY, CENTRE LINE, line marking
111	Mobile	3 LANE, 2 WAY, LEFT EDGE LINE, line marking
113	Mobile	4 LANE, 2 WAY, CENTRE LINE, line marking

Table 11.4 – TCPs using flashing arrow signs, general work

114	Mobile	2 LANE DIVIDED & 4 LANE, 2 WAY, LEFT EDGE LINE, line marking
115	Mobile	2 LANE DIVIDED, RIGHT EDGE LINE, line marking
116	Mobile	3 LANE, 2 WAY, CENTRE LANE, pavement markers
117	Mobile	4 LANE, 2 WAY, CENTRE LINE, pavement markers
438	Mobile	3 LANE, 2 WAY, LANE LINE, line marking
827	Short term	4 LANE, 2 WAY, ROUNDABOUT Kerbside lane
828	Short term	4 LANE, 2 WAY, ROUNDABOUT Median lane

Table 11.4 (contd) – TCPs using flashing arrow signs, general work

TCP	Work	Description
444	Mobile	2 LANE, DIVIDED, RIGHT LANE Deflectograph or FWD testing
445	Mobile	4 LANE, 2 WAY, LEFT LANE Deflectograph or FWD testing
446	Mobile	3 LANE, DIVIDED, MIDDLE LANE Deflectograph or FWD testing
447	Mobile	4 LANE, 2 WAY, RIGHT LANE Deflectograph or FWD testing
448	Mobile	2 LANE, DIVIDED, LEFT LANE Deflectograph or FWD testing
449	Mobile	3 LANE, 2 WAY, OVERTAKING LANE Deflectograph or FWD testing
450	Mobile	3 LANE, 2 WAY, SLOW LANE Deflectograph or FWD testing
451	Mobile	2 LANE, 2 WAY Deflectograph or FWD testing
452	Mobile	3 LANE, 2 WAY, SINGLE LANE Deflectograph or FWD testing
453	Mobile	4 LANE, 2 WAY, RIGHT LANE Benkelman Beam testing

Table 11.5 – TCPs using flashing arrow signs, testing work

TCP	Work	Description
805	Short term	4 LANE, DIVIDED, ALL LANES Loop cutting
805A	Short term	4LANE, UNDIVIDED, ALL LANES Loop cutting
806	Short term	4 LANE, 2 WAY, ROGHT TURN BAY Loop cutting
807	Short term	8 LANE, 2 WAY, ALL LANES Loop cutting
809	Short term	4 LANE, 2 WAY, KERBSIDE LANE Overhead signals < 10 minutes
810	Short term	6 LANE, 2 WAY, CENTRE LANE Overhead signals < 10 minutes
811	Short term	8 LANE, 2 WAY, MEDIAN LANE Overhead signals < 10 minutes
812 & 812A	Short term	4 LANE, 2 WAY, KERBSIDE DEPARTURE LANE Overhead signals
813	Short term	4 LANE, 2 WAY, KERBSIDE LANE Overhead signals > 10 minutes
814 & 814A	Short term	6 LANE, 2 WAY, CENTRE LANE Overhead signals > 10 minutes
815	Short term	8 LANE, 2 WAY, MEDIAN LANE Overhead signals > 10 minutes
816	Short term	4 LANE, 2 WAY, MEDIAN LANE Work from ladder < 10 minutes
817	Short term	5 LANE, 2 WAY, ROGHT TURN BAY Work from ladder < 10 minutes

Table 11.6 – TCPs using flashing arrow signs, traffic signals work

818	Short term	4 LANE, 2 WAY, MEDIAN LANE Work from ladder > 10 minutes
819	Short term	5 LANE, 2 WAY, ROGHT TURN BAY Work from ladder > 10 minutes
820	Short term	4 LANE, 2 WAY, KERBSIDE LANE Work from ladder < 10 minutes
821	Short term	4 LANE, 2 WAY, KERBSIDE LANE Work from ladder > 10 minutes

Table 11.6 (contd) – TCPs using flashing arrow signs, traffic signals work

11.5 Equipment installation

11.5.1 Lamps

The brightness of the lamps is adjusted by an automatic dimming control which dims the light output for night conditions. A photocell detects the ambient light conditions that triggers the dimming facilities.

The flash rate for flashing arrow displays (AL, AR, DA) can vary from 50 to 60 percent on–time and 50 to 40 percent off–time. For diagonal flashing displays (W) the on–time and off–time is the same. The repetition rate for all modes is between 35 and 40 cycles per minute.

Two monitoring lamps are provided at the rear of the Type C sign to allow workers to monitor the mode of operation. These lamps flash as shown in Table 11.3.

11.5.2 Sign boards

Generally, the flashing arrow sign unit should be positioned so as to be as nearly as possible in the driver's line of sight. It is important to always locate signs to give the driver maximum visibility and hence time to understand and react to the sign message. The visibility distance of the sign (ie. the distance at which the motorist can first become aware of the flashing arrow) varies as shown in Table 11.7. The minimum sight distance that should be provided to the flashing arrow sign depends both on the vehicle type and vehicle speed in the approach to the work area.

Table 11.7 provides a guide to the sight distances appropriate for the three types of sign. On high speed roads, every effort should be made to position the sign to achieve the desirable minimum sight distance.

Sign type	Visibility distance (m)	Sight distance	
		Desirable minimum	Absolute minimum
A	500	250	150
B	1000	500	300
C	1500	750	450

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

Table 11.7 – Typical sight distances for placement of flashing arrow signs

The signs must be securely erected and anchored to prevent wind movement or interference by vandals. This is especially true for Type C signs as these are intended to be operated unattended.

The signs must also be aimed carefully to direct their display to the approaching vehicles. It is important that the sign be aimed to vehicles within the "critical zone" which covers the distances where drivers have time to react to the message and change lanes or stop if necessary. This is particularly important if the approach alignment of the road is not straight.

Sighting is usually done by means of a "sighting" device which facilitates aiming of the sign display. Such an aiming device must be substantially free of parallax error and must make allowance for the inherent downcast in the sealed–beam lamps.

In the absence of a "sighting" device fitted to the sign, aiming needs to be undertaken by "trial and error".

Table 11.8 lists the recommended aiming distances from the sign near the start of the taper defining the lane closure.

Approach speed (km/h)	Aiming distance (m) Sign type		
	A	B	C
< 60	60	120	180
60	100	200	300
80	140	280	420
100	200	400	600
> 100	260	520	780

Notes:
The aiming distance should not exceed the sight distance.

The recommended aiming distances for the Type A sign is based on the stopping distance PLUS the reaction distance for 2.5 seconds of travel PLUS an allowance of 30 metres for siting the sign past the start of the taper.

The aiming distances for Type B and C signs are two and three times those for the Type A sign to take advantage of their greater size and visibility.

Type C signs not usually used on low speed roads.

Table 11.8 – Aiming distances for various approach speeds

Figure 11.1, *Illustration of aiming and sight distance*, shows the relationship between these two distances used when setting up flashing arrow signs.

11.5.3 Controls

The controls available are:-

- Power: On/Off
- Mode selection
- Mode monitoring (Type C signs only).

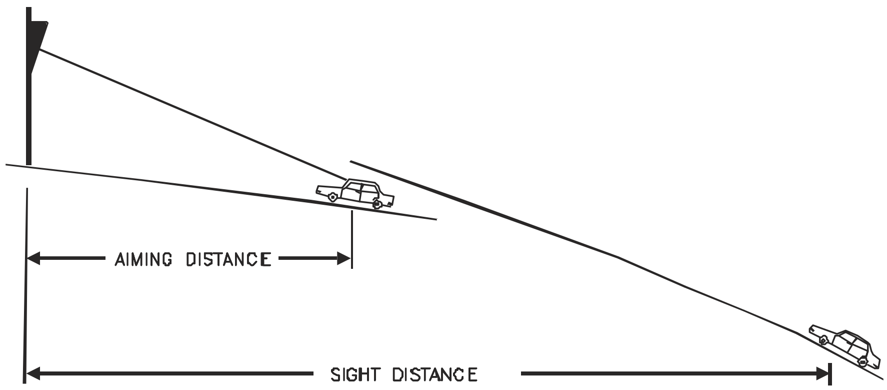


Figure 11.1 – Illustration of aiming and sight distance

11.6 Operation

11.6.1 Control modes

Although the layout and switch configuration may differ, all controls have basically the same functions, namely:-

- Arrow Right (AR)
- Arrow Left (AL)
- Double Arrow (DA)
- Warning (W).

11.6.2 Flash rate

The flash rate is fixed to the levels given in Specification FAS/4 and cannot be varied. It is important to check that all lamps are functioning to give the correct display selected by the controls.

11.6.3 Dimming

The dimming facilities are automatic but care should be taken that any incident light (from street lighting and/or vehicle headlights) falling on the photocell does not adversely interfere with the operation of the dimming feature. The photocell should be occasionally cleaned, since if it is dirty or obstructed, the lamps will not be as bright as they should be.

11.6.4 Setting up

The equipment should be set up to the Manufacturer's Instructions with particular care to the siting and aiming of the signs to suit the layout arrangement being used and the geometry of the road approach to the sign.

11.6.5 Trouble shooting

The monitoring lamps should be regularly observed to confirm that the sign is operating in the appropriate mode for the work site. It is also necessary to regularly inspect the front panel of the sign to ensure that all lamps are clean and alive.

If one lamp is not operating then check it and if it is blown replace with a new lamp. If all lamps are out or all lamps are too dim for the conditions then check the battery or generator for charge. If the charge is satisfactory but the lamps are still too dim for the conditions then check that the photocell is not being blocked from reading the true ambient light level.

11.7 Maintenance

11.7.1 Field service

Operators should familiarise themselves with the manufacturer's instructions. A high level of field service is essential to maintain the sign in good condition to provide an effective warning to motorists at all times.

Field service usually covers:-

- simple fault diagnosis and associated replacement of the faulty modules;
- routine maintenance and servicing, including replacement of lamps and other consumable components;
- keeping the equipment clean and tidy.

These requirements are detailed in the manufacturer's instructions.

11.7.2 Major repairs

If care is taken with the field service, the equipment should remain in good working condition between major service inspections and overhauls. If major faults develop the sign should be taken out of service and alternative traffic control arrangements made. The sign should not be returned to service until the faults have been rectified.

11.7.3 Administration procedures

Refer to local office procedures in respect of administration, costing and maintenance of flashing arrow signs as an item of small plant.

A.1 Introduction

This Appendix contains more than 100 standard TCPs and it will help you select the most appropriate standard TCP for your circumstances . The standard TCP will show what type of traffic control is necessary for your work situation, and what devices and signs to use as a minimum.

There are standard TCPs for short term, long term and mobile work. There are no TCPs for intermittent work. Section 9.1, *Intermittent work*, describes the relevant requirements.

A.2 Finding a suitable standard TCP

Some TCPs are specifically intended for particular work situations such as line marking, shoulder grading, weed spraying, bitumen surfacing, etc. However the following tables do not name every work activity, and judgement will be necessary in selecting the most appropriate TCP.

Selecting a standard TCP will be easier if the following is available:

- the type of work being planned
- the number of lanes the road has at the work area
- whether the road is divided or a single carriageway
- the ADT
- the approach speed of and clearance to passing traffic
- whether it is best to divert traffic around, past or through the work
- whether the work is short term, long term or mobile.

The following information will be useful in choosing a standard TCP:

- Section 4.2, *Selecting standard TCPs*, gives guidance on responsibilities.
- Table A–1 is an index of work situations. It indicates either the relevant standard TCP or the next table to examine.
- Tables A–2 to A–16 show which standard TCPs to use for a range of work types and activities. In these tables, the types of work shown are examples of typical applications for the standard TCPs.

- If Tables A–1 to A–16 do not mention your work, use Table A–17 to select a suitable standard TCP by matching the details of your work situation with those on the TCPs in Appendix D.

If none of the standard TCPs is suitable, refer to Section 5, *Designing new TCPs* and Section 9, *Specific situations*.

Abbreviation	Meaning
A	Traffic goes Around the work area
AV	Advance warning Vehicle
Div	Divided carriageway
E	Traffic Emergency Patrollers
L	Long term work
LV	Lead Vehicle
M	Mobile work
P	Traffic goes Past the work area
Na	Not applicable
S	Short term work
SV	Shadow Vehicle
T	Traffic goes Through the work area
TC	Traffic Controller(s)
TCS	Traffic Control Signals
Un	Undivided carriageway

Figure A–1 – List of abbreviations used in this Appendix

Note(s):

Refer to Section 2.3, *Definitions,* for additional information if necessary.

Work	Reference	
Access to depots, stockpiles, quarries, gravel pits etc.	Appendix D	TCP 195
Batter maintenance	Appendix A	Table A–14
Benkelman Beam testing	Appendix A	Table A–8
Bituminous surfacing	Appendix A	Table A–9
Blasting	Appendix D	TCP 47
Bridge joints – repair – see *Lane closures*	Appendix A	Tables A–2 & A–3
Deflectograph and FWD testing	Appendix A	Table A–10
Drainage maintenance	Appendix A	Table A–7
Emergency situations – RTA Traffic Emergency Patrollers (TEPs)s	Appendix A	Table A-18
Exit ramp, closure	Appendix D	TCP 55
Formation grading	Appendix D	TCP 105
Footway work – short term work	Appendix D	TCP 61
Footway work – long term work	Appendix D	TCP 109
Full road closure	Appendix D	TCP 47
Grading – formation	Appendix D	TCP 105
Grading – shoulder	Appendix D	TCP 99
Guardfence – repair and installation	Appendix A	Tables A–2, A–3 & A–14
Guideposts	Appendix A	Tables A–2, A–4 & A–14
Hand patching	Appendix A	Table A–6
Haul road	Appendix D	TCP 44
Height restriction	Appendix D	TCP 48
Kerb and gutter works	Appendix A	Table A–12
Lane closure – mobile work	Appendix A	Table A–4
Lane closure – long term work	Appendix A	Table A–3
Lane closure – short term work	Appendix A	Table A–2
Line marking	Appendix A	Table A–13
Machine patching, see *Short term lane closure*	Appendix A	Table A–2

Table A–1 Typical work activities and situations

Work	Reference	
Mechanical testing – Deflectograph and FWD	Appendix A	Table A–10
Mowing – two way carriageway	Appendix D	TCP 97
Mowing – one way carriageway	Appendix D	TCP 98
Patching, hand	Appendix A	Table A–6
Patching, machine – see *Short term lane closures*	Appendix A	Table A–2
Pavement marking – installation / removal	Appendix A	Table A–2
Raised pavement markers	Appendix A	Table A–11
Reconstruction	Appendix A	Table A–5
Restoration	Appendix A	Table A–5
Roundabouts	Appendix A	Table A-17
Safety barriers	Appendix A	Table A–14
Services adjustment – see *Drainage maintenance*	Appendix A	Table A–7
Shoulder grading	Appendix D	TCP 99
Shoulder work – miscellaneous	Appendix A	Table A–14
Sign work (roadside)	Appendix A	Table A–14
Snow clearing	Appendix D	TCP 67
Speed zoning at road works	Appendix D	TCP 57
Spotting	Appendix A	Table A–11
Surveying	Appendix A	Table A–16
Test holes, see *Short term lane closures*	Appendix A	Table A–2
Testing – mechanical	Appendix A	Table A–10
Testing – Benkelman Beam	Appendix A	Table A–8
Traffic signal works	Appendix A	Table A–15
Traffic surveys	Appendix D	TCP 385
Weed spraying	Appendix D	TCP 76
Weight restriction	Appendix D	TCP 49

Table A–1 Typical work activities and situations (continued)

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	43 Temporary traffic signals 47 Full road closure - blasting 59 General chicane speed reduction 77 Up to 5 mins, ADT > 3,000 78 Up to 5 mins, ADT < 3,000 83 ADT > 6,000 84 ADT < 6,000 95 Bitumen sealing in one lane 104 Benkelman Beam 108 ADT < 1,500 437 ADT>=1500 440 Traffic through work area 831 Intermittent	*In direction with one lane:* 81 Traffic through work area 91 Traffic using opposing lane 826 Traffic using opposing fast lane *In direction with two lanes:* 86 No delay in fast lane 88 Occasional delay in fast lane	101 Slow lane	92 No delay in fast lane 93 Occasional delay in fast lane
Middle				100 Traffic around work area
Fast		89 Chicane 90 Traffic Controllers	102 Chicane 103 Both fast lanes	94 Traffic around work area

Table A–2 – TCPs for short term lane closures

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	43 Temporary traffic signals 45 Traffic diverted to shoulder 48 High vehicle detour 49 Heavy vehicle detour 50 One lane side track 51 Two lane side track 53 Urban 1 lane detour 54 Urban 2 lane detour 60 At urban intersection 353 Sealing – full width 439 Give way signs 440 Traffic in work area		46 Temporary shift of centre line 60 At urban intersection	52 Carriageway closed, side track across median 55 Exit ramp closed 96 Bitumen sealing in one lane
Middle				52 Carriageway closed
Fast		89 Chicane		52 Carriageway closed

Table A–3 – TCPs for long term lane closures

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	67 Snow clearing 68 General work 76 Weed spraying 451 Testing	*In direction with one lane:* 71 General work 452 Testing *In direction with two lanes:* 69 General work 450 Testing	74 General work 445 Testing	62 Pavement markers 72 General work 448 Testing
Middle				107 General work 446 Testing
Fast		70 General work, without Traffic Controller 116 General work, with Traffic Controller 449 Testing	447 Testing	63 Pavement markers 73 General work wide median 75 General work narrow median 444 Testing

Table A–4 – TCPs for mobile lane closures

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	43 L Temporary traffic signals 45 L Traffic diverted to shoulder 50 L One lane side track 51 L Two lane side track 53 L One direction urban detour 54 L All traffic detour – urban 59 S/L Chicane 60 L At urban intersection 439 L Give way signs 440 S/L Traffic in work area		46 L Shift centre line	52 L Carriageway closed – side track crosses median
Middle			46 L Shift centre line	52 L Carriageway closed, side track crosses median
Fast		89 S/L Chicane		52 L Carriageway closed, side track crosses median

Table A–5 TCPs for restoration and reconstruction

Note(s):

Use TCP 57 for roadwork speed limits.
Use TCP 195 for access to depots, gravel pits, etc.

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	41 S D < 60 km/h 68 M General work with TC 77 S ADT > 3,000, up to 5 mins 78 S ADT < 3,000 108 S ADT < 1,500 437 S ADT>=1500 Over 5 mins 831 Intermittent work	*In direction with one lane:* 71 M General work with TC 81 S Traffic through work area 91 S Traffic around work area *In direction with two lanes:* 69 M No delay in fast lane 86 S No delay in fast lane 88 S Minor delay in fast lane	74 M No delay in fast lane	72 M General work 92 S No delay in fast lane
Middle				107 M General work
Fast		70 M General work without TC 80 S Traffic Controller 89 S/L Chicane		82 S ADT<10,000, up to 5 mins 94 S Over 5 mins 73 M Wide median 75 M Narrow median

Table A–6 – TCPs for hand patching

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	41 S D < 60 km/h 61 S Footway closed 83 S ADT > 6,000 84 S ADT < 6,000 108 S ADT < 1,500 42 L Shoulder closed 45 L Lane closed 50 L Side track 51 L Side track 60 L At intersection 109 L Footway closed 40 M Clear of traffic	*In direction with one lane:* 91 S Traffic around work area *In direction with two lanes:* 86 S No delay in fast lane 88 S Occasional delay in fast lane	46 L Shift centre line 101 S Slow lane work	92 S No delay in fast lane 93 S Occasional delay in fast lane 52 L Carriageway closed
Middle				100 S Traffic around work area 52 L Carriageway closed
Fast		90 S Traffic Controllers 89 S/L Chicane	102 S Chicane 103 S Both fast lanes	94 S Traffic around work area 52 L Carriageway closed

Table A–7 – TCPs for drainage maintenance

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	68 M 104 S	*In direction with one lane:* 91 S *In direction with two lanes:* 86 S 69 M 450 M	101 S 74 M	92 S 72 M
Middle				100 S 107 M
Fast		89 S 70 M	102 S Chicane 103 S 453 M	94 S 73 M

Table A–8 – TCPs for Benkelman Beam testing

Width	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
One lane	95 S D<= 60 km/h			96 L All speeds, minor delay
Full width	56 L ADT < 5,000 or D < 60 km/h 353 L ADT > 5,000 and D > 80 km/h			

Table A–9 – TCPs for bituminous surfacing

Lane	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left	451	*In direction with one lane:* 452 *In direction with two lanes:* 450	445	448
Middle				446
Fast		449	447	444

Table A–10 – TCPs for Deflectograph and FWD testing

Line	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left edge	77 S ADT ≥ 3,000 78 S ADT < 3,000 68 M	*In direction with one lane:* 81 S 71 M *In direction with two lanes:* 80 S 69 M	74 M	62 M
Right edge				82 S 63 M
Centre	108 S ADT < 1,500 437 S ADT > 1,500 106 M	116 M	117 M	
Lane		70 M 80 S		62 M 75 M 107 M 82 S

Table A–11 – TCPs for raised pavement markers and spotting

Location	TCP
Left side	42 L Shoulder closed 45 L Kerbside lane closed 53 L Detour 60 L At intersection 61 S Footway closed109 L Footway closed
Median	94 Fast lane closed

Table A–12 – TCPs for kerb & gutter works

Line	2 lane 2 way	3 lane 2 way	4 or more lanes undivided	4 or more lanes divided
Left edge	64	111	114	114
Right edge				115
Centre	66	110	113	
Lane		438	58	65

Table A–13 – TCPs for line marking

Work type	TCP	
Short term	41	D < 60 km/h
	77	Minor traffic delay, ADT ≥ 3,000
	78	Minor traffic delay, ADT < 3,000
	99	Grading shoulders
	101	Lane closed, high speed road, flashing arrow
	440	Lane closed, Traffic Controllers
Long term	42	Shoulder closed
	43	Lane closed, temporary traffic signals
	45	Lane and shoulder closed
	439	Lane closed, give way signs
	440	Lane closed, Traffic Controllers
Mobile	40	Clear of road
	68	Miscellaneous mobile work
	97	Mowing two way road
	98	Mowing divided carriageway

Table A–14 – TCPs for shoulder work

Note(s):

Typical uses of this table include: signs, guideposts, safety barriers, batters, grading, mowing, etc.

Location	TCP	
Footway/Closed kerbside lane	802	Blacked out site, all work done on footway > 80 minutes
	812	Work on tertiary post with blocked lane, > 80 minutes
	820	Kerbside lane closed < 80 minutes
	821	Kerbside lane closed > 80 minutes
	822	Short term maintenance, no lane blocked < 80 minutes
	822	Routine maintenance, no lane blocked > 80 minutes
Road	804	Loop cutting – 2 lane/2 way intersection
	805	Loop cutting – 2 approach lanes with median
	805A	Loop cutting – 2 approach lanes no median
	806	Loop cutting – right turn bay
	807	Loop cutting – 4 approach lanes
	814	Loop cutting – centre lane of 3 approach lanes
Median	803	Blacked out site, with right turn bay > 80 minutes
	816	2 lane approach < 80 minutes
	817	2 lane approach with right turn bay <80 minutes
	818	2 lane approach > 80 minutes
	819	2 lane approach with right turn bay > 80 minutes
	822	Short term maintenance, no lane blocked < 80 minutes
	822	Routine maintenance, no lane blocked > 80 minutes
Overhead	809	2 lane approach – kerbside lanes < 80 minutes
	810	3 lane approach – centre lane < 80 minutes
	811	Multilane approach < 80 minutes
	812	2 lane departure > 80 minutes
	813	2 lane approach > 80 minutes
	814	3 lane approach – centre lane > 80 minutes
	815	Multilane approach – mediandside lane > 80 minutes

Table A–15 – TCPs for traffic signal works

Notes:

1. If Police on point duty wish to modify the layout, act accordingly. Record the request in the diary with details, eg date/time/location/name of Police making request. Advise Supervisor when return to depot.
2. Pedestrian crossings should not be blocked. If necessary, provide alternative crossing or assistance.
3. For loop marking, use of a shadow vehicle with flashing lights ON to protect staff marking out loop is considered adequate.
4. Reduced size signs will be used.

5. TCP809-811,816, 817, 820, 822 (< 80min work)
If staff feel that it is unsafe to proceed as shown in the TCP after an on-site risk assessment, the appropriate one for work > 80min should be used instead.

Location	Traffic Control
Shoulder (lip and kerb)	459 2 way road
Travel lanes	Intermittent work or lane closure. See Section 9.1, Table A–2, or Table A–4
Medians	463 1 way carriageway
Narrow medians	Intermittent work or lane closure. See Section 9.1, Table A–2, or Table A–4
Roadside	Not required if work area is more than 3 metres from the nearest edge of a traffic lane

Table A–16 TCPs for surveying

Location	Traffic Control
Kerb side lane	827 S 4 lane/2 way
Median lane	828 S 4 lane/2 way
Single lane approach	829 S up to 10 minutes delay
Multilane approach	830 S roundabout lane closure

Table A–17 TCPs for roundabouts

Location	Traffic Control	
Shoulder	843	2 lanes/1 way, wide median shoulder
Left (or Kerb side) lane	844	2, 3 or 4 lanes/1 way
	846	2 lanes/2 way
Median lane	845	2, 3 or 4 lanes/1 way
	848	4 lanes/2 way, undivided, affecting both carriageways
Centre lane	847	3 or 4 lanes/1 way, initial response, traffic passing both sides
	847	3 lanes/1 way, close lanes 1 and 2
	847	3 lanes/1 way, close lanes 2 and 3

Table A–18 TCPs emergency situations (RTA TEPs)

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
40	2	Un	No limits	Clear of travel lanes	M	A	Signs
41	2	Un	No limits	Shoulder	S	A	Signs
42	2	Un	No limits	Shoulder	L	A	Signs
43	2	Un	No limits	In lane	S & L	A	TCS
44	2	Na	No limits	Haul road access	L	T	TC or TCS
45	2	Un	No limits	In lane	L	A	Signs
46	6	Un	No limits	In kerbside and middle lanes	L	A	Signs
47	2	Na	No limits	Full road closure	S	T	TC
48	2	Na	No limits	Height restriction	L	na	Signs
49	2	Na	No limits	Weight restriction	L	na	Signs
50	2	Un	No limits	One lane	L	P	Signs
51	2	Un	No limits	Full width	L	P	Signs
52	4	Div	No limits	Full width of one carriageway	L	P	Signs
53	2	Un	No limits	Half width of road	L	P	Signs
54	2	Un	No limits	Full width of road	L	P	Signs
55	4 or more	Div	No limits	Full width of exit ramp	L	P	Signs
56	2	Un	< 5,000	Full width	L	T	TC
57	2	Un	No limits	Various	S & L	T	Speed Zone

Table A–19 – Main features of standard TCPs

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
58	4	Un	No limits	Lane line	M	A	LV & AV
59	2	Un	No limits	In one lane	S & L	A	TC
60	2	Un	No limits	Kerbside lane at intersection	L	A	Signs
61	2	Un	No limits	On footway	S	A	Signs
62	4	Div	No limits	On lane line and left edge line	M	A	SV & AV
63	4	Div	No limits	On right edge line	M	A	SV & AV
64	2	Un	No limits	Left edge line	M	A	AV
65	4	Div	No limits	Lane line	M	A	AV
66	2	Un	No limits	Centre line	M	A	LV & AV
67	2	Un	No limits	Full width	M	A	Signs
68	2	Un	< 1,500	Edge lines	M	A	TC & AV
69	3	Un	No limits	Edge line adjacent to slow lane	M	A	SV & AV
70	3	Un	No limits	Central lane. lane line	M	A	SV & AV
71	3	Un	No limits	Edge line adjacent to single lane	M	T	TC & AV
72	4	Div	No limits	Left lane	M	A	SV & AV
73	4	Div$^{\chi}$	No limits	Right lane	M	A	SV & AV

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

χ Median wider than 3 m.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
74	4	Un	No limits	In left lane or on left edge line	M	A	SV & AV
75	4	Un$^{\delta}$	No limits	In right lane or on right edge line	M	A	SV & AV
76	2	Un	No limits	Shoulders and verges	M	A	Signs or AV
77	2	Un	> 3,000	In lane, or edge line or on shoulder	S	T	TC
78	2	Un	< 3,000	In lane, or edge line or on shoulder	S	T	TC
80	3	Un	No limits	Fast lane	S	T	TC
81	3	Un	No limits	Single lane	S	T	TC
82	4	Div	< 10,000	Fast lane, lane line, right edge line	S	T	TC
83	2	Un	> 6,000	In lane	S	A	TC
84	2	Un	< 6,000	In lane	S	A	TC
86	3	Un	No limits	In slow lane	S	A	Signs
88	3	Un	No limits	In slow lane with plant or personnel moving regularly in and out of fast lane	S	A	TC
89	3	Un	No limits	In fast lane	S & L	A	Signs

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

δ Median narrower than 3 m.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
90	3	Un	No limits	In fast lane with plant or personnel moving regularly in and out of slow lane	S	A	TC
91	3	Un	No limits	In single lane	S	A	TC
92	4	Div	No limits	In slow lane	S	A	Signs
93	4	Div	No limits	In slow lane with plant and personnel moving regularly in and out of fast lane	S	A	TC
94	4	Div	No limits	Fast lane, with plant and personnel wholly in fast lane	S	A	Signs
95	2	Un	No limits	Half width – in one lane only	S	A	TC
96	4	Div	No limits	In slow lane	L	A	TC
97	na	Un	No limits	Mowing, shoulders and verges	M	A	Signs
98	na	Div	No limits	Mowing, shoulders, verges and medians	M	A	Signs
99	2	Un	No limits	Shoulders and earth drains	S	A	Signs
100	6	Un	No limits	In middle lane	S	A	Signs

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
101	4	Un	No limits	In slow lane	S	A	Signs
102	4	Un	No limits	In fast lane	S	A	Signs
103	4	Un	No limits	In fast lane	S	A	Signs
104	2	Un	No limits	In lane	S	A	TC
105	2	Un	No limits	Whole carriageway	S	T	Signs
106	2	Un	< 1,500 > 1,500	On centre line	M	A	TC & AV TC, LV & AV
107	6	Div	No limits	Kerb lane restricted and middle lane closed	M	A	AV & SV
108	2	Un	< 1,500	In lane	S	A	TC
109	All roads	Na	No limits	Footway	L	A	Signs
110	3	Un	No limits	Centre line	M	A	LV & AV
111	3	Un	No limits	Edge line adjacent to slow lane	M	A	AV
113	4	Un	No limits	Centre line	M	A	LV & AV
114	4	Div & Un	No limits	Left edge line	M	A	AV
115	4	Div	No limits	Right edge line	M	A	AV

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
116	3	Un	No limits	Centre line, fast lane	M	A	AV, TC & SV
117	4	Un	No limits	Centre line	M	A	AV, SV & LV
195	na	Na	No limits	Work vehicles turning on and off	S & L	na	Signs
353	2	Un	≥ 5,000 & V > 80 km/h	Full width of road	L	T	TC
385	2	Un	No limits	Left lane	S	T	TC
437	2	Un	No limits	Left lane	S	A	TC
438	3	Un	No limits	Left lane	M	A	AV & LV
439	2	Un	< 1,500	Left lane	L	A	Give way signs
440	2	Un	No limits	Left lane	S & L	A	TC
444	4	Div	No limits	Fast lane	M	A	AV

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
445	4	Un	No limits	Slow lane	M	A	AV
446	6	Div	No limits	Middle lane	M	A	AV
447	4	Un	No limits	Fast lane	M	A	AV
448	4	Div	No limits	Slow lane	M	A	AV
449	3	Un	No limits	Overtaking lane	M	A	AV
450	3	Un	No limits	Slow lane	M	A	AV
451	2	Un	No limits	Left lane	M	A	LV, AV & TC
452	3	Un	No limits	Single lane	M	A	LV, AV & TC
453	4	Div & Un	No limits	Fast lane	M	A	AV & SV
459	na	Un	< 10,000	Both shoulders	M	A	Signs
463	na	Div	No limits	Shoulder and median	M	A	Signs
802	6	Div	No limits	Footpath	S	P	Signs & cones
803	5	Div	No limits	Median	S	P	Signs & cones
804	2	Un	No limits	Kerbside lane - loop cutting	S	T	TC

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
805	4	Div	No limits	Both approach lanes - loop cutting	S	P	Flashing arrow & lamps or signs, & cones
805A	4	Un	No limits	Both approach lanes - loop cutting	S	P	Flashing arrow & lamps or signs, & cones
806	4	Div	No limits	Right turn bay - loop cutting	S	P	Flashing arrow & lamps, signs & cones
807	8	Div	No limits	4 approach lanes - loop cutting	S	P	Flashing arrow & lamps or signs, & cones
809	4	Div	No limits	Kerbside lane - overhead signal	S	P	Flashing arrow & lamps
810	6	Div	No limits	Centre lane – overhead signal	S	P	Flashing arrow & lamps
811	8	Div	No limits	Median lane - overhead signals	S	P	Flashing arrow & lamps
812	4	Div	No limits	Kerbside departure lane - overhead signals	S	P	Flashing arrow & lamps, signs and cones
812A	4	Div	No limits	Kerbside departure lane - overhead signals	S	P	Flashing arrow & lamps, signs and cones

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
813	4	Div	No limits	Kerbside lane – overhead signal	S	P	Flashing arrow & lamps, signs & cones
814 & 814A	6	Div	No limits	Centre lane – overhead signal	S	P	Flashing arrow & lamps, signs & cones
815	8	Div	No limits	Median lane - overhead signals	S	P	Flashing arrow & lamps, signs & cones
816	4	Div	No limits	Median lane - ladder	S	P	Flashing arrow, lamps & cones
817	5	Div	No limits	Right turn bay - ladder	S	P	Flashing arrow, lamps & cones
818	4	Div	No limits	Median lane - ladder	S	P	Flashing arrow & lamps, signs & cones
819	5	Div	No limits	Right turn bay - ladder	S	P	Flashing arrow & lamps, signs & cones
820	4	Div	No limits	Kerbside lane - ladder	S	P	Flashing arrow & lamps
821	4	Div	No limits	Kerbside lane - ladder	S	P	Flashing arrow & lamps, signs & cones
822	5	Div	No limits	Work on median or footpath	S	P	Cones and signs

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

TCP	Lanes	Div or Un	ADT$^{\alpha}$	Where on the road is the work area?	Short term, long term, or mobile work?	Traffic around, past or through the work area?	Main type of traffic control$^{\beta}$
826	3	Un	No limits	In the single lane	S	P	Signs and cones
827	4	Un	No limits	Kerbside lane – roundabout	S	P	Flashing arrow, signs & cones
828	4	Un	No limits	Median lane – roundabout	S	P	Flashing arrow, signs & cones
829	2	Un	No limits	Single lane – roundabout	S	P	TC, signs & cones
830	4	Un	No limits	Roundabout lane	S	P	Signs & cones
831	2	Un	No limits	Intermittent work	S	T	Signs and spotter
843	2	Div	No limits	Shoulder	S	P	E
844	2,3 or4	Div	No limits	Left lane	S	P	E
845	2, 3 or 4	Div	No limits	Median lane	S	P	E
846	2 lanes	Un	No limits	Left lane	S	P	E
847	3 or 4	Div	No limits	Centre lane	S	P	E
847-1 847-2	3	Div	No limits	Centre lane	S	P	E
848	2	Un	No limits	Centre lanes	S	P	E

Table A–19 – Main features of standard TCPs (continued)

Note(s):

α Lane closures and similar temporary arrangements may reduce the capacity of the road, and the Site Supervisor shall make all necessary arrangements to compensate for reduced capacity.

β The type of traffic control may depend on circumstances at the site such as available sight distance and traffic volumes. This column mentions only the dominant type of traffic control shown on each standard TCP.

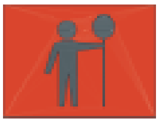
For sign sizes and layouts refer to AS 1743, or the RTA website

SIGN	NUMBER	REMARKS
	T1–1	See also T1–31.
	T1–2	
	T1–3–1	
	T1–3–2	
	T1–4	
	T1–5	T1–5–1 (fluorescent red background) is for day use only. At night, use either T1–5–2 (yellow background) or T1–224 (black background, with Class 1 yellow symbol and border).
	T1–6	

TEMPORARY SIGNS
SHEET 1 OF 10

T000360

T000360

SIGN	NUMBER	REMARKS
	T1–10	
	T1–11	
	T1–200 *	T1–200–1 (combination fluorescent/retroreflective red–orange background) is for day use only. At night, use either T1–200–2 (Cl.1 yellow background) or T1–200–3 (Cl.1 yellow symbol & border on black background).
	T1–14	
	T1–15	
	T1–16	

* Not Australian Standard (RTA NSW sign)

TEMPORARY SIGNS
SHEET 2 OF 10

T000361

T000361

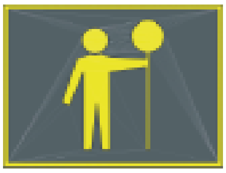
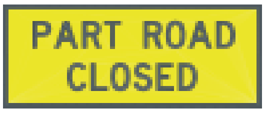
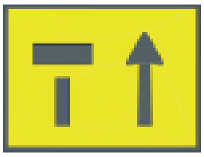
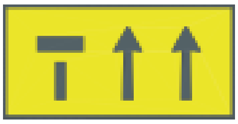
SIGN	NUMBER	REMARKS
	T1–18	
	T1–28	
	T1–31	
	T1–201*	
	T1–220*	
	T1–221*	
	T1–223*	Class 1 yellow border and letters with black background.

* Not Australian Standard (RTA NSW sign)

TEMPORARY SIGNS
SHEET 3 OF 10

T000362

T000362

SIGN	NUMBER	REMARKS
	T1–224*	Class 1 yellow border and symbol with black background.
	T1–200–3*	Class 1 yellow border and symbol with black background.
	T2–4	
	T2–5	
	T2–6–1	Example only
	T2–6–2	Example only

* Not Australian Standard (RTA NSW Sign).

TEMPORARY SIGNS
SHEET 4 OF 10

T000363

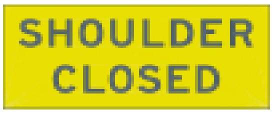
T000363

SIGN | NUMBER | REMARKS

T2–13

T2–14

T2–16



T2–19 *

T2–20

T2–21–1

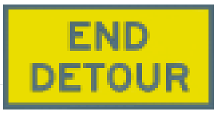
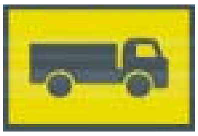
T2–22

* Not Australian Standard (RTA NSW Sign)

TEMPORARY SIGNS
SHEET 5 OF 10

T000364

T000364

<table>
<tr><th>SIGN</th><th>NUMBER</th><th>REMARKS</th></tr>
<tr><td>
</td><td>T2–23</td><td></td></tr>
<tr><td></td><td>T2–25</td><td></td></tr>
<tr><td>
</td><td>T2–207 *</td><td></td></tr>
<tr><td>
</td><td>T2–235(L) *</td><td></td></tr>
<tr><td>
</td><td>T2–235(R) *</td><td></td></tr>
<tr><td>
</td><td>T2–237 *</td><td></td></tr>
<tr><td>
</td><td>T3–216 *</td><td></td></tr>
<tr><td></td><td>T3–3</td><td></td></tr>
</table>

* Not Australian Standard (RTA NSW sign)

TEMPORARY SIGNS
SHEET 6 OF 10

T000365

T000365

SIGN NUMBER REMARKS

T3–6

T3–7

T3–9

T3–11

T3–12

T3–13

T3–14

TEMPORARY SIGNS
SHEET 7 OF 10

T000366

T000366

SIGN | NUMBER | REMARKS

T3–217 *

T4–1 *

T4–2

T4–3

T4–4

T4–5

* Not Australian Standard (RTA NSW sign)

TEMPORARY SIGNS
SHEET 8 OF 10

T000367

T000367

SIGN NUMBER REMARKS

T4–211*

T5–1(L)

T5–1(R)

T5–4

T5–5

T6–1(L)

T6–1(R)

* Not Australian Standard (RTA NSW sign)

TEMPORARY SIGNS
SHEET 9 OF 10

T000368

T000368

SIGN	NUMBER	REMARKS
	T6–201 *	
	T6–207 *	
	T6–233 *	
 	R6–8 (STOP) T7–1 (SLOW)	
	T8–1	
	T8–2(L)	
	T8–2(R)	
	T8–3	

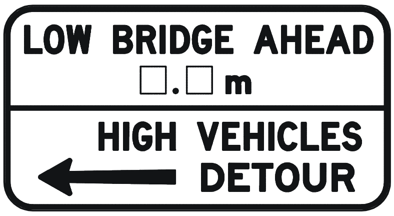
* Not Australian Standard (RTA NSW Sign)

TEMPORARY SIGNS
SHEET 10 OF 10

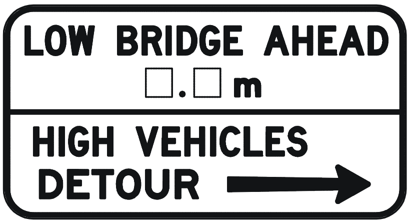
T000369

T000369

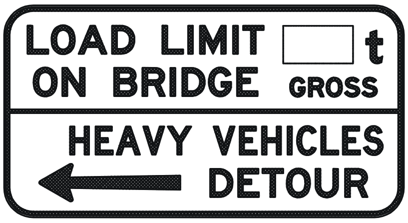
SIGN	NUMBER	REMARKS



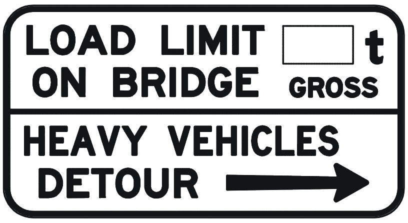
G9–3(L)



G9–3(R)



G9–4(L)



G9–4(R)

G9–5–1(L)

G9–5–1(R)

GUIDE SIGNS
SHEET 1 OF 3

T000370

T000370

SIGN	NUMBER	REMARKS
	G9–5–2(L)	
	G9–5–2(R)	
	G9–47–2	*
	G9–232	*
	G9–233	*

* Not Australian Standard (RTA NSW Sign)

GUIDE SIGNS
SHEET 2 OF 3

T000371

T000371

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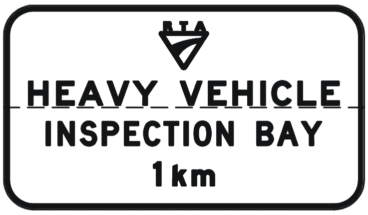
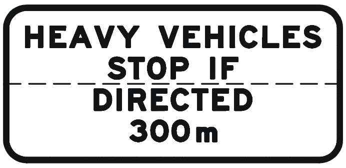
SIGN	NUMBER	REMARKS
	G9–260 *	
	G9–262 *	
	G9–263 *	
	G9–265 *	

* Not Australian Standard (RTA NSW Sign)

GUIDE SIGNS
SHEET 3 OF 3

T000473

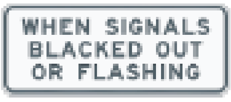
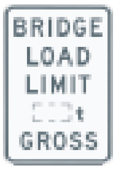
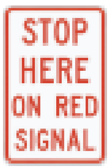
T000473

SIGN	NUMBER	REMARKS
	R1–1	
	R1–2	
	R1–4	
	R2–14(L)	
	R2–14(R)	
	R4–1–100	
	R4–1–60	

REGULATORY SIGNS
SHEET 1 OF 2

T000372

T000372

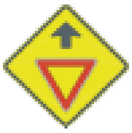
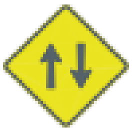
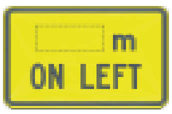
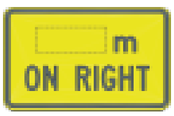
SIGN	NUMBER	REMARKS
	R4–3	
	R4–212 *	Sign is hinged to be lockable in both open and closed positions. The selected speed limit is inserted in the circle. All sizes are available. For details of size C see drawing T000035 in *Traffic Engineering Manual*, Section 3, *Speed Zoning*.
	R4–225 *	
	R9–201 *	
	R6–3	
	R6–6	
	R6–11	
	R6–12	

* Not Australian Standard (RTA NSW sign)

REGULATORY SIGNS
SHEET 2 OF 2

T000373

T000373

SIGN	NUMBER	REMARKS
	W3–2	
	W3–3	
	W4–8	
	W4–11	
	W5–22(R)	See also T2–25.
	W5–205 *	
	W8–5	
	W8–207(L) *	
	W8–207(R) *	

* Not Australian Standard (RTA NSW Sign)

WARNING SIGNS
SHEET 1 OF 1

T000374

T000374

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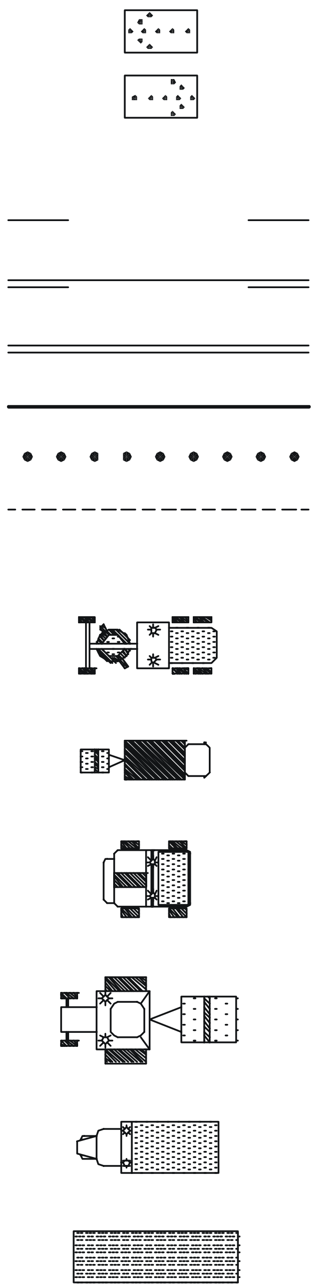


Flashing Arrow Sign (Left)

Flashing Arrow Sign (Right)

Separation Line

Single Barrier Line – (BS)

Double Barrier Line – (BB)

Edge Line

Traffic Cones

Delineators

Grader or Snow Plough
(with flashing yellow lamps)

Work Vehicle and Trailer
(with flashing yellow lamps)

Linemarker
(with flashing yellow lamps)

Tractor with Mower
(with flashing yellow lamps)

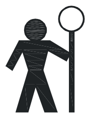
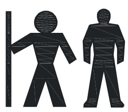
Work Vehicle or Truck
(with flashing yellow lamps)

Work Area

LIST OF STANDARD SYMBOLS
SHEET 1 OF 3

T000358

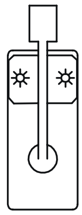
T000358

	Antiglare screen
	Barrier Board Position
	Barrier Board
	Daytime Strobe
	Flashing Yellow Lamps (for sign mounting)
	Rotating Flashing Yellow Lamps (for vehicle mounting)
	Traffic Controller
	Reflector Carrier & Spotter
	Sign – single sided
	Sign – double sided
	Traffic Signal Position
	Traffic Signal Display
	Pedestrian Containment Fencing

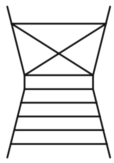
LIST OF STANDARD SYMBOLS
SHEET 2 OF 3

T000359

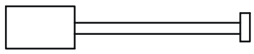
T000359



EPV



Ladder



Mastarm with Lantern

LIST OF STANDARD SYMBOLS
SHEET 3 OF 3

T000823

T000823

Traffic Control at Work Sites
Location Risk Assessment

Road No: .... Location: ....

Type of Work: ....

Date: .... Time: .... Completed by: ....

Answers to the questions below may require minor modifications to be made to the Traffic Control Plan, this may include the installation of additional signs or changes to the sign locations. Record any action taken in the bottom box.

1	Will the location of any intersections, on-loading or off-loading ramps within the worksite increase the risk to workers ?	Yes/No
2	Will vehicles be entering or leaving the worksite from private or commercial driveways ? If yes will extra safety control measures be required to cater for those vehicles ?	Yes/No Yes/No
3	Is there adequate sight distance for road users to signs and traffic controllers ?	Yes/No
4	Are signs or traffic controllers in the shade ?	Yes/No
5	Will control measures be safe for the approach speeds of traffic ?	Yes/No
6	Will work be undertaken outside peak times ? If not, will the control measures cater for the traffic peak ?	Yes/No Yes/No
7	Will bus stops (including school) be affected ?	Yes/No
8	Will pedestrians be affected ?	Yes/No
9	Will cyclists be affected ?	Yes/No
10	Are there any overhead power lines that might be a risk to construction vehicles and plant ?	Yes/No
11	Is the time of day significant (ie night work, low setting sun) ?	Yes/No

Item No	Action taken.

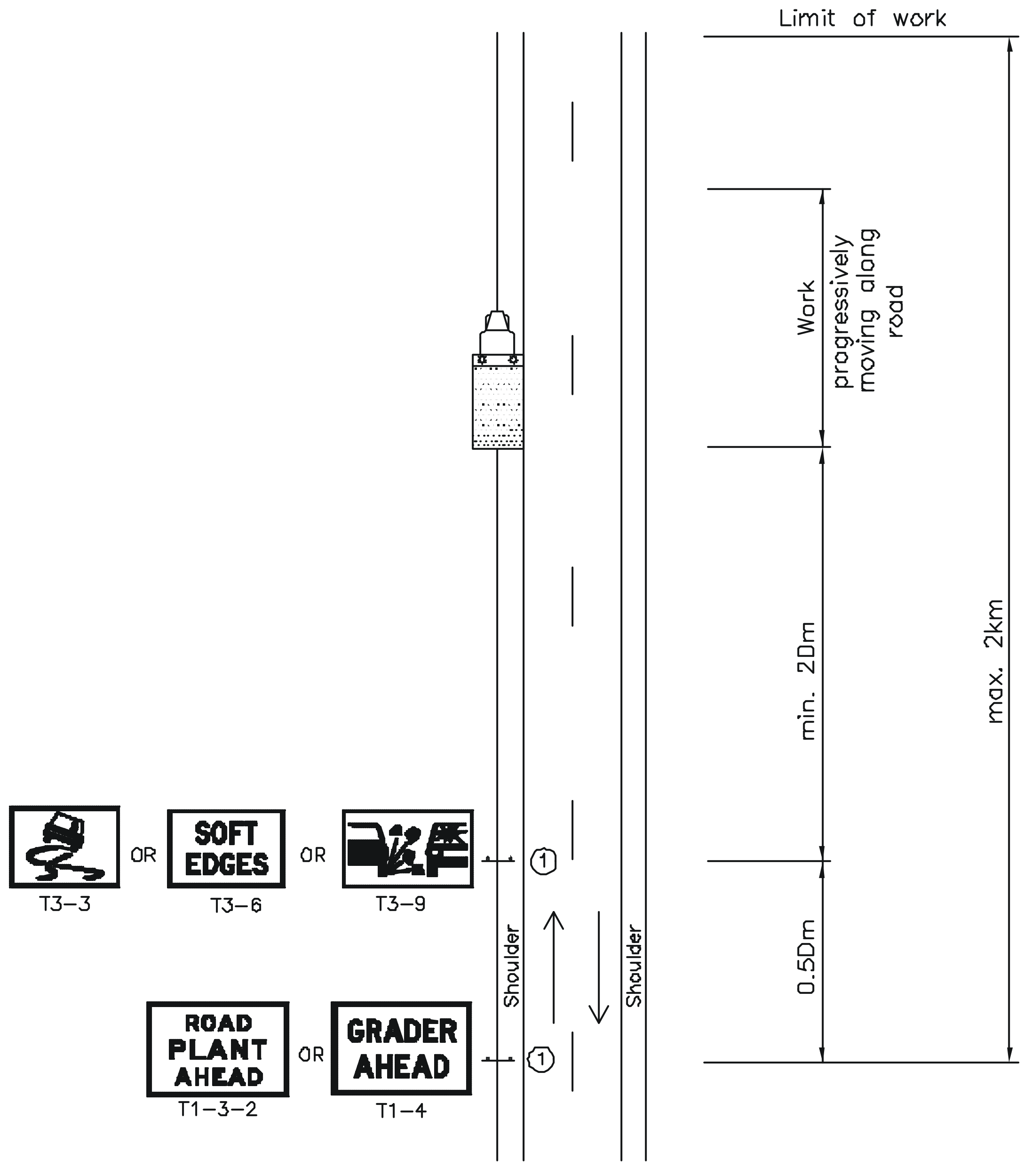
Use of checklist on previous page

To assist in the assessment of risk at traffic control work sites the checklist on the previous page has been devised and is to be used as follows:-

- a standard TCP is to be selected or a new TCP designed for the work to be undertaken
- the checklist opposite is then to be photocopied onto the back of or fixed to the TCP
- the TCP and checklist are to be taken to the work site where the checklist is to be completed
- any action considered necessary as a result of the use of the checklist is to be taken and recorded in the bottom box
- the checklist is to be signed and dated by the person responsible for making the minor modifications
- any minor modifications made are to be shown on the TCP and initialled by the person responsible for making the changes.

Notes on TCPs

- Where Traffic Controllers are used, approach speeds of traffic must be reduced to a maximum of 60 km/h. The following TCPs do not generally, for clarity, detail the signs required for a posted roadwork speed zone of 60 km/h. If it is intended to install a roadwork speed zone then the relevant TCP can be modified to incorporate the principles of Section 8.2, *Roadwork speed zones* and TCP 57.
- Some of the following TCPs detail arrangements that are required for long-term works, when personnel are not on site (i.e. TCP 46). When personnel are on site these TCPs would need to be modified to incorporate additional signs such as workers symbolic (T1-5)



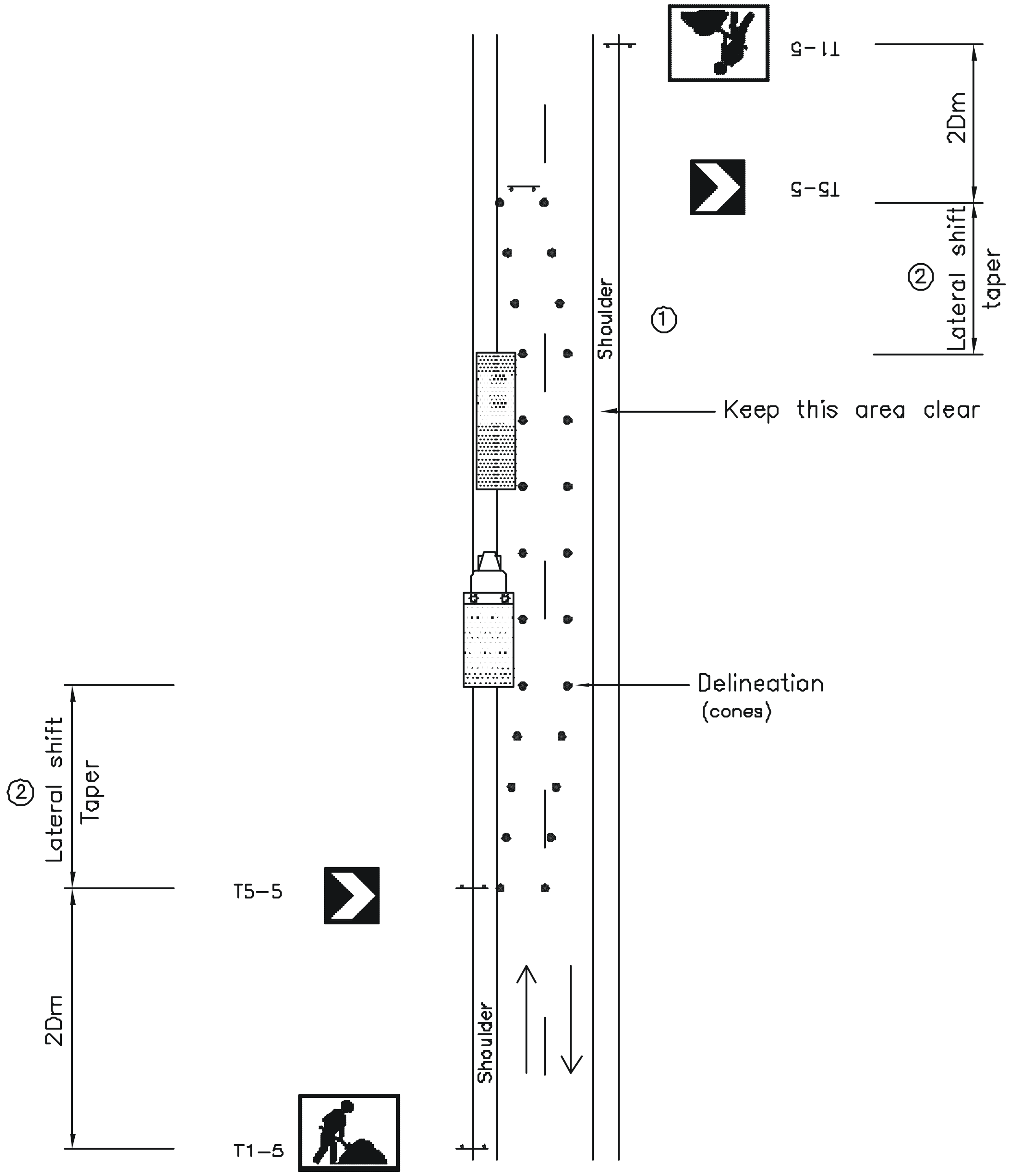
NOTE

(1) Signs as appropriate are placed on the shoulder.

FREQUENTLY CHANGING WORK SITE
CLEAR OF TRAFFIC

T000040

TCP 40



NOTES:

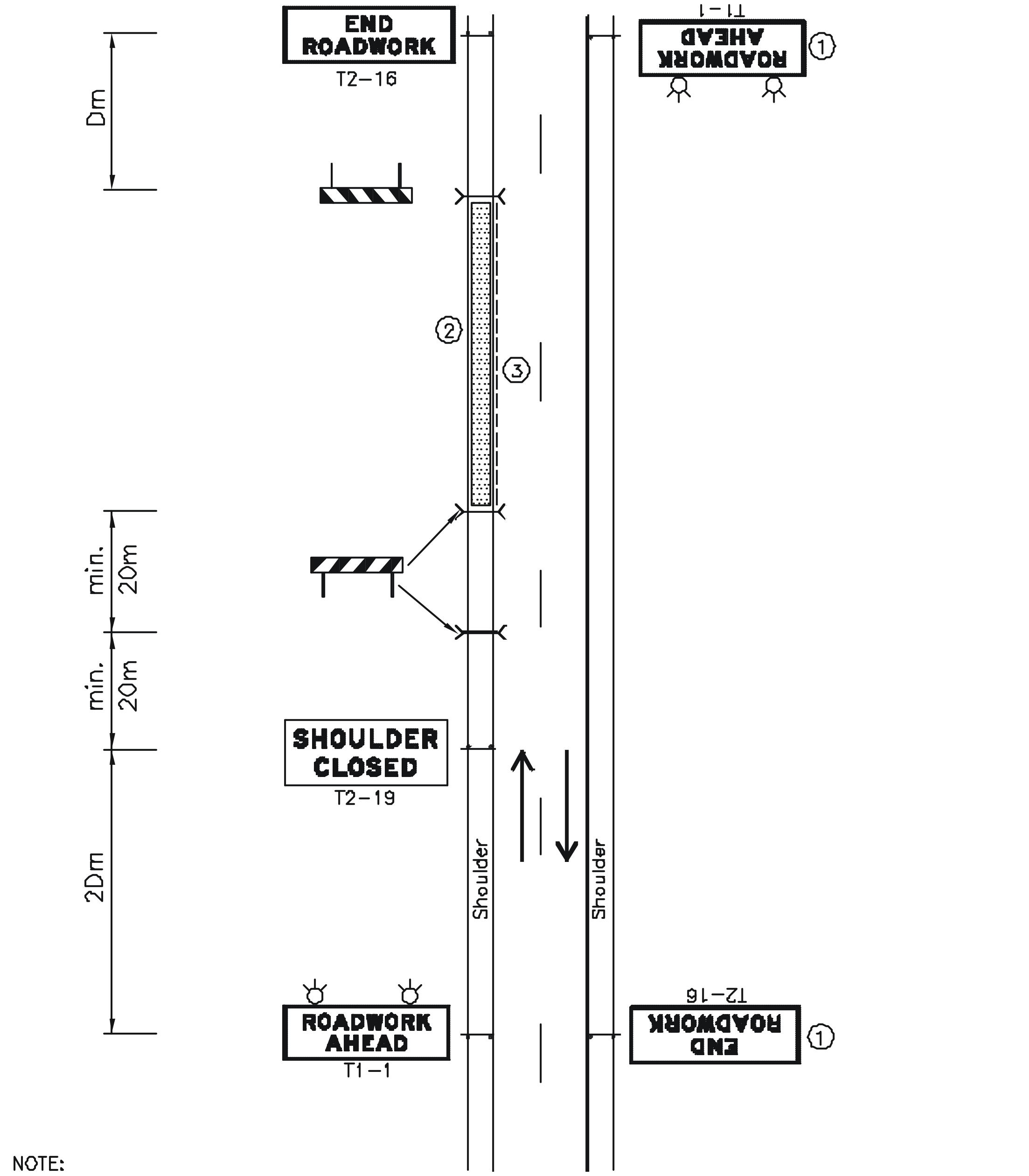
① Suitable only where D is less than 60km/h. Where D is 60km/h or more, consider TCPs 77, 78, 83, 84 95, 108, 437 or 440.

② The length of tapers is to be determined from ***Traffic Control at Work Sites***, Table 5.2, ***Recommended taper lengths***.

SHORT TERM WORK
2 LANE / 2 WAY
PART LANE CLOSURE

T000041

TCP 41



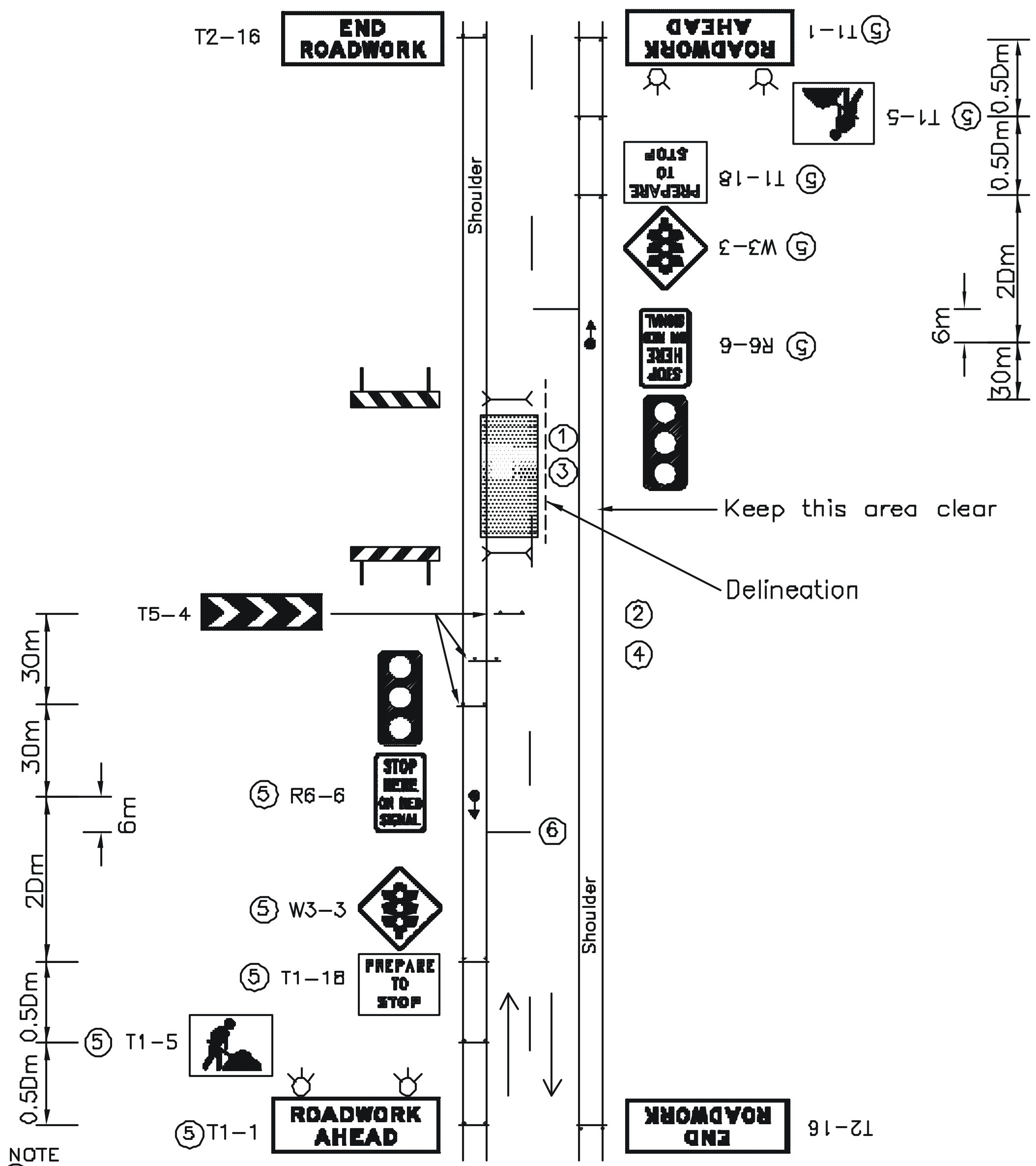
NOTE:

1. Southbound T1–1 and T2–16 signs should be omitted on a one way carriageway.
2. At night or when work has stopped, barriers to be erected along the work site at right angles to the traffic flow.
3. Check need for safety barrier. See *Traffic Control at Work Sites* Section 9.6. *Safety barriers*.

LONG TERM WORK
ALL ROADS
SHOULDER CLOSED

T000042

TCP 42



NOTE

(1) Remaining clear carriageway width should be 3.5m min. but may be reduced to an absolute minimum of 2.5m where ADT is less than 100 vehicles per day.

(2) TCP 59 (Chicane speed reduction) may be used in conjunction with this arrangement where speeds are high and sight distance is long.

(3) Check need for safety barrier. See *Traffic Control at Work Sites*, Section 9 6, *Safety barriers*.

(4) For use where shoulders are too narrow to use TCP 45, and traffic cannot flow through the work area between shifts.

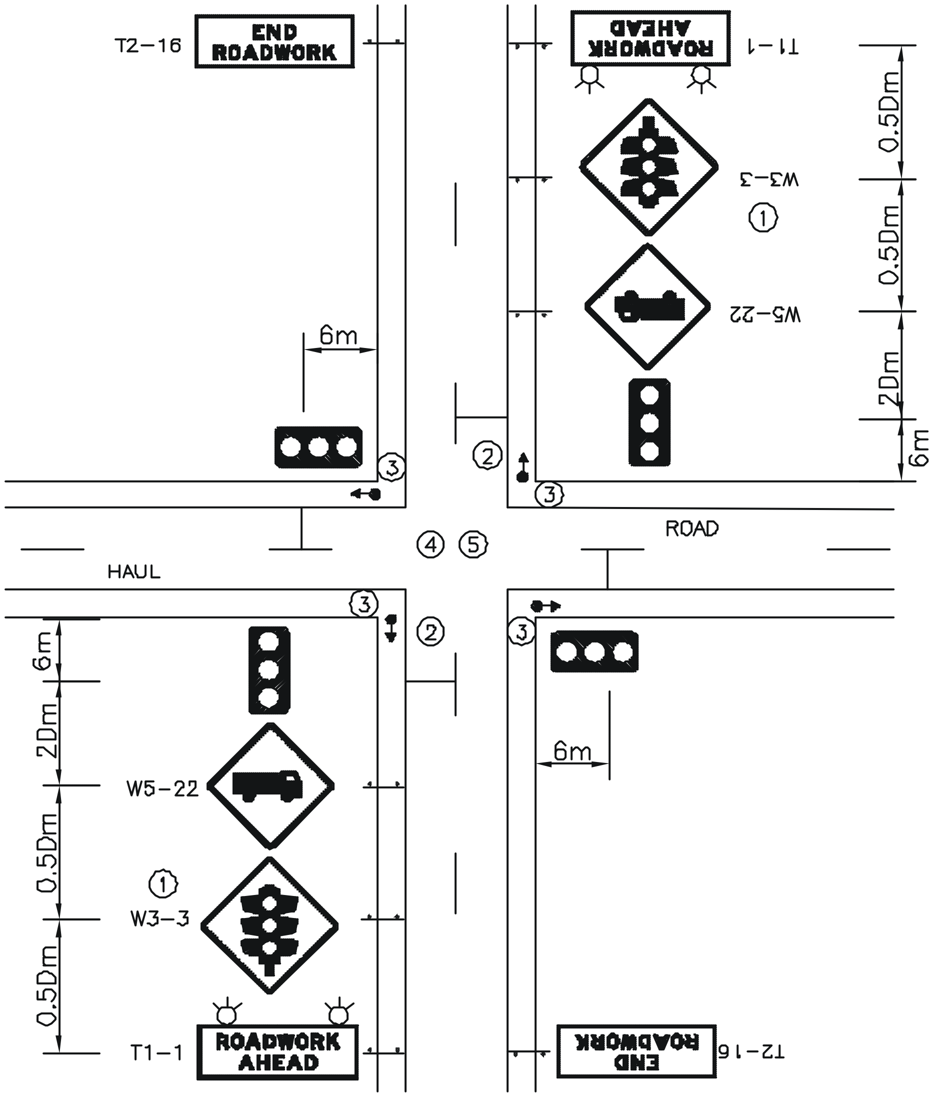
(5) Erect additional T1-1, W3-3 and R6-6 signs on right side of road if necessary. See *Traffic Control at Work Sites*, Section 3.2.4, *Duplication of signs*.

(6) Stop line to be 200mm – 300mm wide, 6m in advance of traffic signal.

SHORT & LONG TERM WORK
2 LANE / 2 WAY
LANE CLOSURE

T000043

TCP 43



NOTE:

(1) If traffic signals cannot be seen from the W3–3 sign, add W8–5 distance plate to this sign to highlight the situation

(2) In daylight, Traffic Controllers with T1–200 & T1–18 signs may be used instead of traffic signals.

(3) Determine the locations for traffic signal posts after advice from a person experienced in traffic signal design.

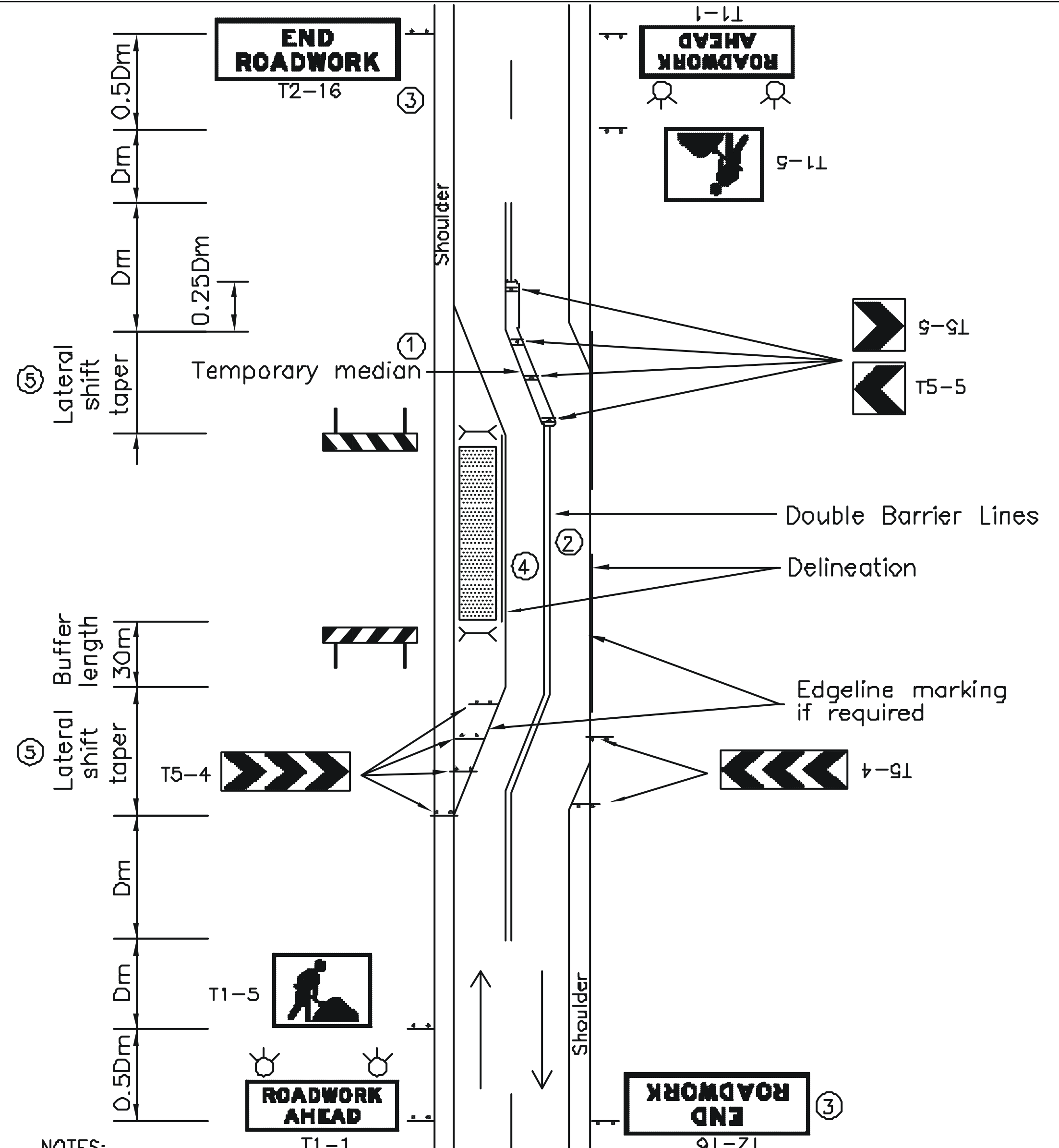
(4) If work continues into darkness, the haul road crossing should be suitably illuminated.

(5) If highway pavement affected, then use appropriate road signs to highlight the condition.

LONG TERM WORK
2 LANE / 2 WAY
HAUL ROAD CROSSING

T000044

TCP 44



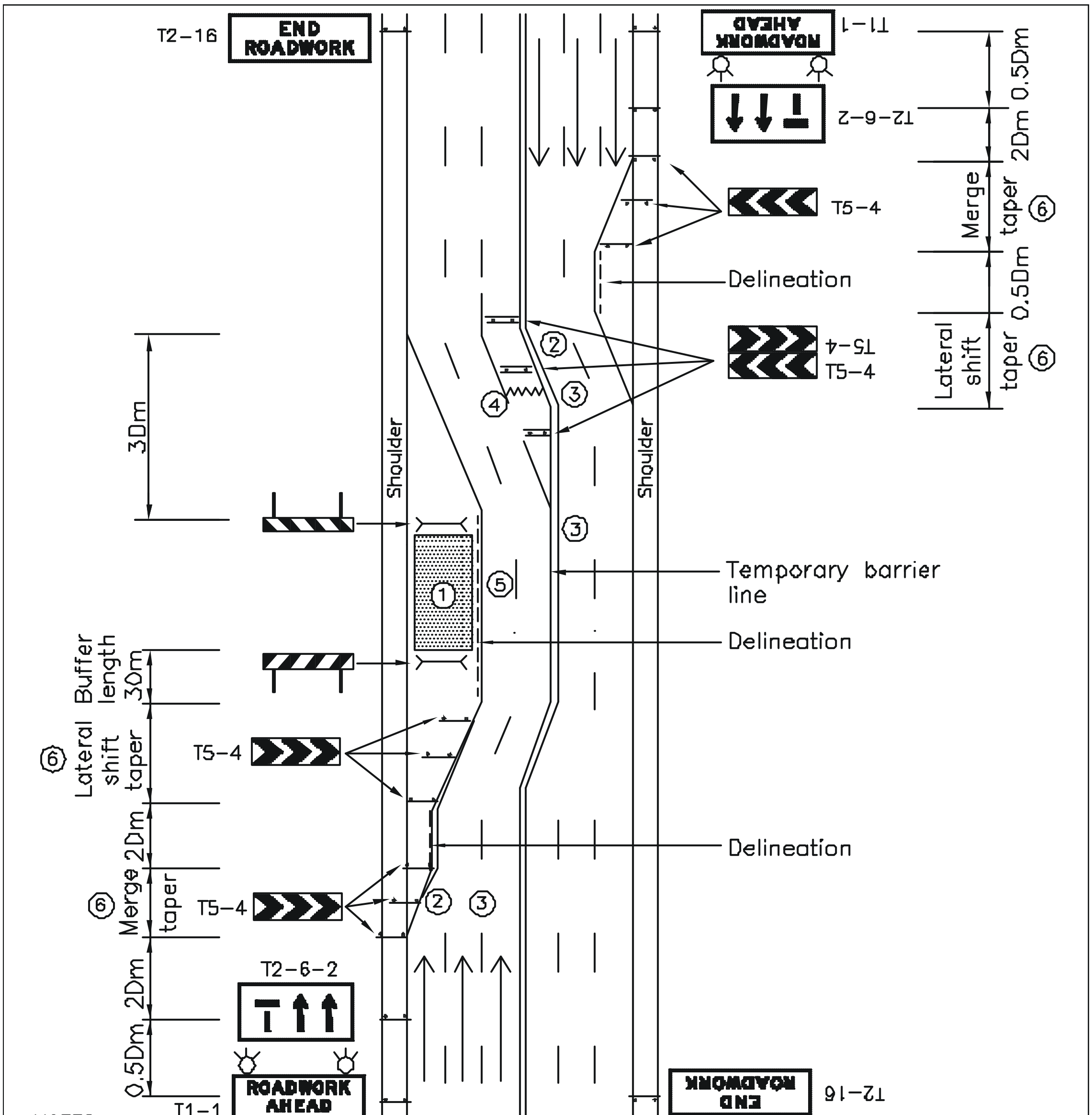
NOTES:

1. The temporary median should be a minimum width of 1.2m.
2. Place raised retroflective pavement markers adjacent to double barrier lines.
3. Duplicate T1–1 sign on right side where necessary.
4. Check need for safety barrier. See ***Traffic Control at Work Sites***, Section 9.6, ***Safety barriers***.
5. The length of lateral shift tapers is to be determined from ***Traffic Control at Work Sites***, Table 5.2, Recommended taper lengths.

LONG TERM WORK
2 LANE / 2 WAY
LANE CLOSURE – NO CONTROL

T000045

TCP 45



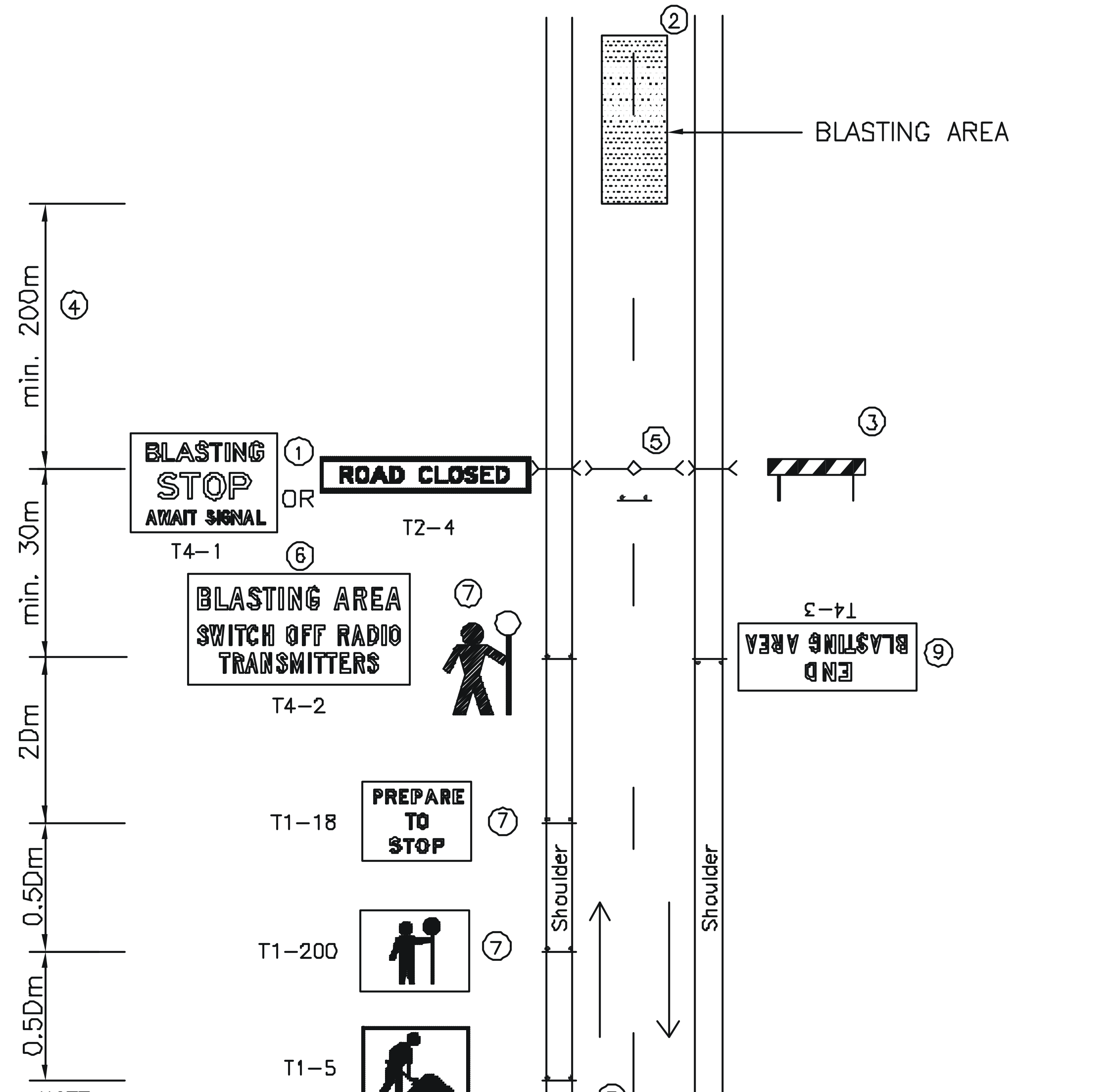
NOTES:

1. At night or when work has stopped, barriers may be erected along the work area at right angles to the traffic.
2. To avoid confusion unnecessary lines should be removed and new lines painted.
3. If necessary, supplement with RRPMs or structural barriers.
4. An antiglare screen should be used where headlight glare is a problem.
5. Check need for safety barrier. See ***Traffic Control at Work Sites***, Section 9.6. ***Safety barriers***.
6. The length of tapers is to be determine from ***Traffic Control at Work Sites***, Table 5.2, ***Recommended taper lengths***.

LONG TERM WORK
6 LANE / 2 WAY
TWO OUTER LANE CLOSURE

T000046

TCP 46



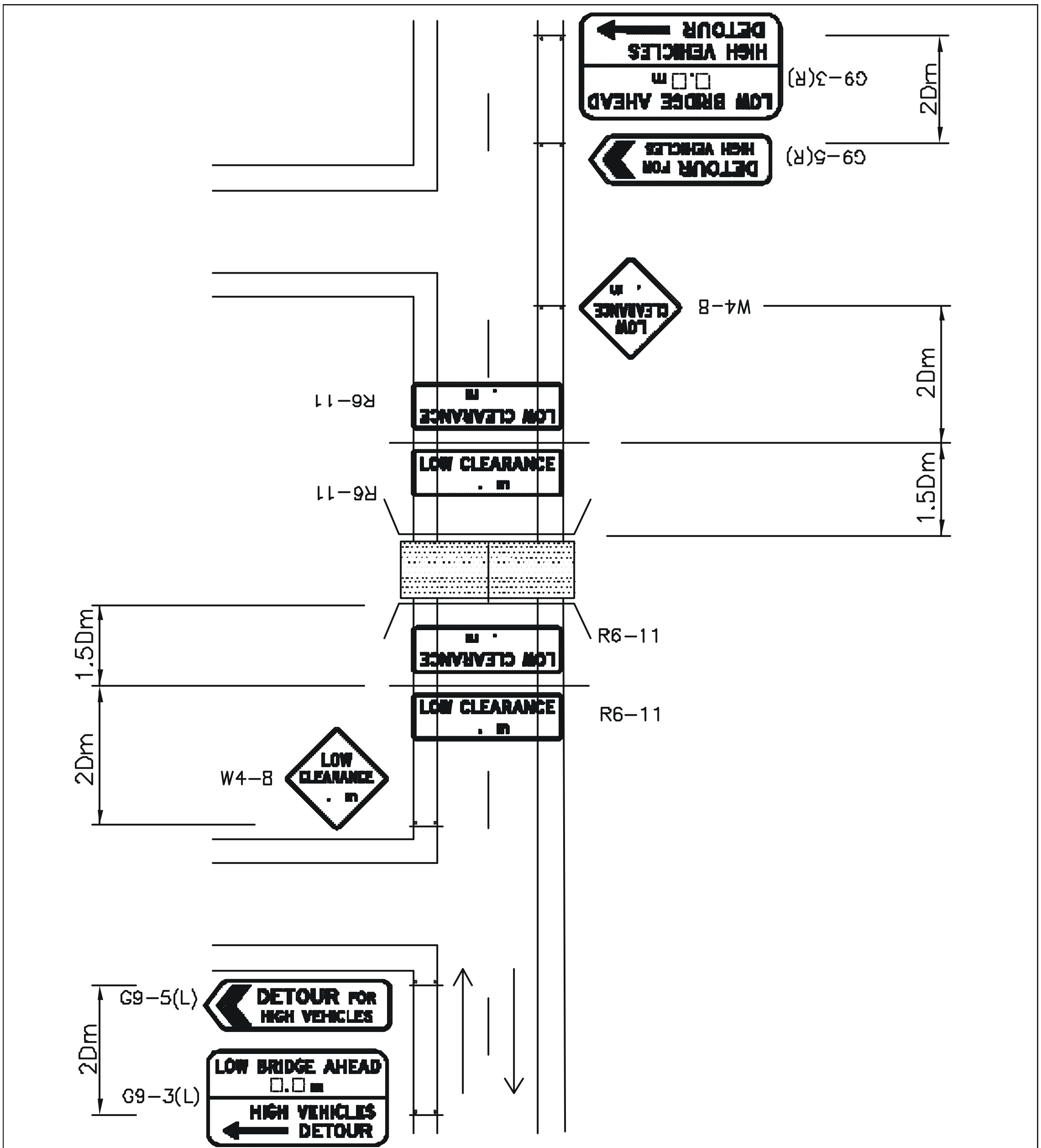
NOTE

1. For general road closures, use T2–4 instead of T4–1.
2. The same arrangement should be used on all other approaches.
3. For blasting works the temporary barriers should also block pedestrian access
4. At blasting works the temporary barriers should be erected not less than 400m from the blasting area where flyrock is not controlled
5. The temporary barriers should not be removed until the All Clear has been sounded.
6. Signs T4–2 and T4–3 are only required where electric detonators are used.
7. T1–200 and T1–18 signs must be covered when Traffic Controller is absent
8. Add advance warning signs (T1–1, T1–16 or T1–201) unless ADT is less than 300 vehicles per day and delay is less than 15 minutes. Use T2–16 where advance warning signs are used.

SHORT TERM WORK
2 LANE / 2 WAY
FULL ROAD CLOSURE, EG. BLASTING

T000047

TCP 47



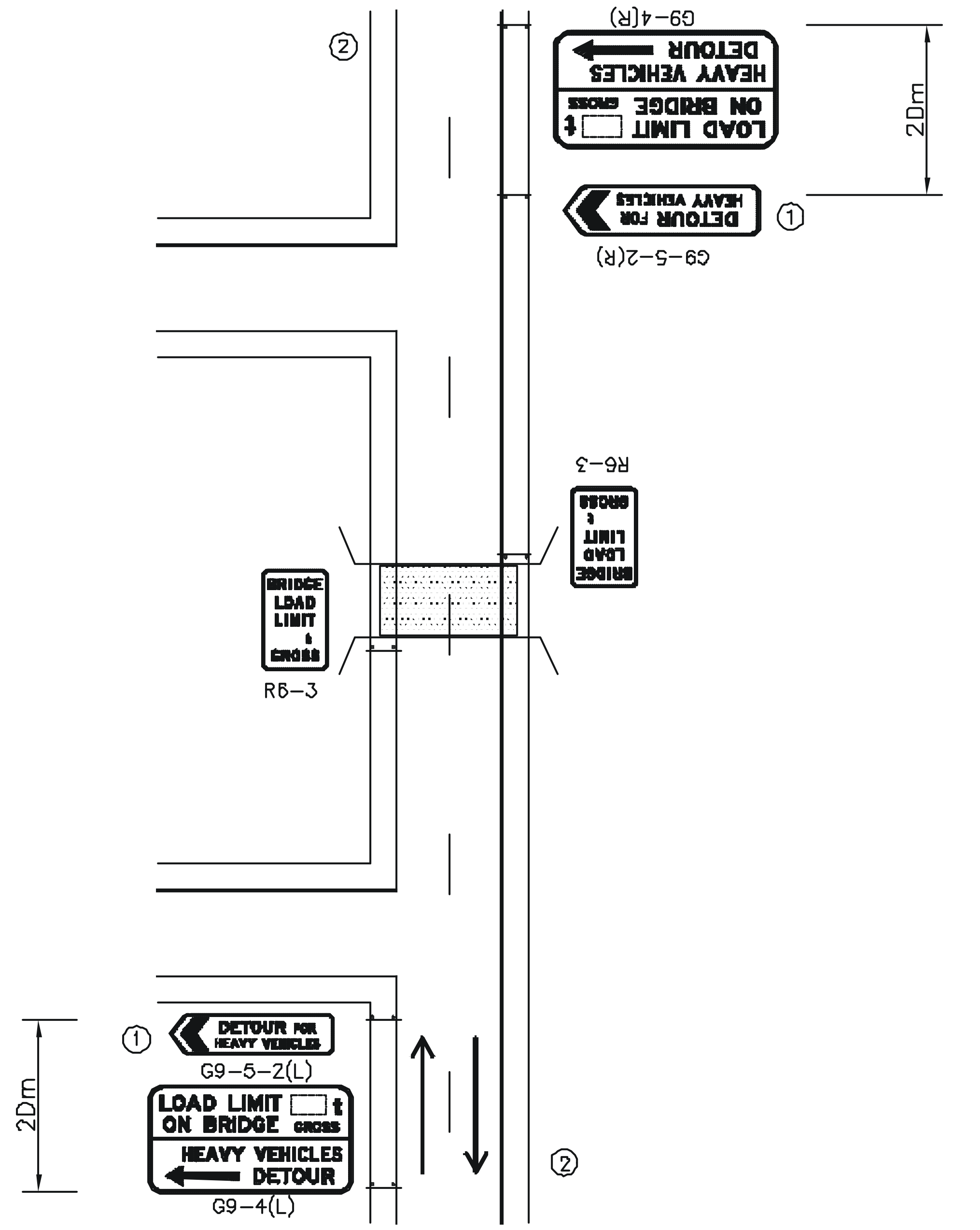
NOTE:

1. Use sign R6-12 where clearance is more than 4.6m but less than 5.3m.
2. Low clearance warning gauges should be used in all cases where permanent clearance is less than or equal to 4.6m or where any temporary clearance is less than 5.3m.
3. The detour should be signed at intersections along the route by sign G9-5.
4. High traffic volumes may require duplication of G9-3 signs on the right side of road.

LONG TERM WORK
2 LANE / 2 WAY
HIGH VEHICLE DETOUR

T000048

TCP 48

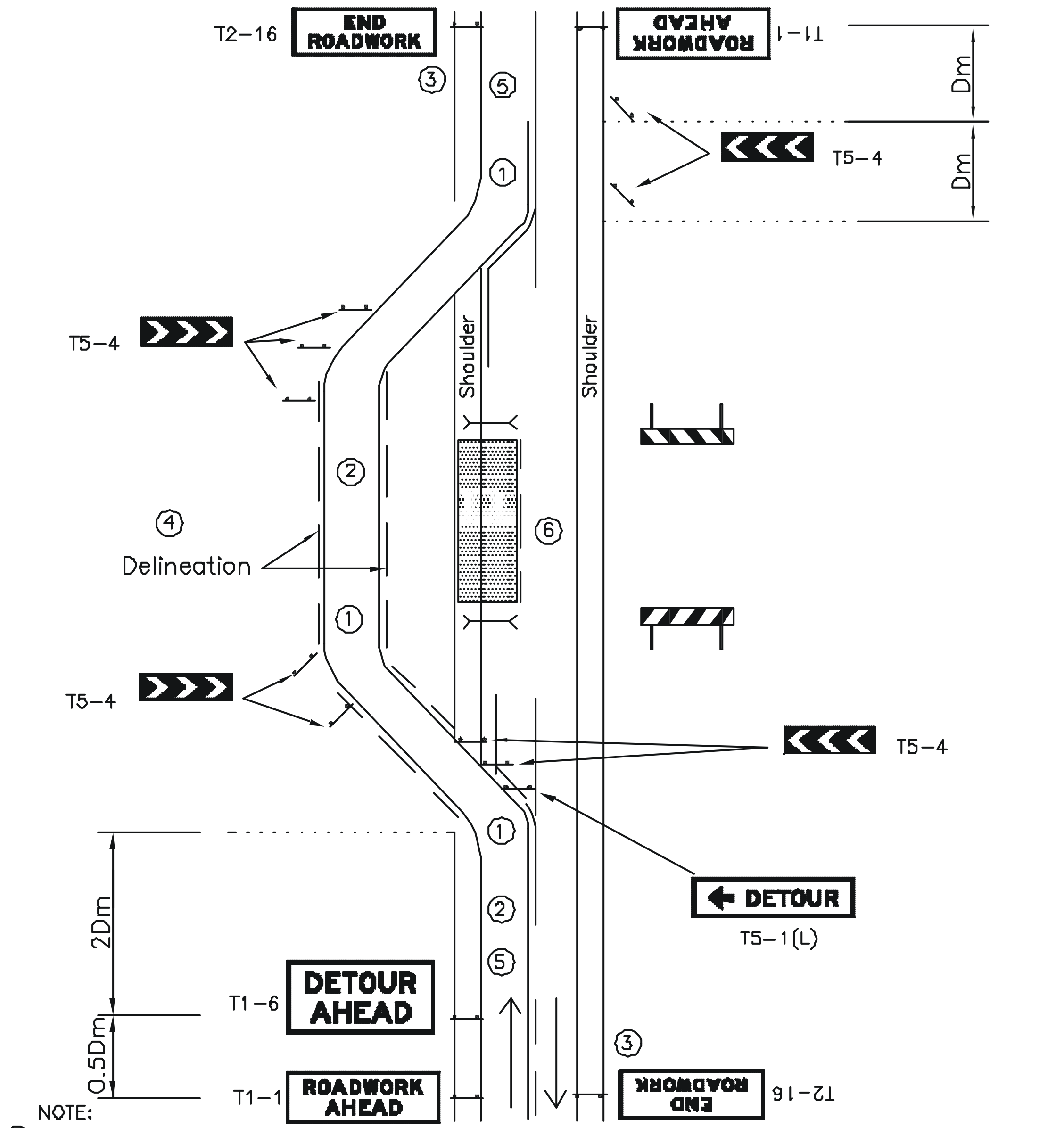


NOTE:
(1) The detour should be signed at intersections along the route by sign G9-5-2.
(2) High traffic volumes may require duplication of G9-4 signs on the right side of the road.

LONG TERM WORK
2 LANE / 2 WAY
HEAVY VEHICLE DETOUR

T000049

TCP 49



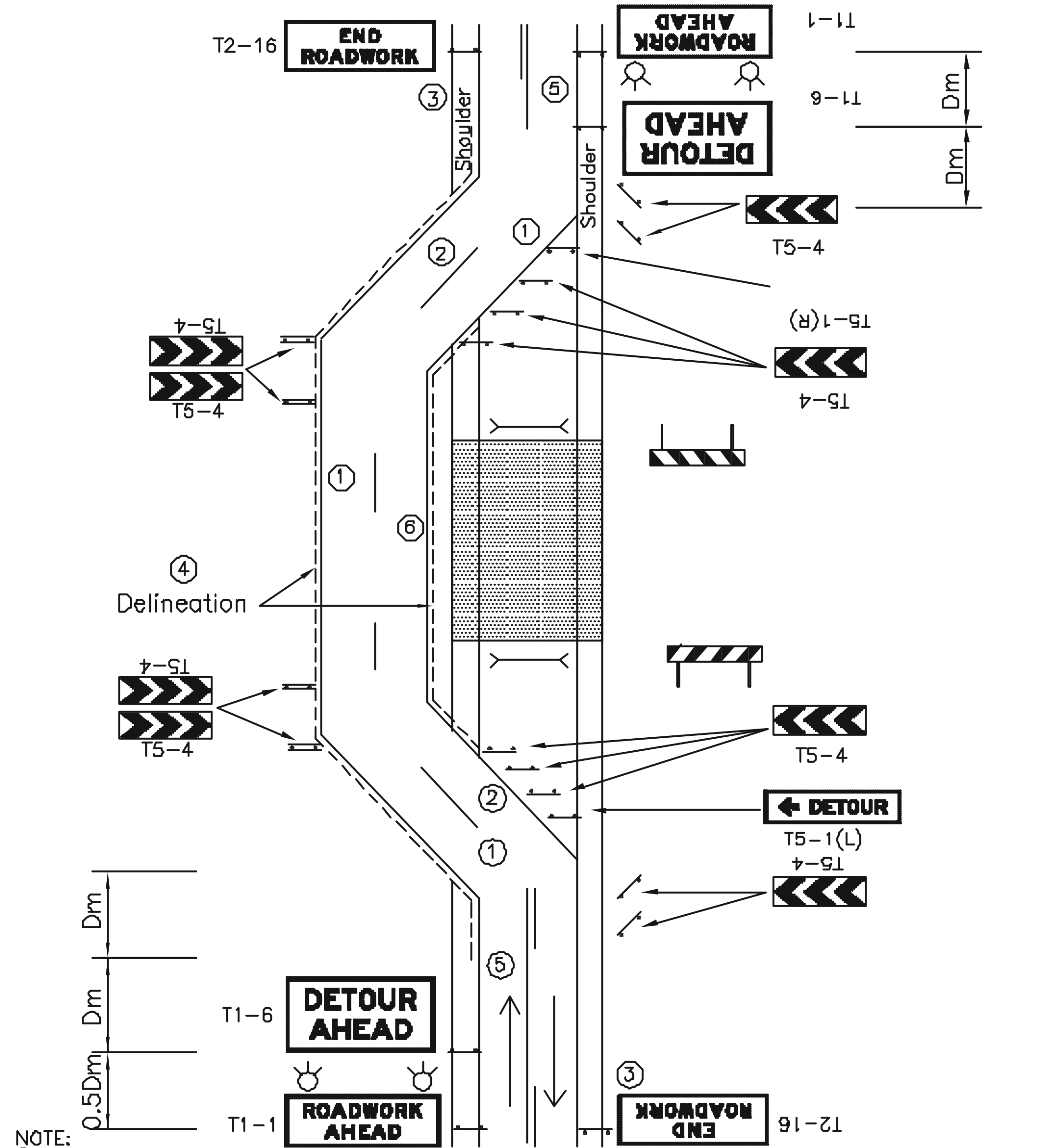
NOTE:

1. The side-track pavement width should not be less than 3.5m and designed to suit operating speeds. CURVE warning and ADVISORY SPEED signs should be used where appropriate.
2. The surface of the side-track should be similar to the approaches.
3. For high volume roads, consider duplicate sign T1-1 on the right-hand side.
4. Delineate both sides of the side-track with line marking, RRPMs and guide posts with reflectors.
5. Mark unbroken barrier lines on approaches 1.5Dm in length.
6. Check need for safety barrier. See *Traffic Control at Work Sites*, Section 9.6, *Safety barriers*

LONG TERM WORK
2 LANE / 2 WAY
ONE LANE SIDE TRACK

T000050

TCP 50



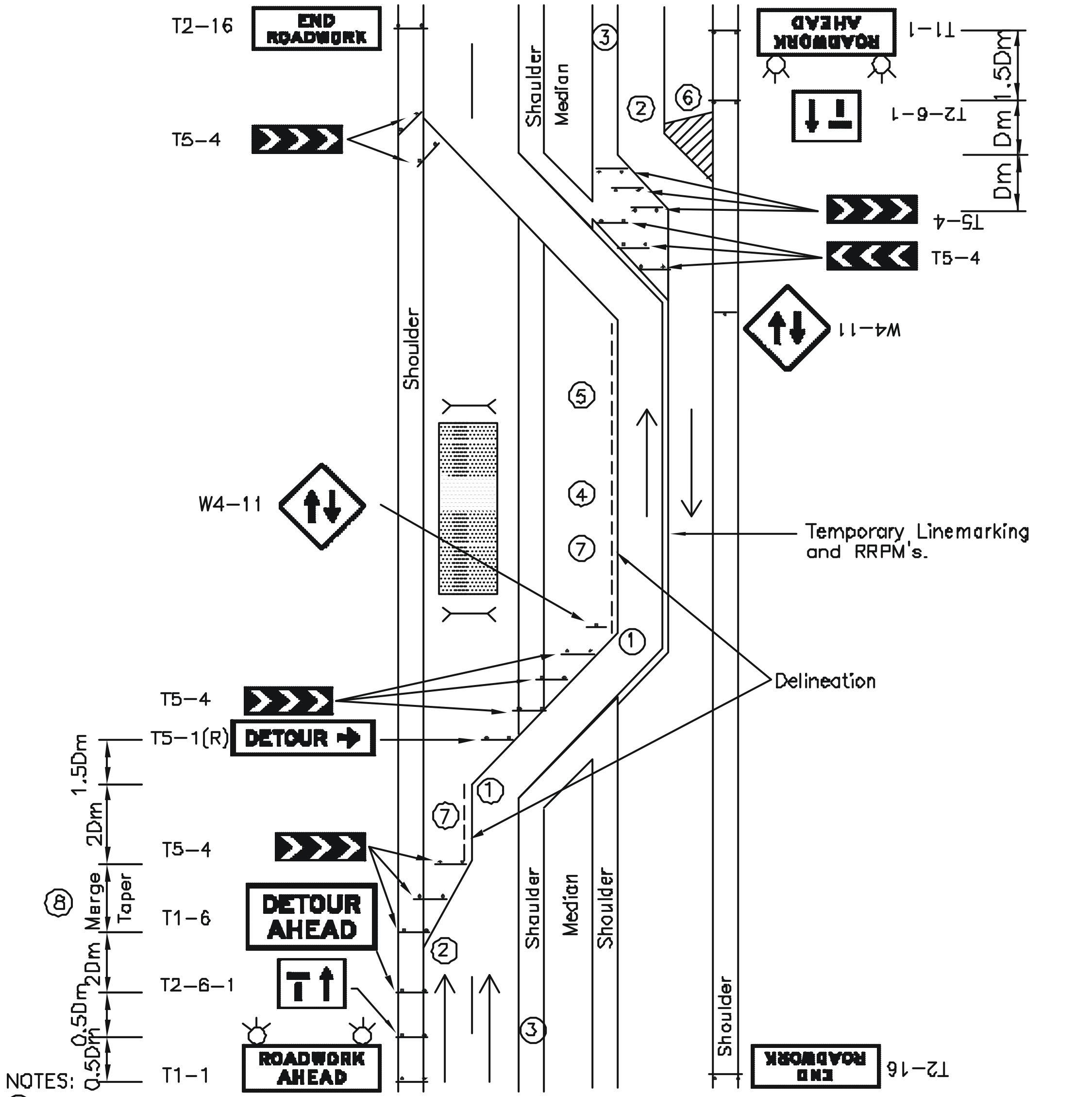
NOTE:

1. The side track pavement width should not be less than 7m and designed to suit operating speeds. CURVE warning and ADVISORY SPEED signs should be used where appropriate.
2. The surface of the side–track should be similar to the approaches.
3. For high volume roads, consider duplicate sign T1–1 on the right–hand side.
4. Delineate both sides of the side–track with line marking RRPMs and guide posts with reflectors.
5. Mark unbroken barrier lines on approaches, 1.5Dm in length.
6. Check need for barrier. See ***Traffic control at Work Sites***, Section 9.6, ***Safety barriers***.

LONG TERM WORK
2 LANE / 2 WAY
TWO LANE SIDE TRACK

T000051

TCP 51



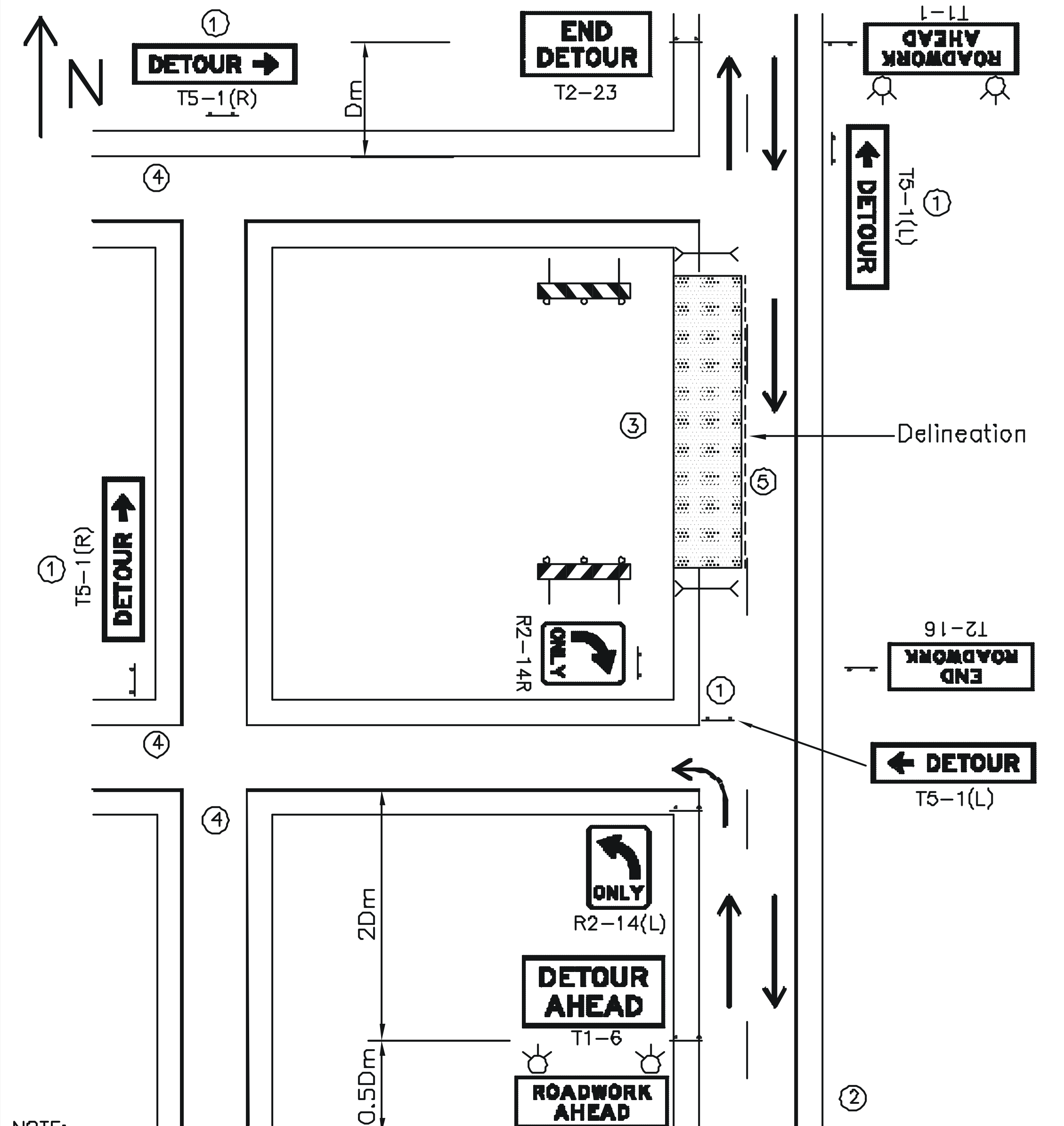
NOTES:

1. The side-track pavement width should not be less than 3.5m and designed to suit operating speeds. CURVE warning and ADVISORY SPEED signs should be used where appropriate.
2. The surface of the side-track should be similar to the approaches.
3. Duplicate signs T1–1, T1–6 and T2–6–1 in the median if there is room.
4. Repeat signs W4–11 where the side-track exceeds 400m.
5. If possible, keep pedestrians away from this area. See *Traffic Control at Work Sites*, Section 9.3, *Pedestrians*.
6. For details of closure of southbound kerbside lane, see TCP 46.
7. Check need for safety barrier See *Traffic Control at Work Sites*, Section 9.6, *Safety barriers*.
8. The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.

LONG TERM WORK
FOUR LANE / DIVIDED
SIDE TRACK CROSSING MEDIAN

T000052

TCP 52



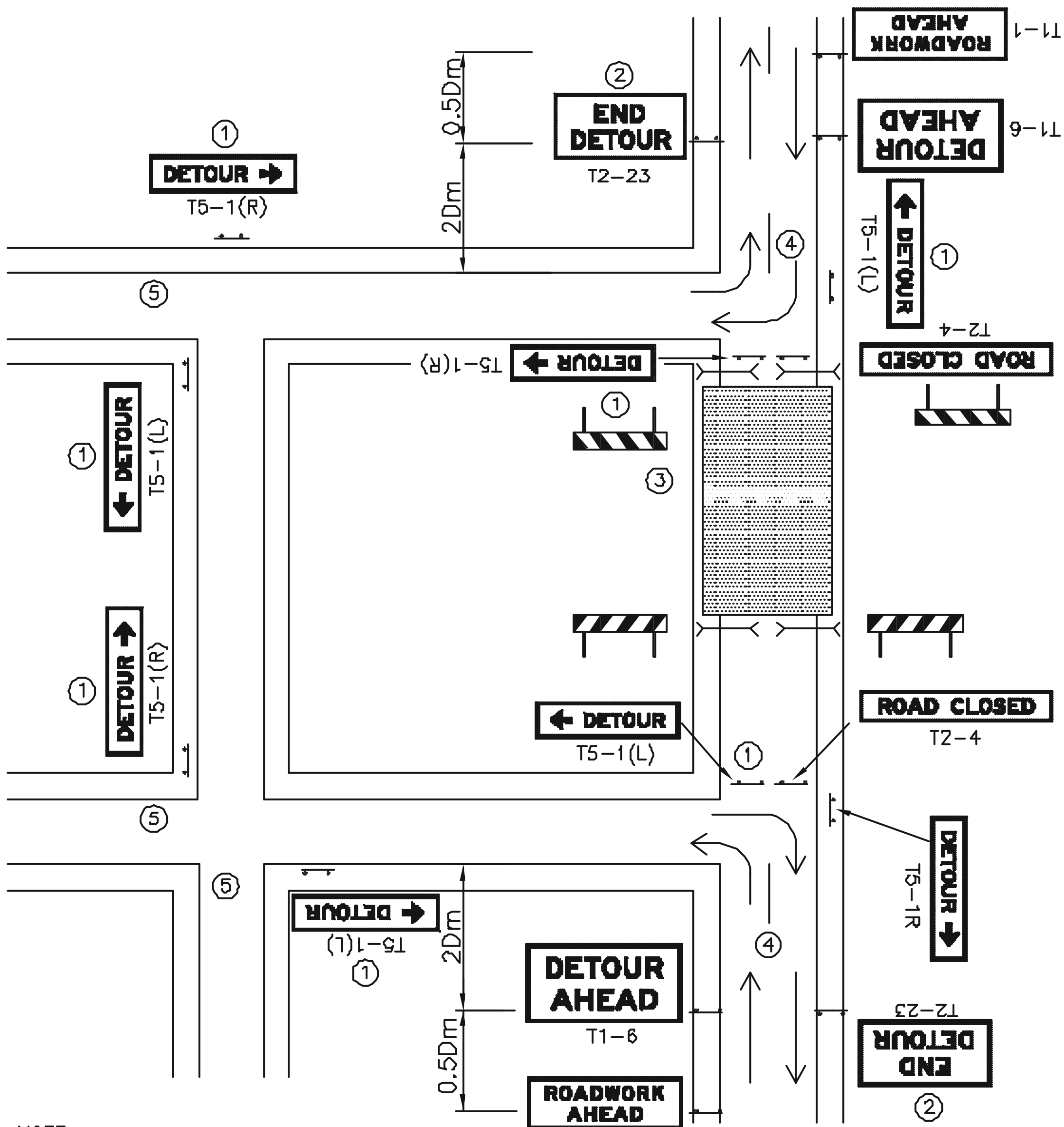
NOTE:

1. Direction and reassurance signs may be required for guidance of through traffic.
2. For high traffic volumes, consider duplicating signs T1-1 (northbound) and T1-6 on the right-hand side.
3. Means of access for local traffic and pedestrians across the work area should be provided and suitable guide signs erected.
4. Additional signs to be considered to guide traffic using roads in vicinity of work site.
5. Check need for safety barrier. See *Traffic Control at Work Sites*, Section 3.2.4, *Duplication of signs.*

LONG TERM WORK
2 LANE / 2 WAY
ONE DIRECTION DETOUR

T000053

TCP 53



NOTE:

(1) Direction and reassurance signs may be required for guidance of through traffic.

(2) For high traffic volumes, consider duplicating signs T1-1 (northbound) and T1-6 on the right-hand side.

(3) Means of access for local traffic and pedestrians across the work area should be provided and suitable guide signs erected.

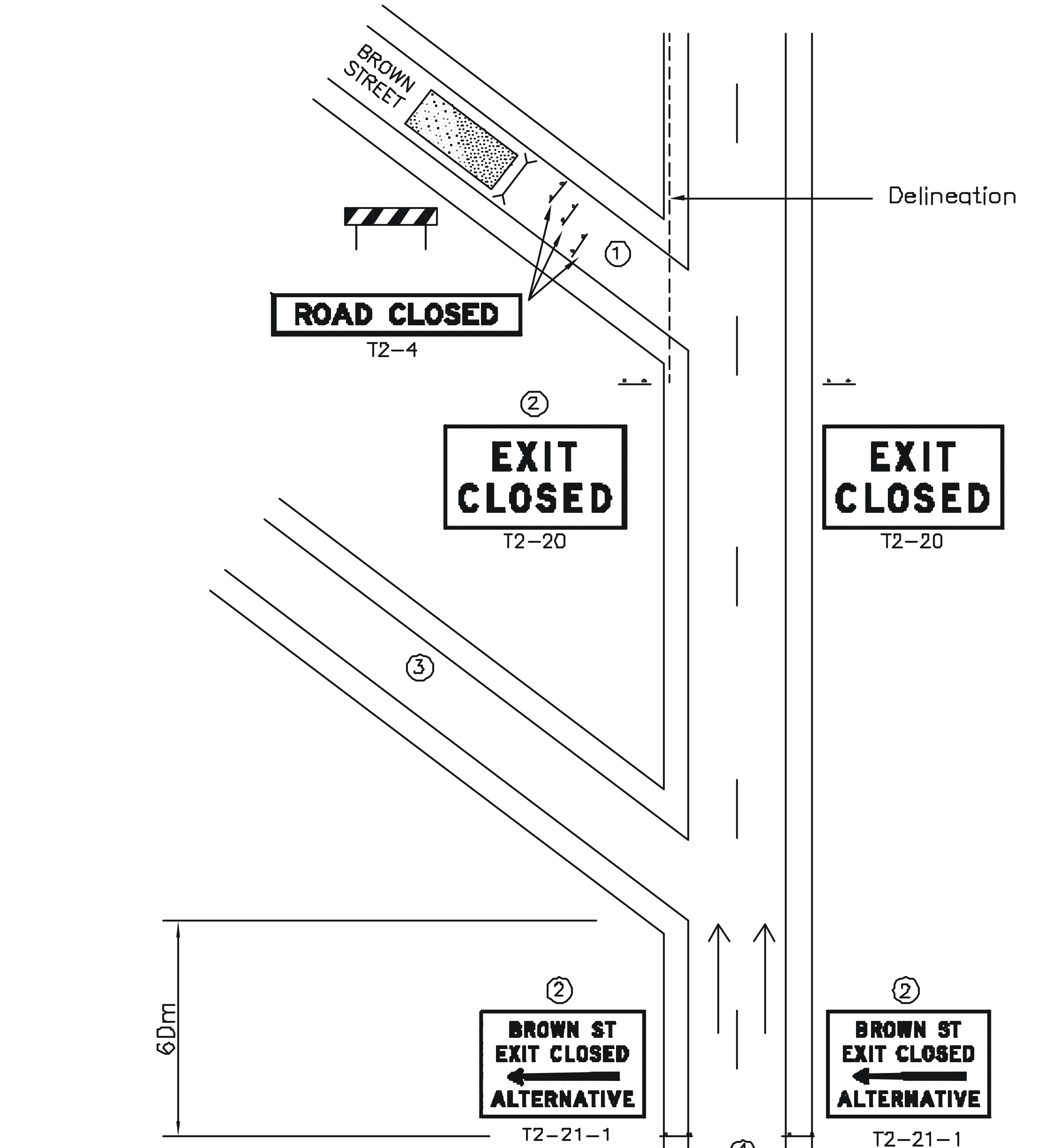
(4) Consider the use of temporary barrier lines to prevent overtaking on the approach to the work area.

(5) Additional signs to be considered to guide traffic using roads in vicinity of work site.

LONG TERM WORK
2 LANE / 2 WAY
DETOUR ALL TRAFFIC

T000054

TCP 54



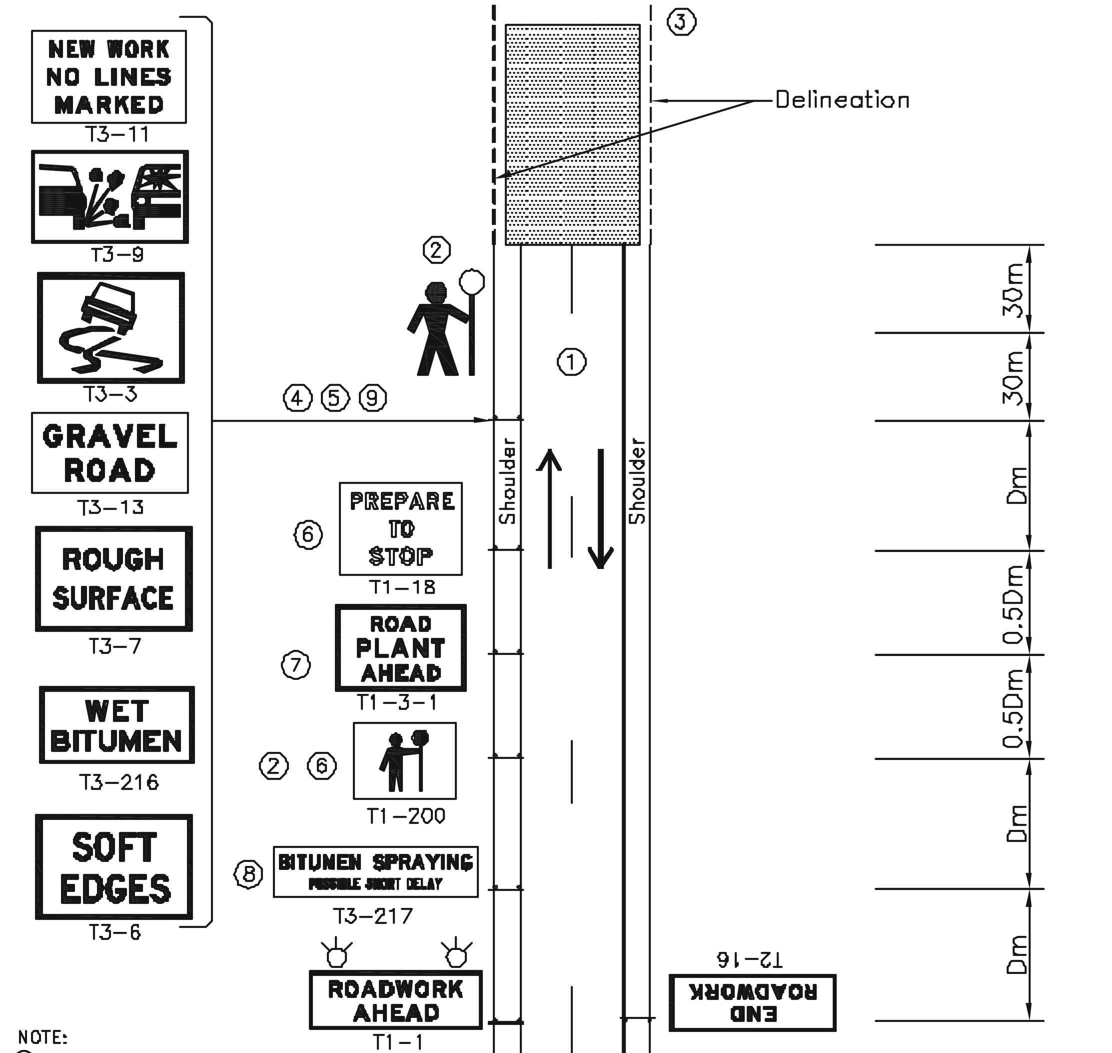
NOTE:

1. Barriers and sign T2-4 should be placed at right angles to the exit ramp direction.
2. Warning of the exit closure should be given in advance of the preceding on-ramp where the associated exit is the alternative route.
3. A suitable route should be signed to guide diverted traffic to it's original destination.
4. Changes should be made to guide signs that refer to destinations along the closed road.

LONG TERM WORK
2 LANE / DIVIDED
EXIT CLOSURE

T000055

TCP 55



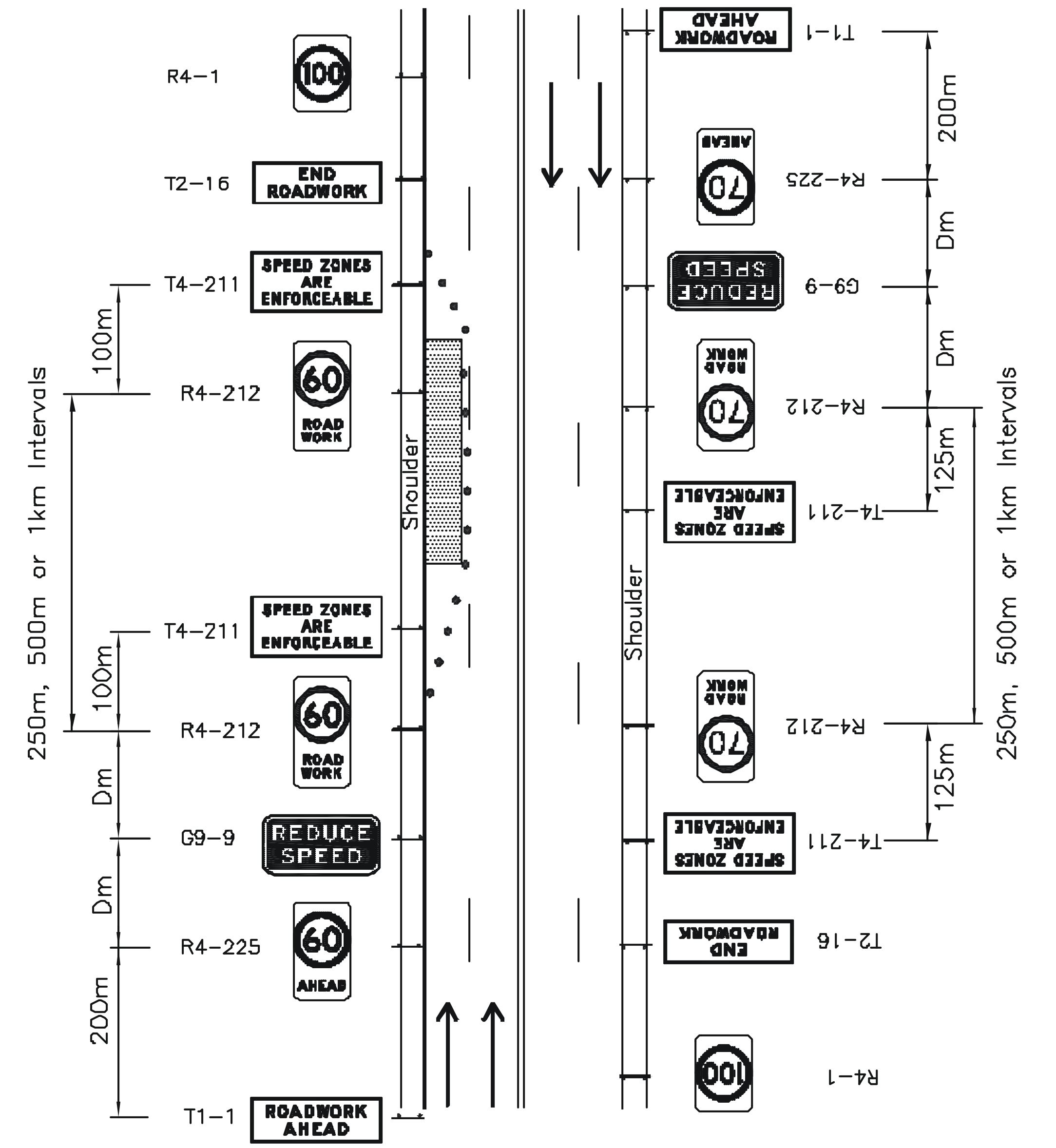
NOTE:

1. This arrangement is most applicable to bituminous surfacing and similar works on lightly trafficked roads. Use TCP 353 where speed limit exceeds 60km/h and ADT exceeds 5,000 vehicles per day. Speed limit repeater signs are to be erected in accordance with Section 8.2.4(c).
2. Traffic Controllers, T1-200 & T1-18 signs should always be used for bituminous surfacing works but may not be necessary for other works where ADT is less than 500 vehicles per day.
3. The same traffic control arrangement is used for traffic from the opposite direction.
4. One or more of the signs T3-1, T3-3, T3-6, T3-7, T3-9 or T3-13 that is the most appropriate to be used and repeated along the work site for long work areas.
5. Sign T3-11 to be used on bituminous surfacing works, to remain in place until line marking is reinstated.
6. T1-200 and T1-18 signs must be covered when Traffic Controller is absent.
7. T1-3-1 must be removed or securely covered between shifts.
8. Display T3-217 sign on all bitumen surfacing works during the shifts when spraying or paving takes place.
9. For bituminous surfacing work, signs T3-3 and T3-9 are to remain in place until loose aggregate is removed.

LONG TERM WORK
2 LANE / 2 WAY
SPEED LIMIT 60km/h OR LESS

T000056

TCP 56



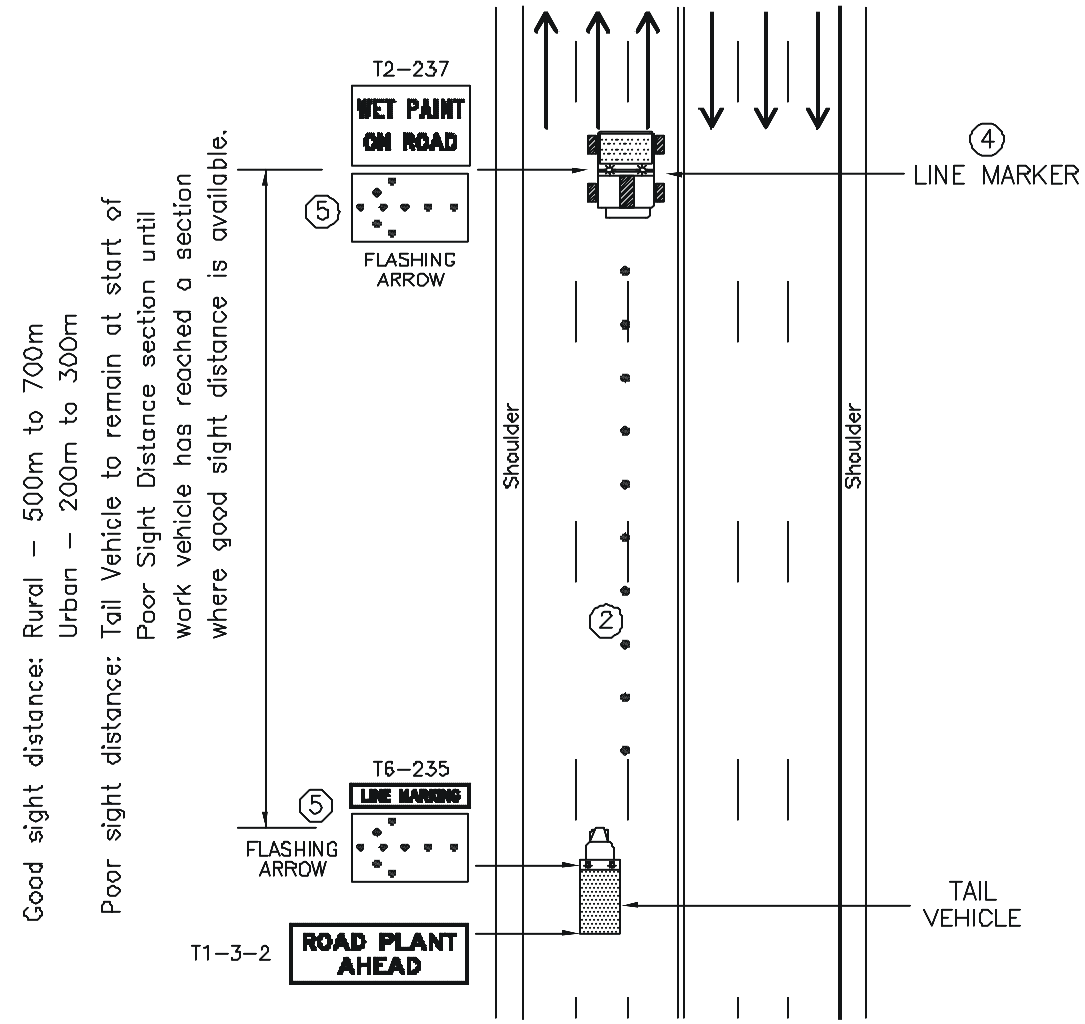
NOTES:

1. This sign arrangement shall only be used with other appropriate TCP's detailing other roadwork signs and devices.
2. The value of speed limits displayed shall match the speed zone approval.
3. Additional signposting will be required on side roads entering the roadworks speed zone.
4. "SPEED ZONES ARE ENFORCEABLE" signs are required for works in excess of 4 weeks or where speed zone compliance is a problem.
5. See Section 8.2, ***Roadwork speed zones*** of ***Traffic Control at Work Sites.***

GENERAL WORKS – ALL ROADS
ROADWORK SPEED LIMITS

T000057

TCP 57



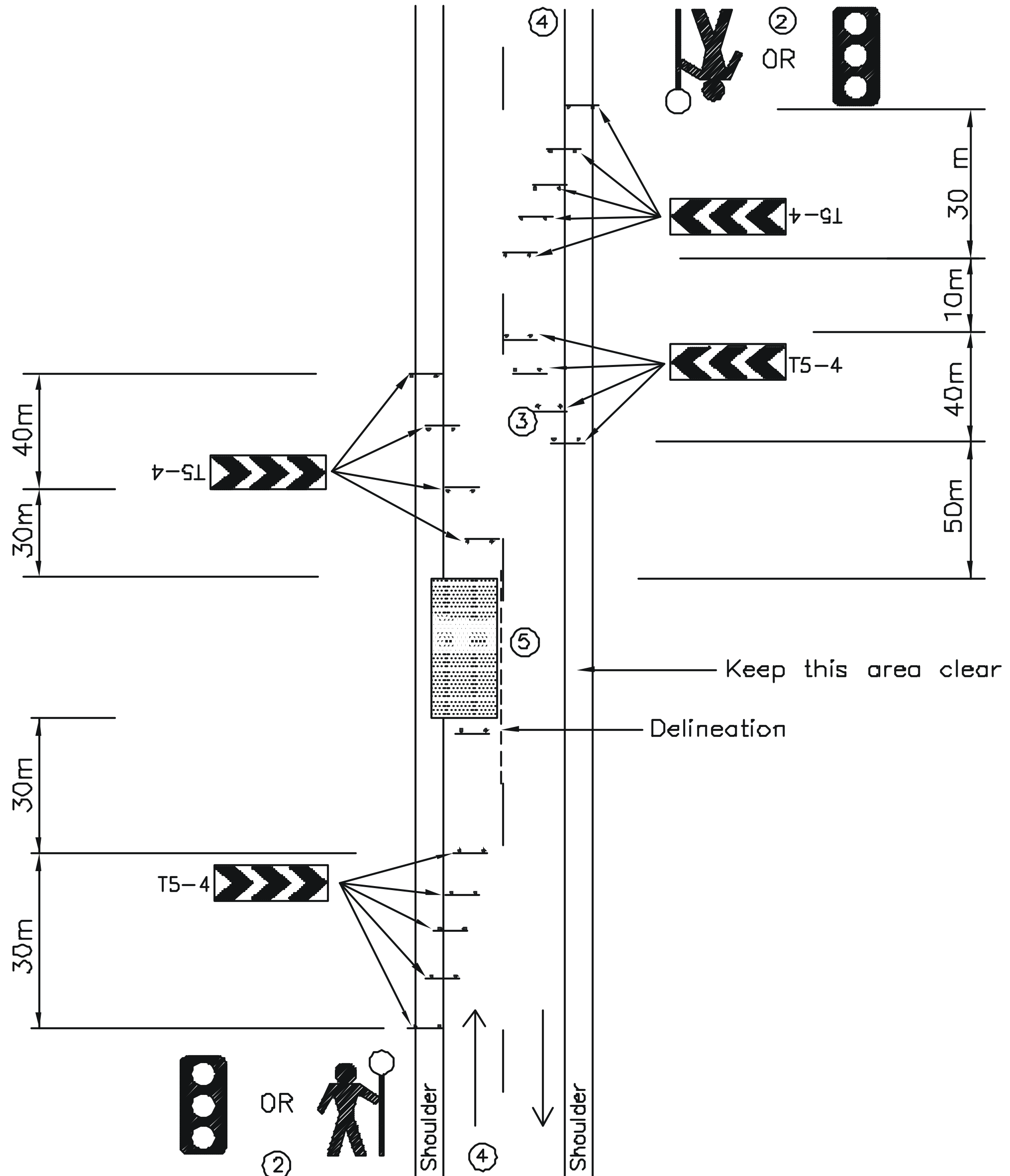
NOTES:

1. Diagramatic shows use of centre-mounted guns. Where line marker is using side-mounted guns, it is to travel within the appropriate lane and apropriate flashing arrows displayed.
2. Traffic cones to be laid along the line of the wet line where traffic conditions dictate.
3. Where traffic cones are used, an additional tail vehicle shall be used to provide warning of the cone recovery operation.
4. Line Marker to travel as far to the right as possible. Vehicle should overlap the lane line by at least 1/3 the width of each vehicle.
5. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.

MOBILE WORK
6 LANE / 2 WAY
LINE MARKING – LANE LINE

TC00058

TCP 58



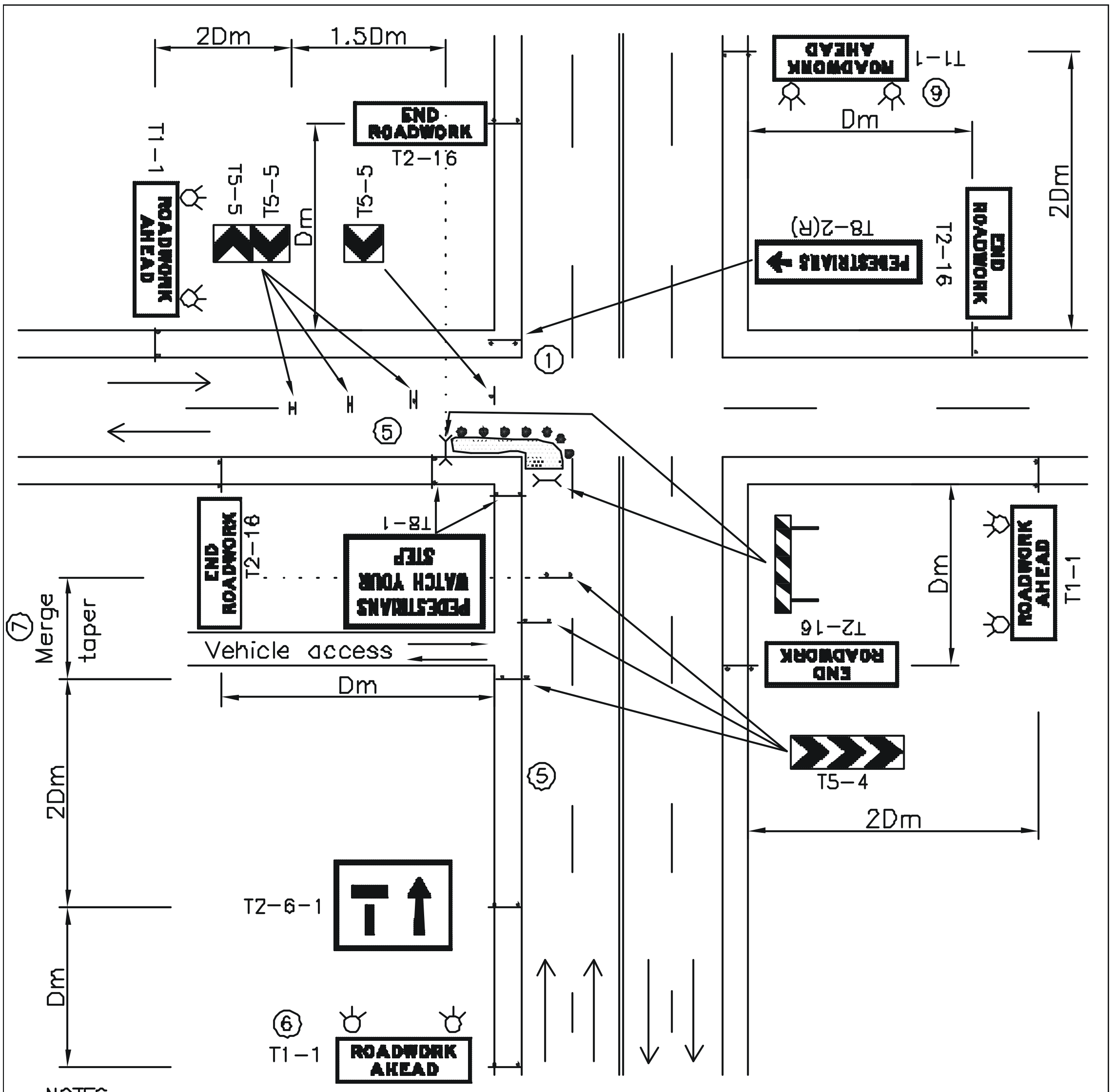
NOTES:

1. This arrangement may be used on straight, high speed approaches with good sight distance which result in unacceptable speeds through the work site which cannot be contralled by other methods.
2. This arrangement must only be used with Traffic Controllers or portable traffic signals.
3. The travelled path should not be less than 3.5m wide.
4. This Traffic Control Plan is to be used only as a supplement to TCP 43 or TCP 440
5. Check need for safety barrier. See ***Traffic Control at Works Site***, Section 9.6, ***Safety barriers.***

GENERAL WORK
2 LANE / 2 WAY
CHICANE SPEED REDUCTION

T000059

TCP 59



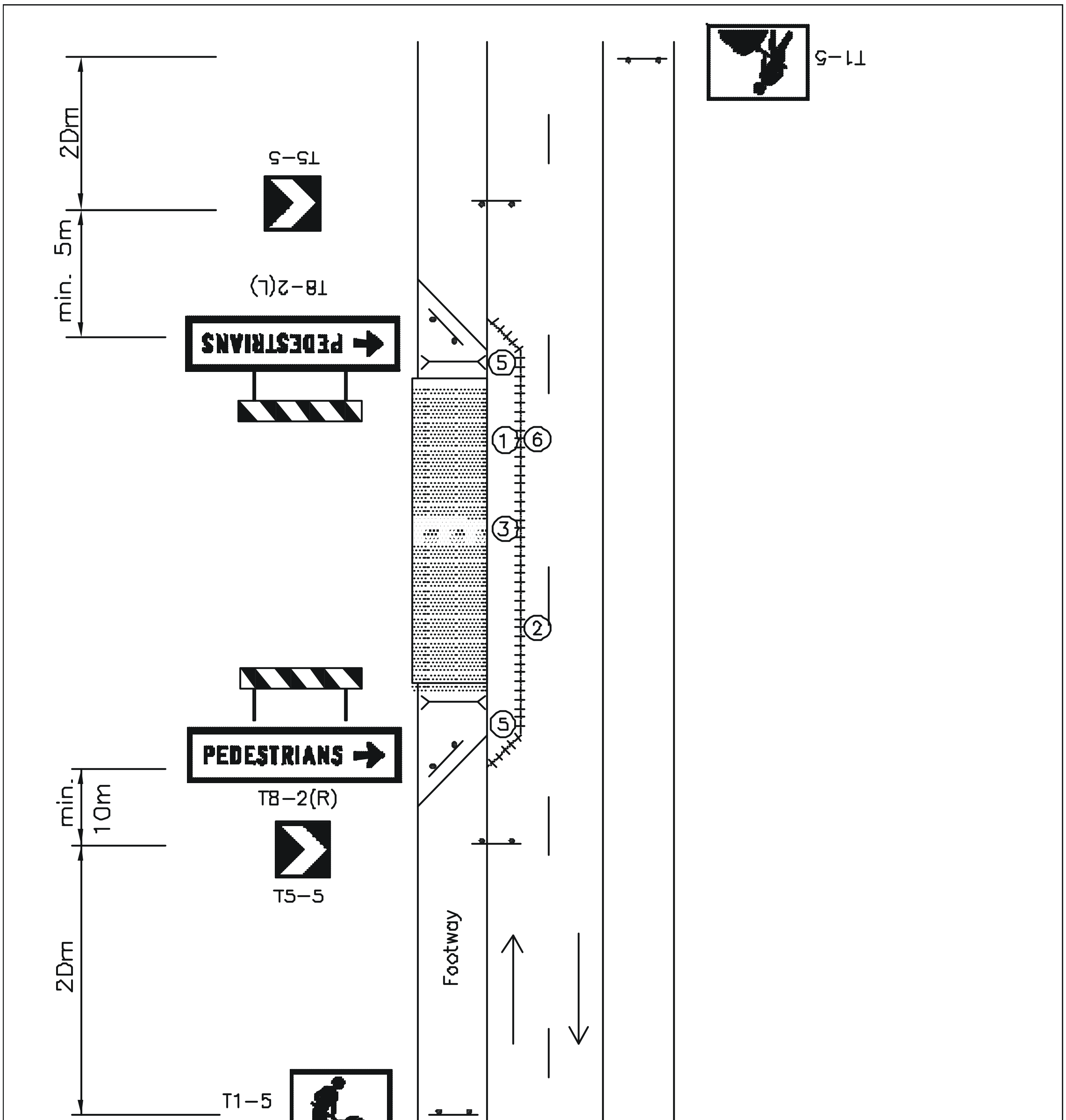
NOTES:

1. Check need for safety barrier. See ***Traffic Control at Work Sites,*** Section 9.6, ***Safety barriers.***
2. Consider parking restrictions to simplify traffic control.
3. Means of access for local traffic and pedestrians across the work area should be provided and suitable guide signs erected.
4. If the residual traffic lane width is less than 3m (3.5m desirable), maintain an adequate lane width by shifting opposing traffic to the left and delineating the travelled path.
5. Remove misleading linemarking.
6. High traffic volumes may require sign T1-1 to be duplicated on the right-hand side.
7. The length of merge tapers is to be determined from ***Traffic Control at Work Sites,*** Table 5.2, Recommended taper lengths.

LONG TERM WORK
URBAN INTERSECTION
KERBSIDE WORK

T000060

TCP 60

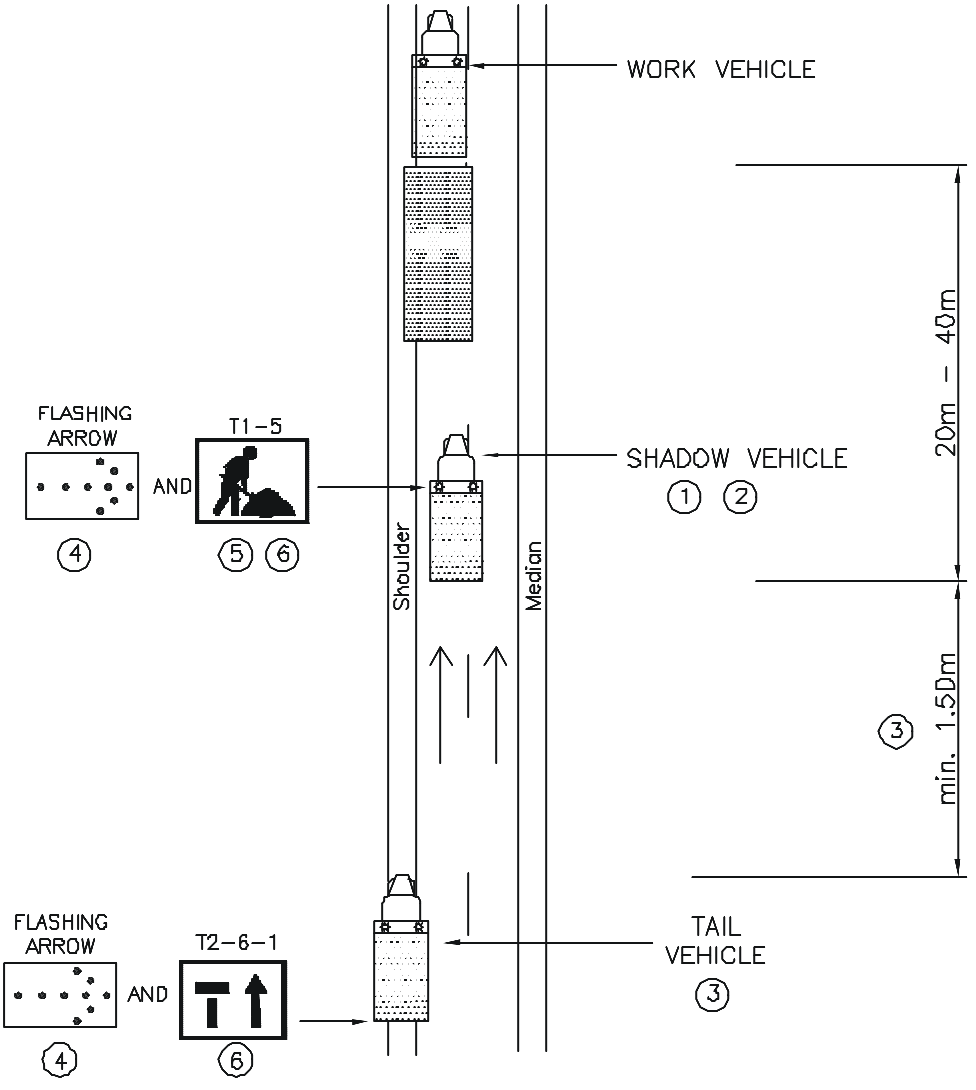


NOTE:
1. Prohibit vehicles stopping along the length of narrowed carriageway.
2. Provide a minimum traffic lane width of 3.0m (desirable 3.5m).
3. Provide a minimum clear width of 1.2m (desirable 2.0m) for pedestrian traffic.
4. Arrange vehicular access across the work area using portable barriers or plastic mesh fencing.
5. Provide a temporary ramp for prams and a safe path for pedestrians
6. Ensure that the requirements of *Traffic Control at Work Sites*, Section 3.6, *Safe clearances between workers and through traffic*, are met for the pedestrians.

SHORT TERM WORK
ALL ROADS
WORK OCCUPYING THE FULL WIDTH OF A FOOTWAY

T000061

TCP 61



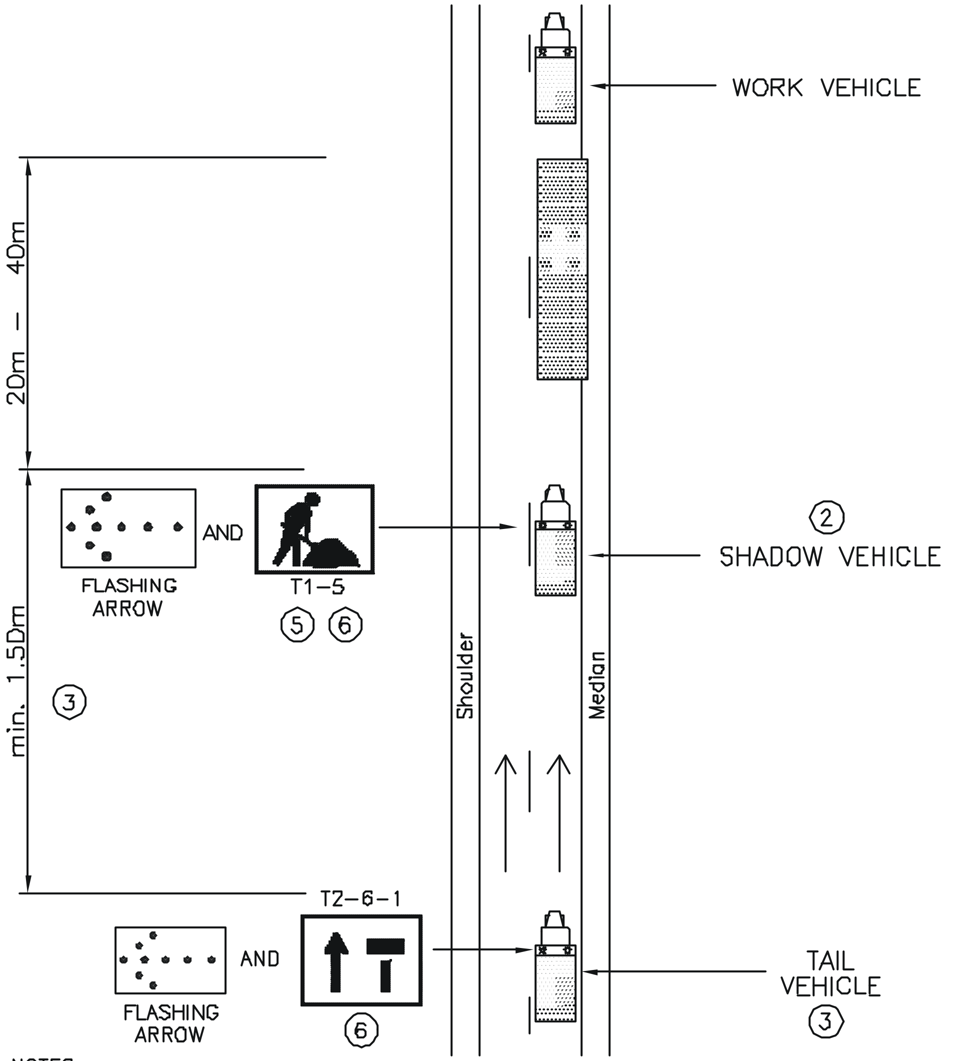
NOTES:

1. For work carried out on lane line the shadow vehicle should overlap the lane line by up to 1/3 the width of the shadow vehicle.
2. For work wholly within the lane or on edgeline the Shadow Vehicle shall travel close to, but not overlap the lane line.
3. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.
4. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type size A, B or C equipment.
5. Minimum size: A – Urban or Low Speed Rural.
   B – High Speed approaches.
6. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
2 LANE / DIVIDED
PAVEMENT MARKER ON LANE LINE AND/OR LEFT EDGE LINE
INSTALLATION

T000062

TCP 62



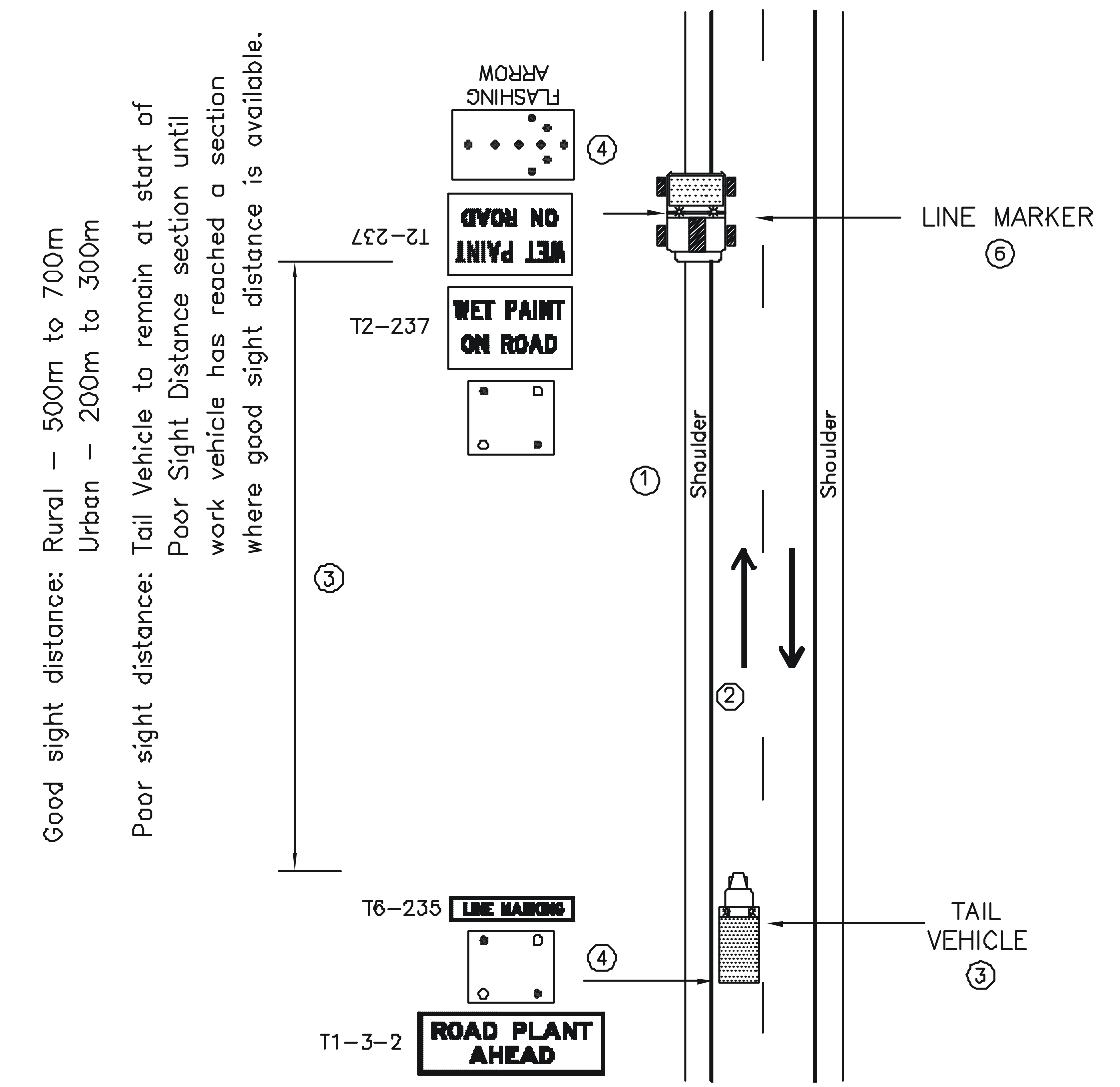
NOTES:

1. For use only in right lane or on right edge line. use TCP 62 for work on lane line
2. For work wholly within the lane or on edgeline the Shadow Vehicle shall travel close to but not overlap the lane line.
3. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm
4. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11 4 1. ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
5. Minimum size: A – Urban or Low Speed Rural.
   B – High Speed approaches.
6. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
2 LANE / DIVIDED
PAVEMENT MARKER MAINTENANCE ON RIGHT EDGE LINE

T000063

TCP 63



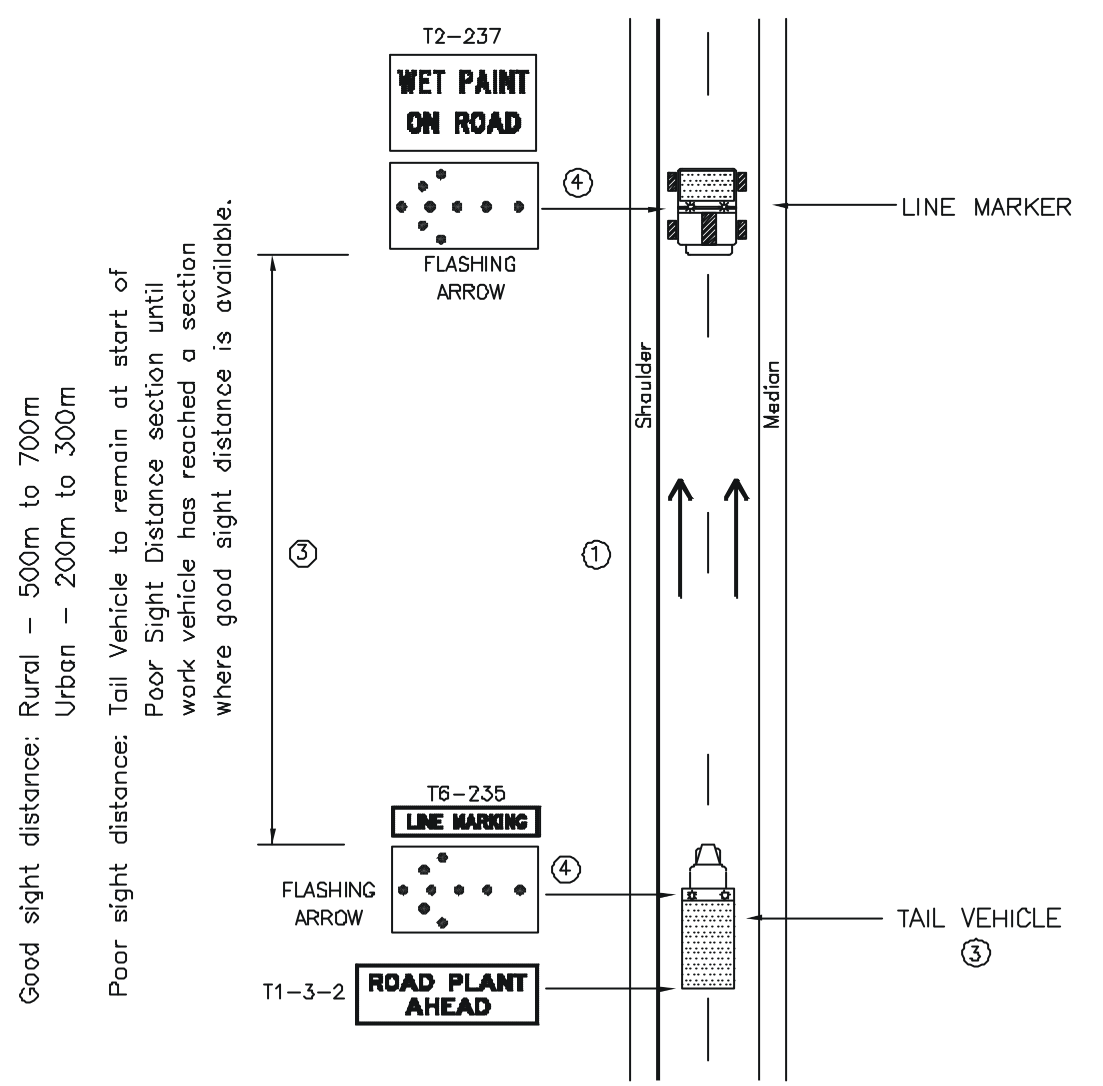
NOTES:

1. A mirror image of this arrangement to apply for right–hand edge line on divided carriageways.
2. Line marking should be carried out with traffic flow.
3. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.
4. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
5. At crests and curves where sight distance is restricted switch the flashing arrow to warning mode until sight distance is restored.
6. Diagram shows use of centre–mounted guns. Where left hand guns are used line marker travels within the lane of same travel direction.

MOBILE WORK
2 LANE / 2 WAY
LINE MARKING – LEFT EDGE LINE

T000064

TCP 64



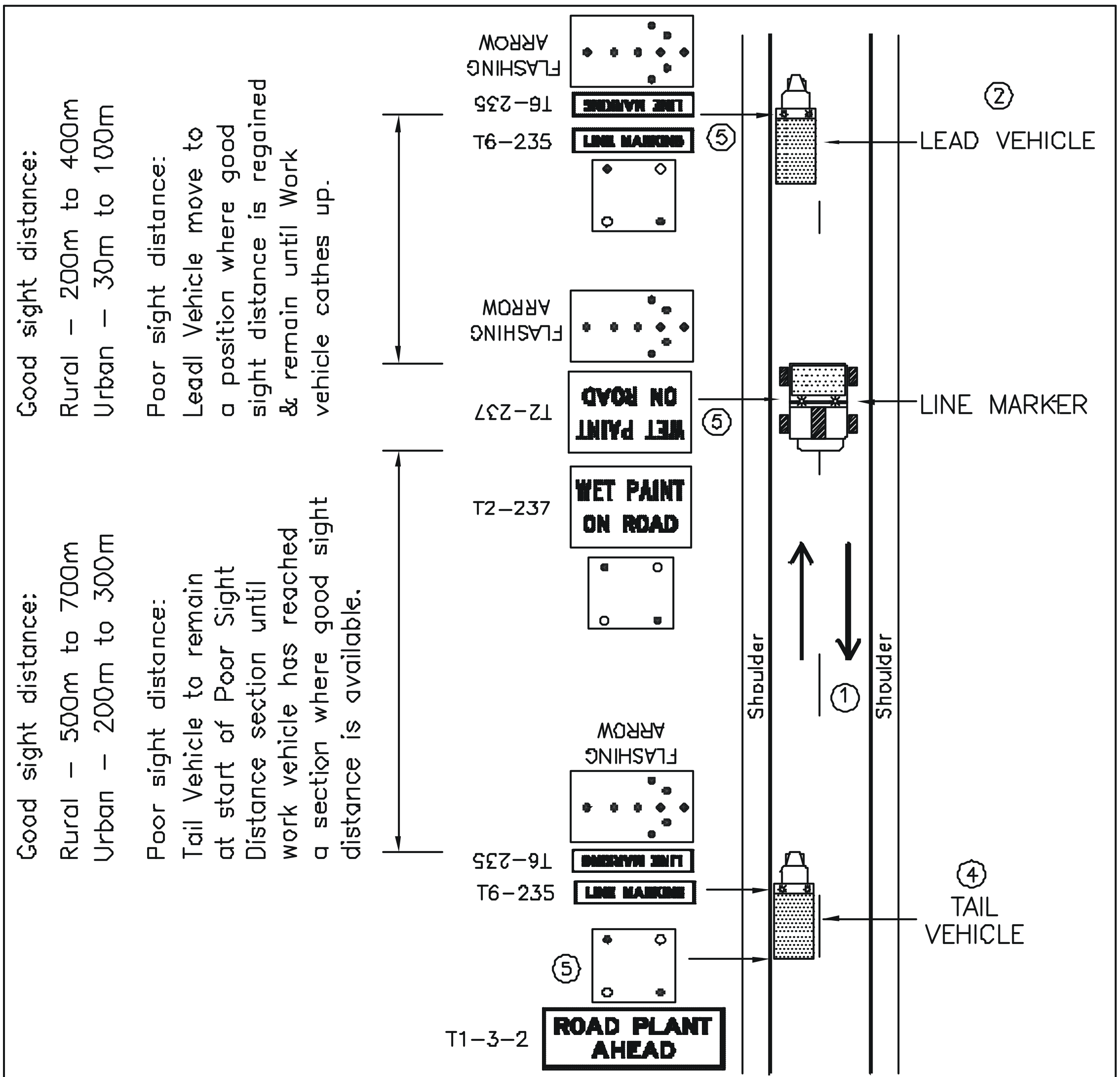
NOTES:

1. Diagramatic shows use of centre–mounted guns. Where line marker is using side–mounted guns, vehicles are to travel within the appropriate lane and apropriate flashing arrows displayed.
2. A mirror image of this arrangement is to be used where right–hand shoulder width is not adequate for traffic.
3. On crests and curves, ensure that sight distance to Vehicle is not less than Dm.
4. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.

MOBILE WORK
2 LANE / DIVIDED
LINE MARKING – LANE LINE

T000065

TCP 65



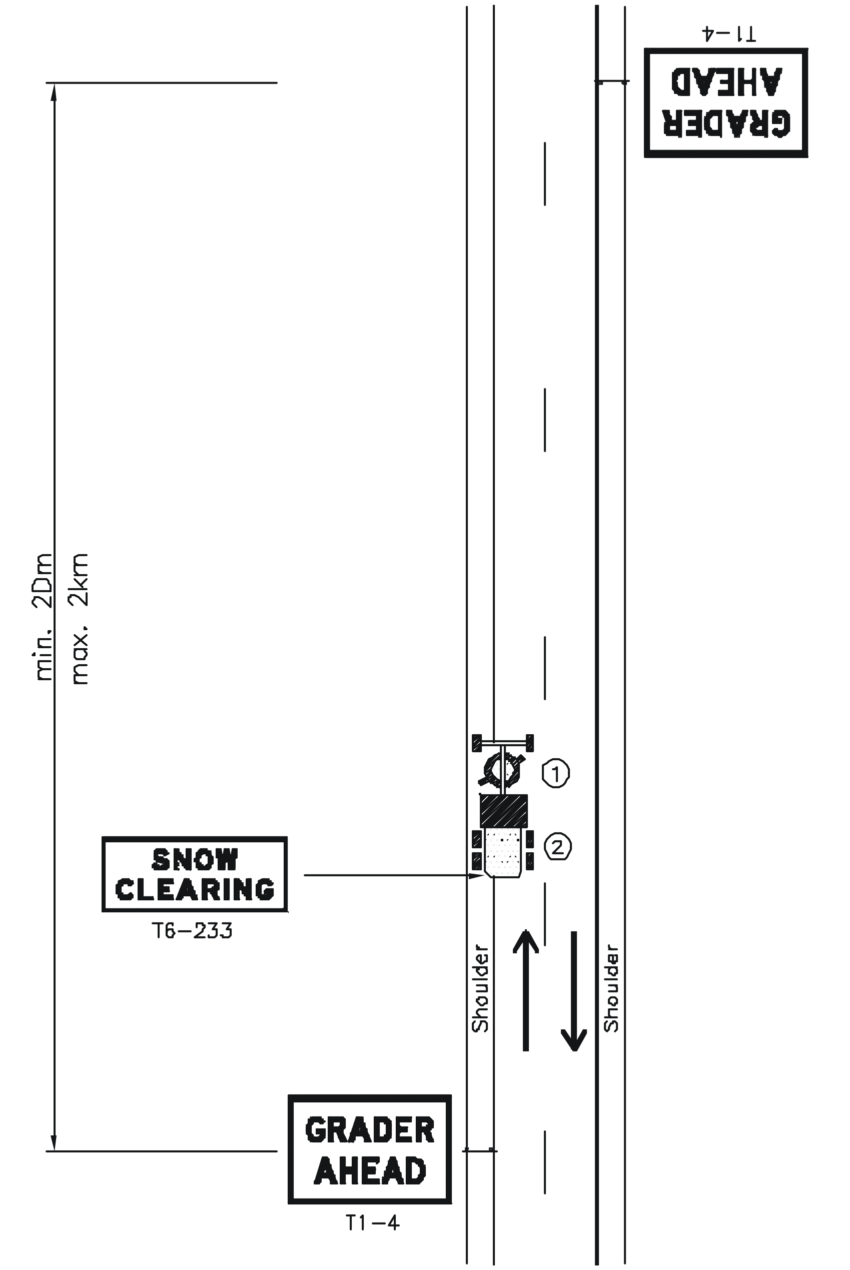
NOTES:

1. Diagram shows use of centre–mounted guns. Where right hand–mounted guns are used, Vehicles are to travel within the lane of same travel direction.
2. Traffic cones to be laid along the line of the wet line where traffic conditions dictate.
3. Where traffic cones are used, an additional tail vehicle shall be used to provide warning of the cone recovery operation.
4. On crests and curves, ensure that sight distances to Lead Vehicle and Vehicle are not less than Dm.
5. Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use size A, B or C equipment.

MOBILE WORK
2 LANE / 2 WAY
LINE MARKING – CENTRE LINE

T000066

TCP 66

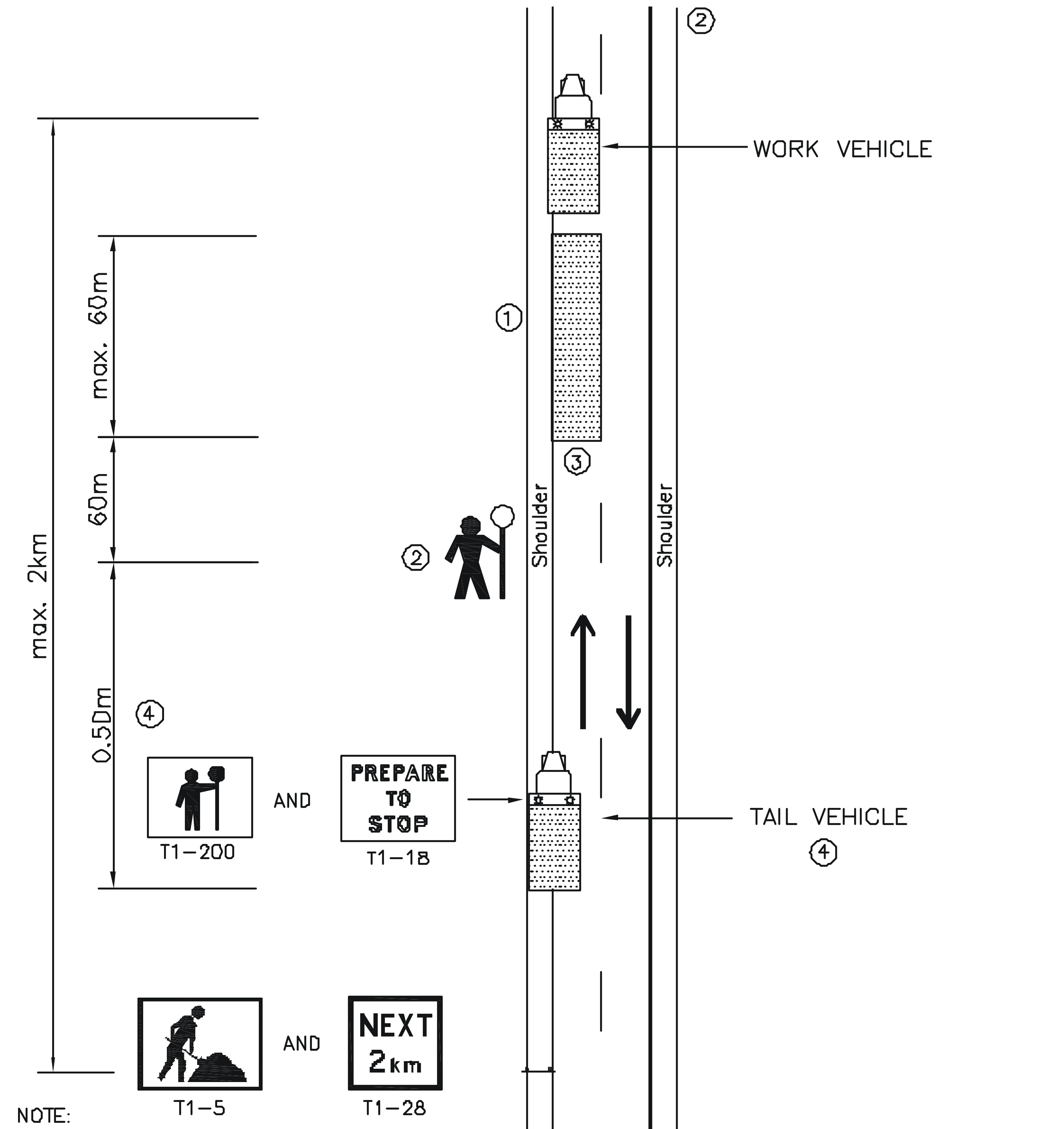


NOTE:
(1) Plant has flashing lights and floodlights.
(2) Grader should be driven in direction of traffic flow.

MOBILE WORK
2 LANE / 2 WAY
SNOW CLEARING

T000067

TCP 67



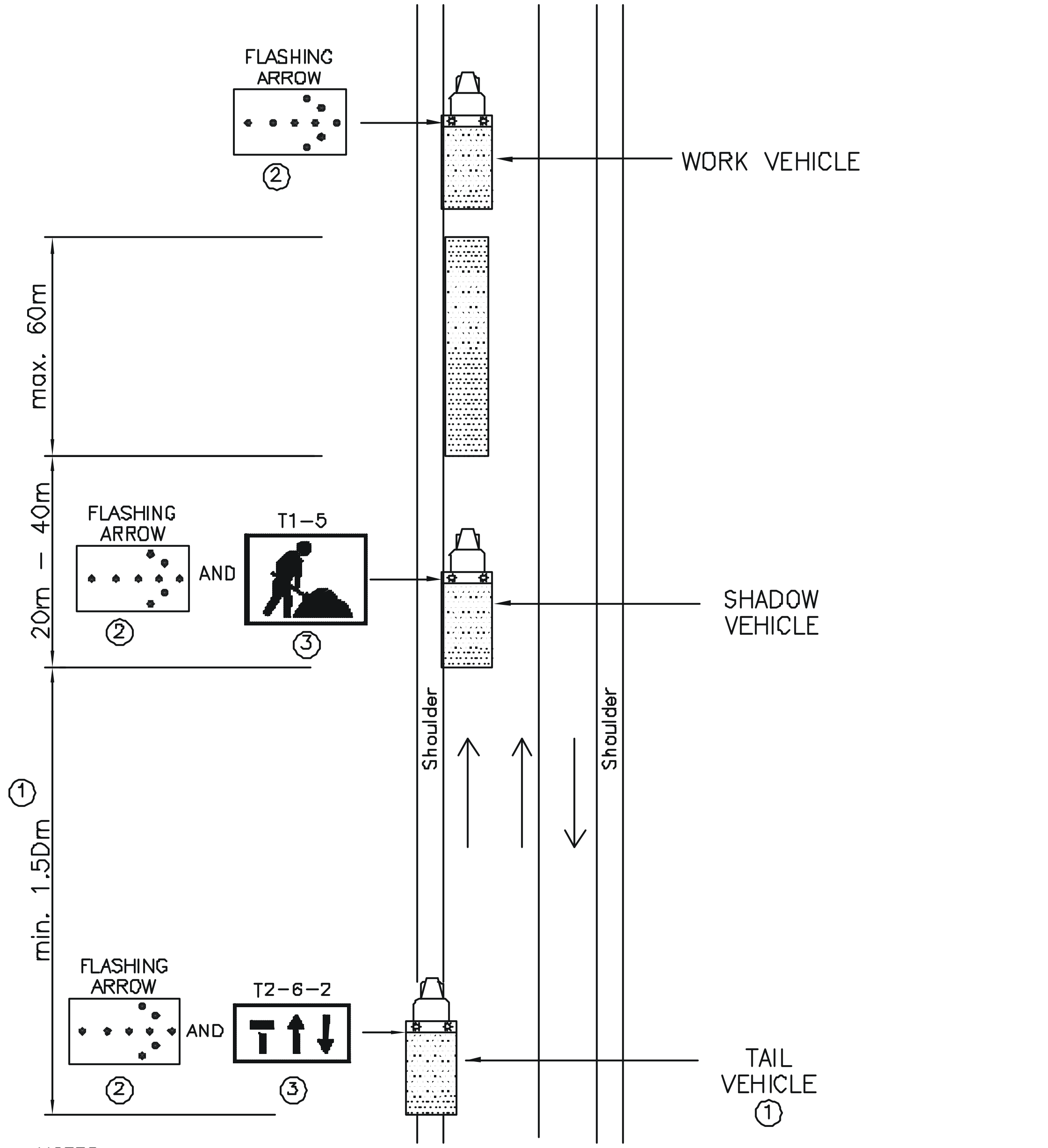
NOTE:

1. This arrangement is suitable for patching or spotting and maintaining pavement markers on edge lines. Use TCP 106 for similar work on centre line.
2. Where ADT exceeds 1,500 vehicles per day or sight distance between the Traffic Controller and traffic from the opposite direction is less than 300m (400m where travel speeds exceed 100 km/h), a Lead Vehicle and a second Traffic Controller will be necessary. T1-200 and T1-18 signs are to be displayed on this Lead Vehicle.
3. Work to be carried out in the direction of traffic.
4. On crests and curves ensure that sight distance to Tail Vehicle is not less than Dm.

MOBILE WORK
2 LANE / 2 WAY

T000068

TCP 68



NOTES:

① On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.

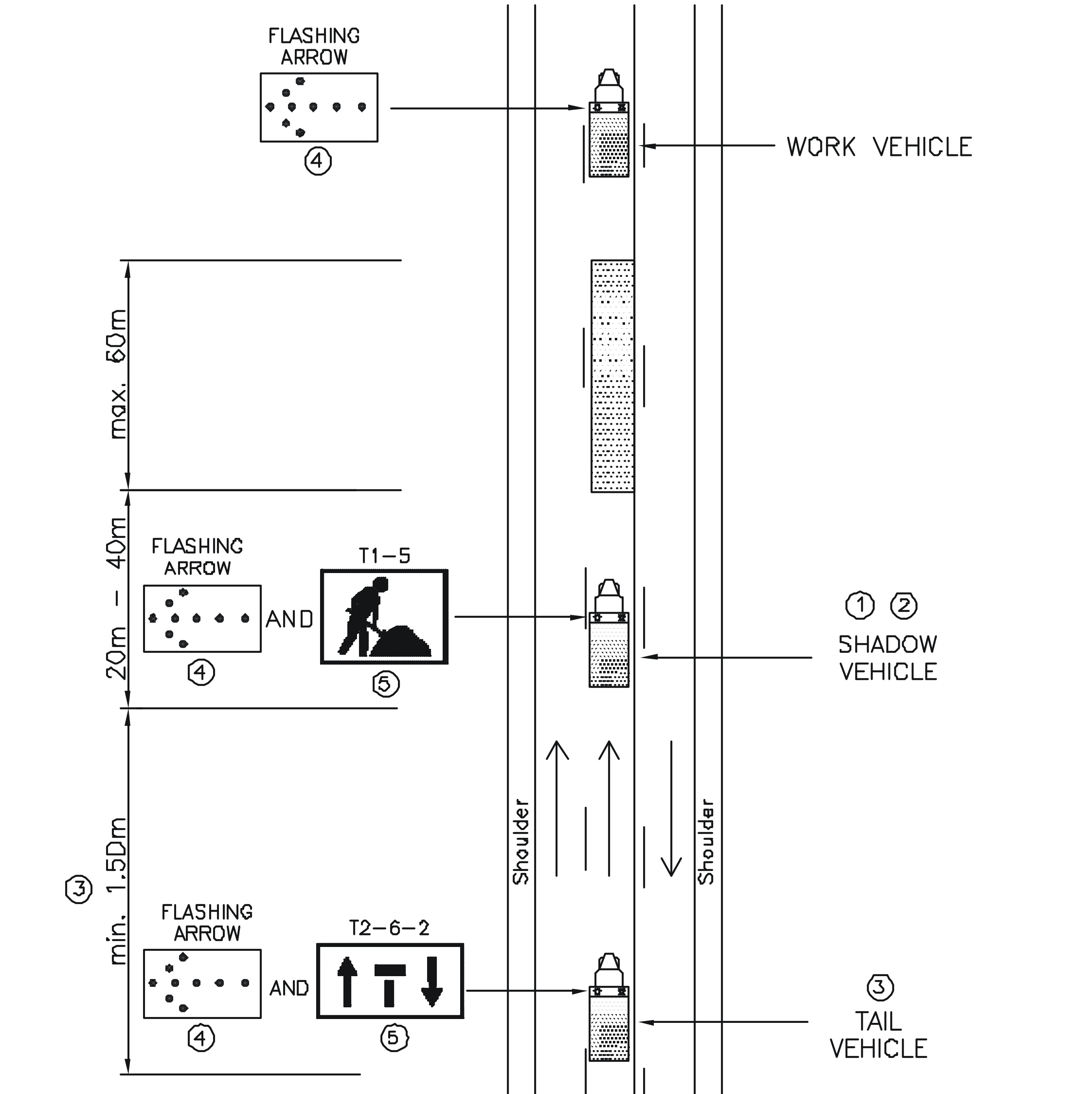
② Reference should be made to *Traffic Control at Work Sites*, Section 3 2 2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment.

③ Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / 2 WAY
WORK ON LEFT EDGE LINE AND IN SLOW LANE

T000069

TCP 69



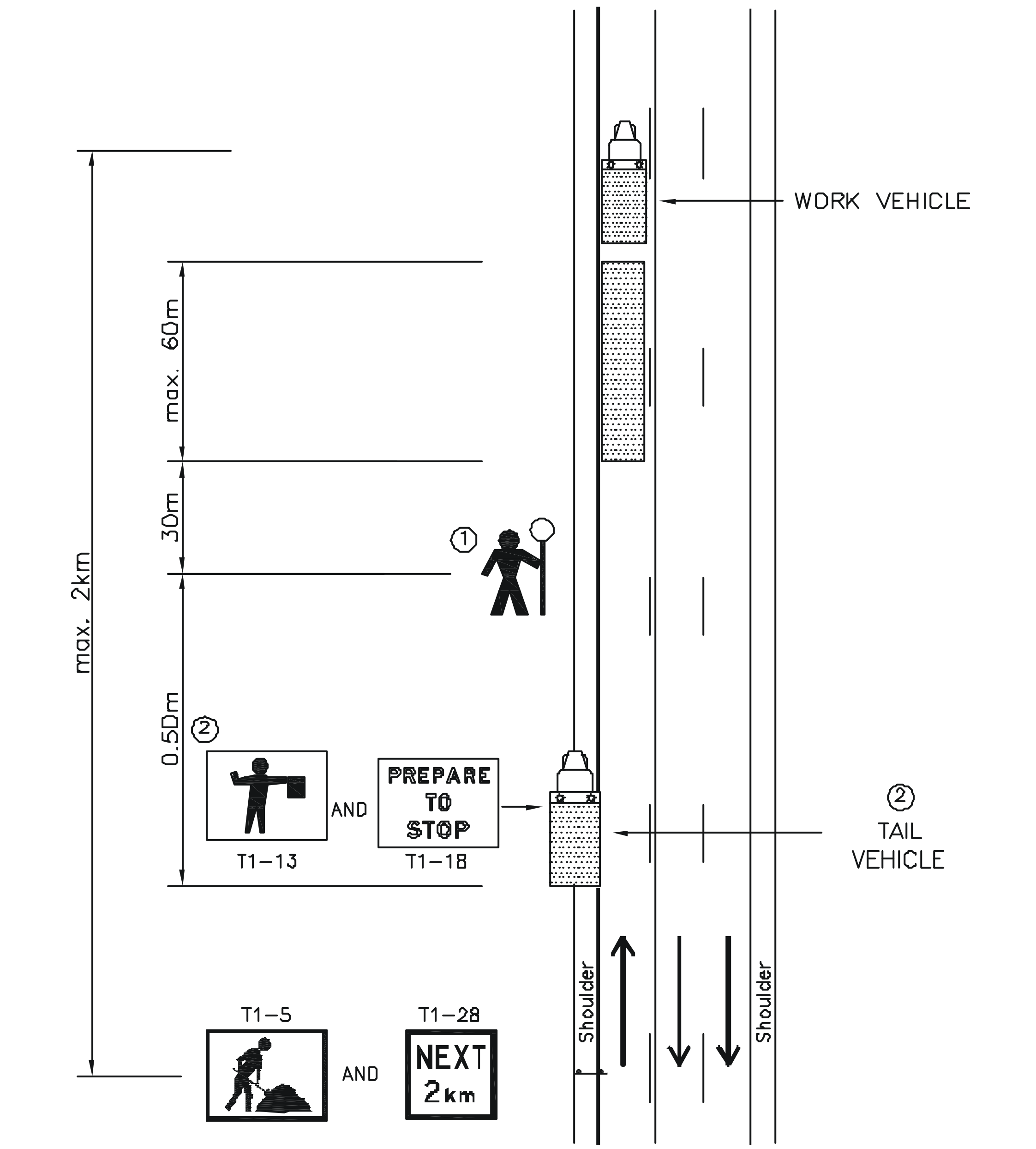
NOTES:

1. For work on the lane line, the shadow vehicle shall overlap the lane line by 1/3 the width of the Shadow Vehicle.
2. For work wholly in the central lane, the Shadow Vehicle shall travel close to but not overlap the lane line.
3. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.
4. Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment.
5. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / 2 WAY
WORK ON LANE LINE OR IN CENTRAL LANE

T000070

TCP 70

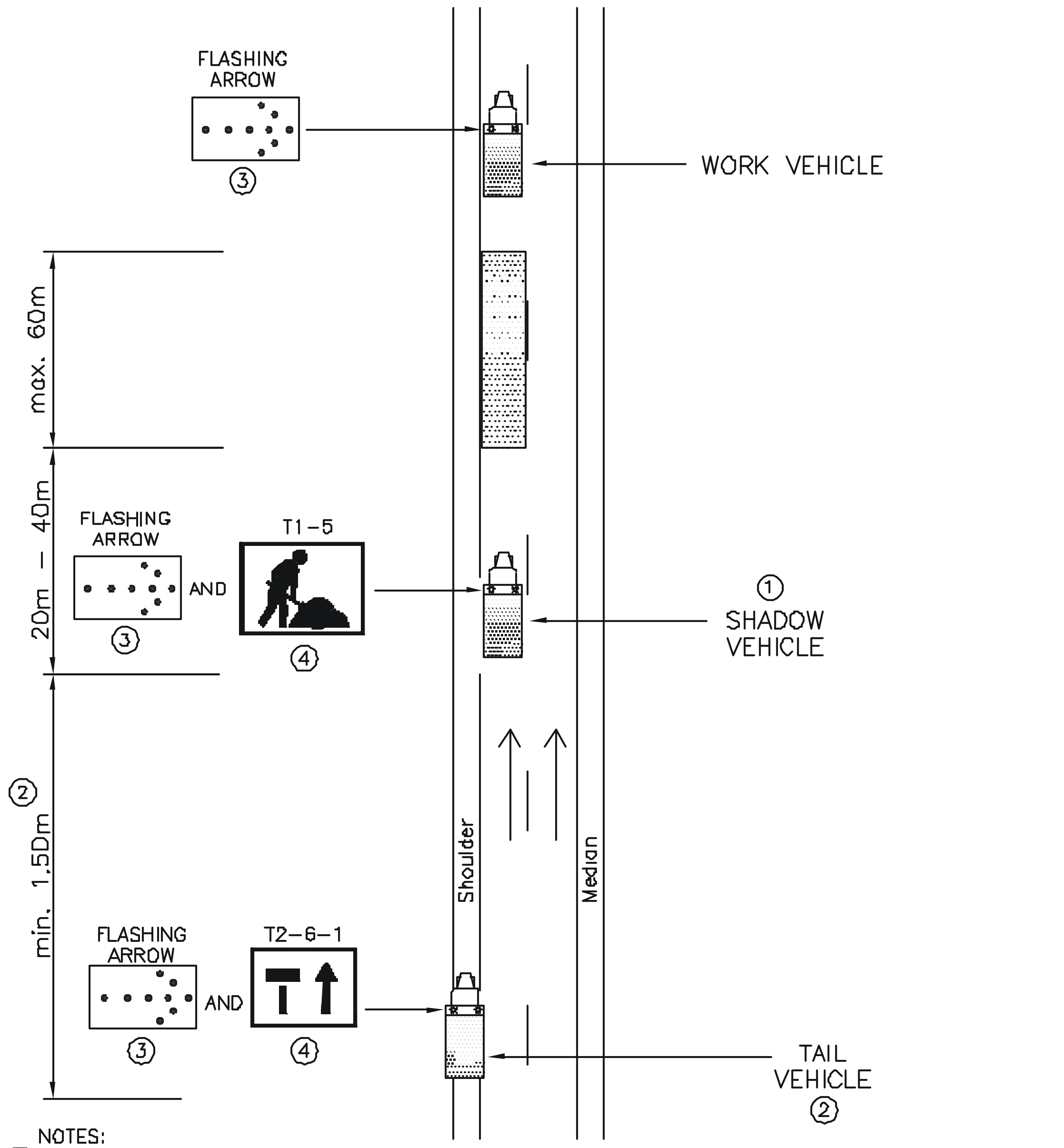


NOTE:
1. Traffic Controller to stop traffic for duration of work and then direct traffic through work area, once it has been cleared of personnel and the Work Vehicle.
2. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.

SHORT TERM WORK
3 LANE / 2 WAY
WORK ON SINGLE LANE OR ADJACENT EDGE LINE

T000071

TCP 71



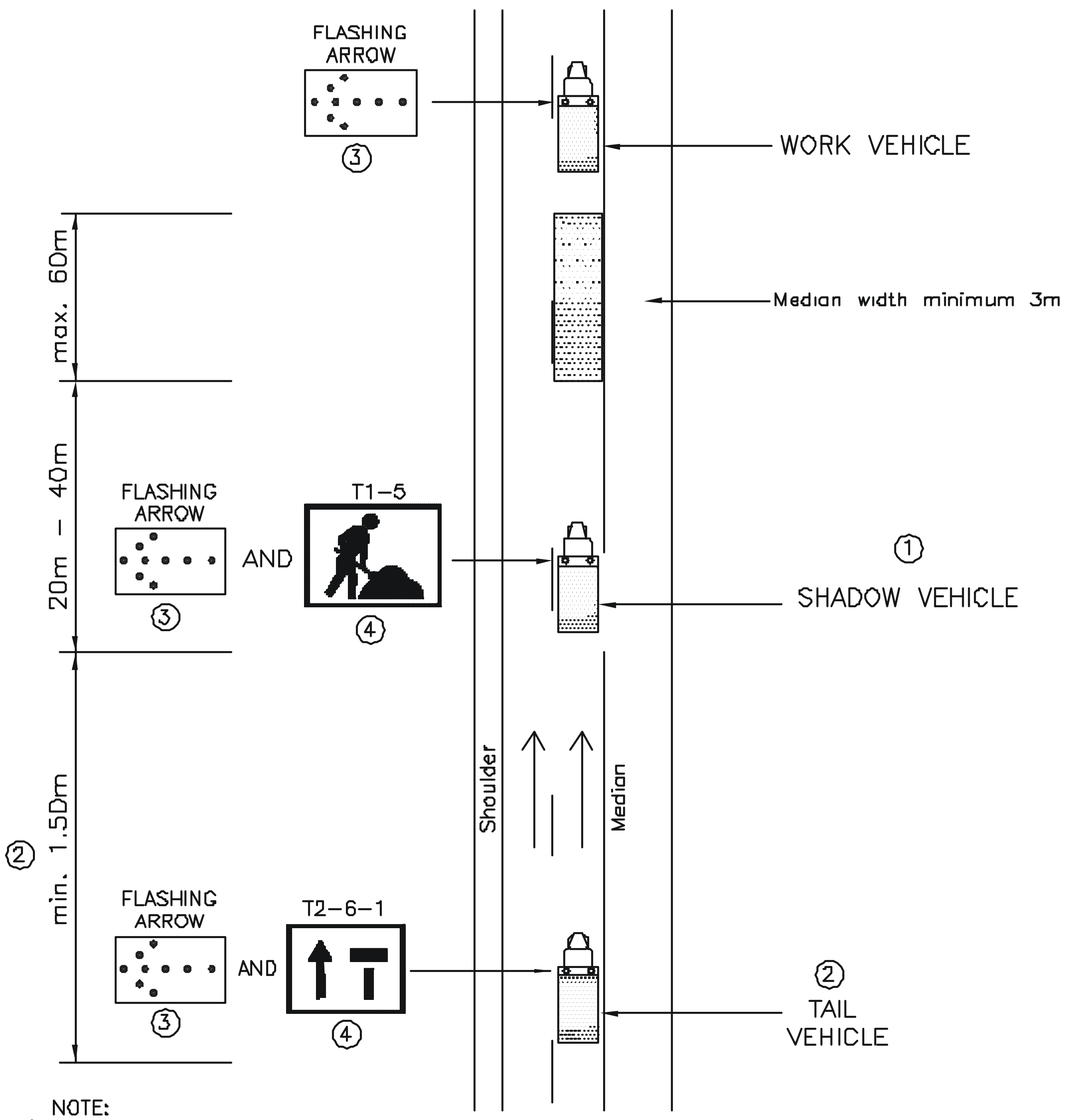
NOTES:

1. The Shadow Vehicle shall travel close to the lane line.
2. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
3. Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment
4. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
2 LANE / DIVIDED
WORK IN LEFT LANE

T000072

TCP 72



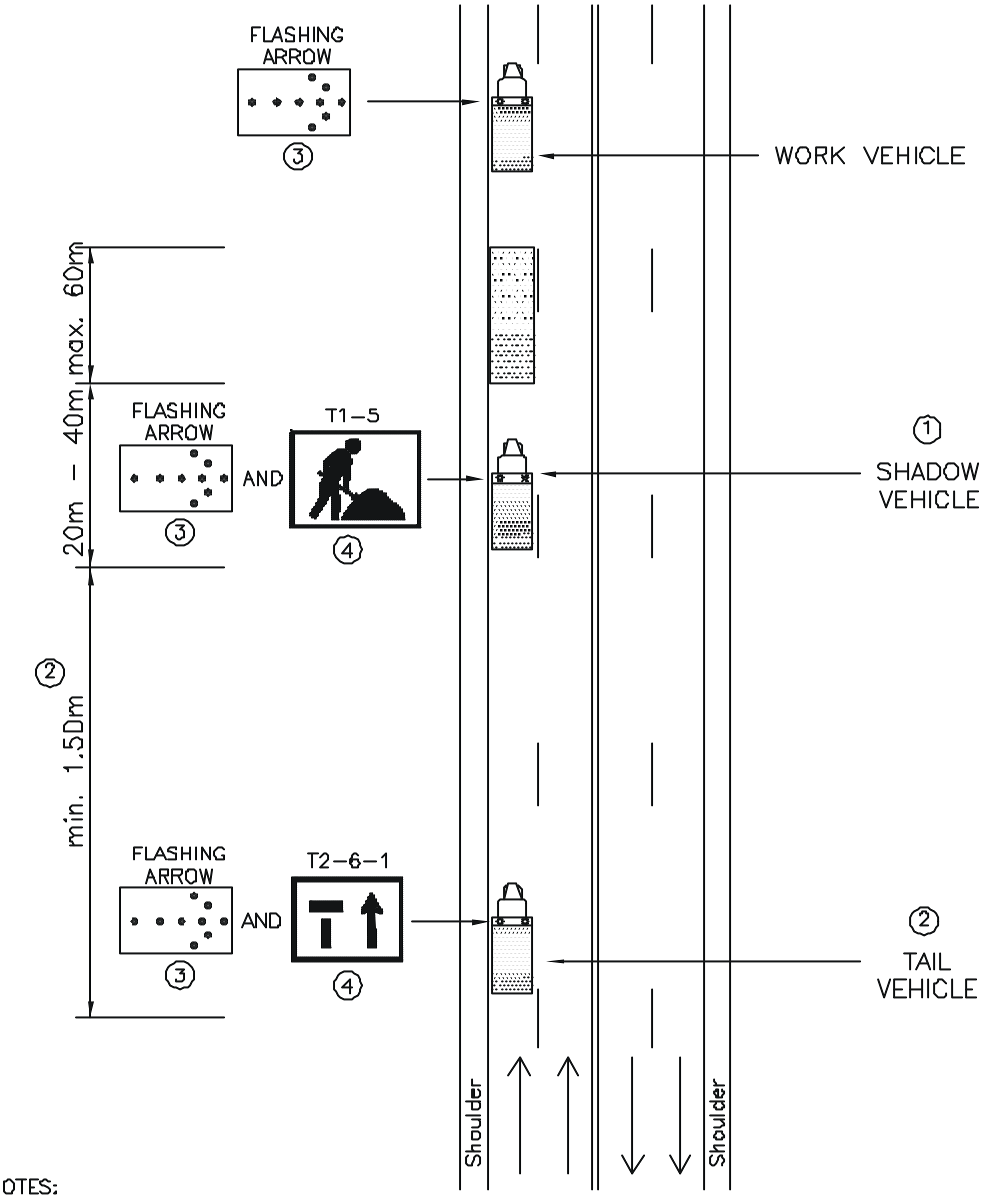
NOTE:

1. The Shadow Vehicle shall travel close to the lane line.
2. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
3. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11 4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.
4. Ensure that static signs, used with flashing arrow signs, are located onthe vehicle so that they are readily visible but do not obscure the flashing arrow sign

MOBILE WORK
2 LANE / DIVIDED
WORK IN RIGHT LANE (WIDE MEDIAN)

T000073

TCP 73



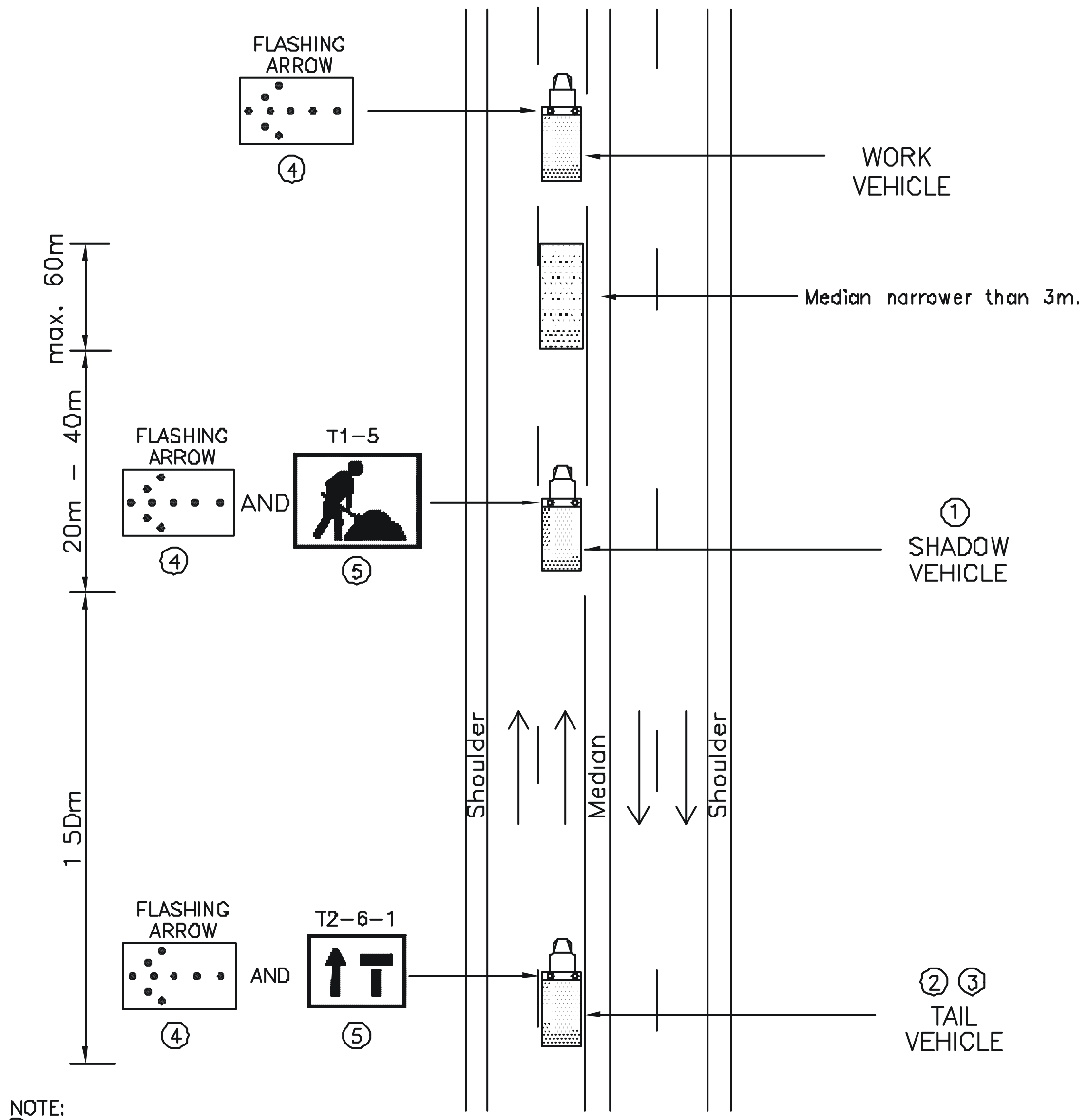
NOTES:

1. The Shadow Vehicle shall travel close to the lane line.
2. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
3. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.
4. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign

MOBILE WORK
4 LANE / 2 WAY
WORK IN LEFT LANE OR ON EDGE LINE

T000074

TCP 74



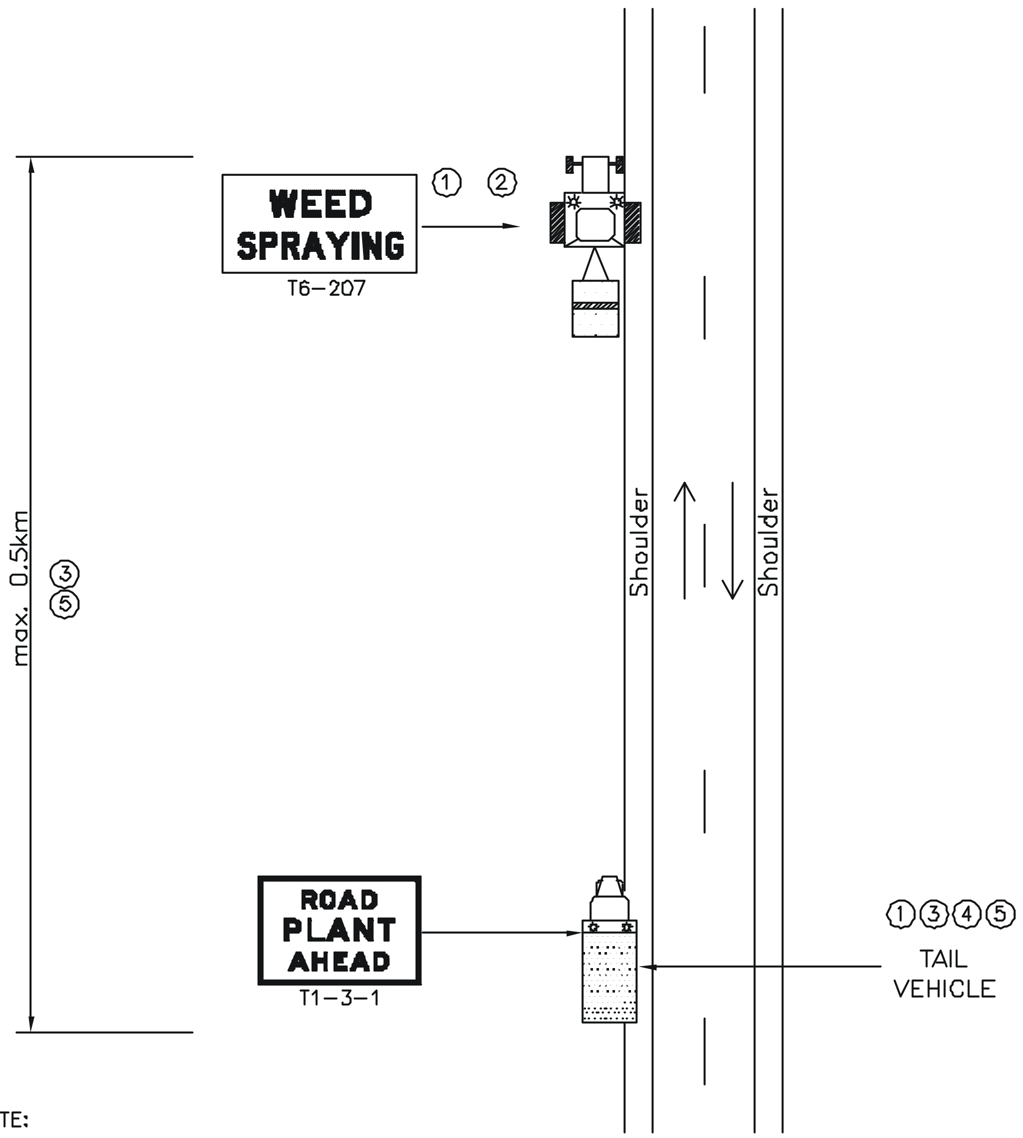
NOTE:

1. The Shadow Vehicle shall travel close to the lane line.
2. The Tail Vehicle shall travel close to the right edge line.
3. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
4. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.
5. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
4 LANE / 2 WAY
WORK IN RIGHT LANE (NARROW MEDIAN)

T000075

TCP 75



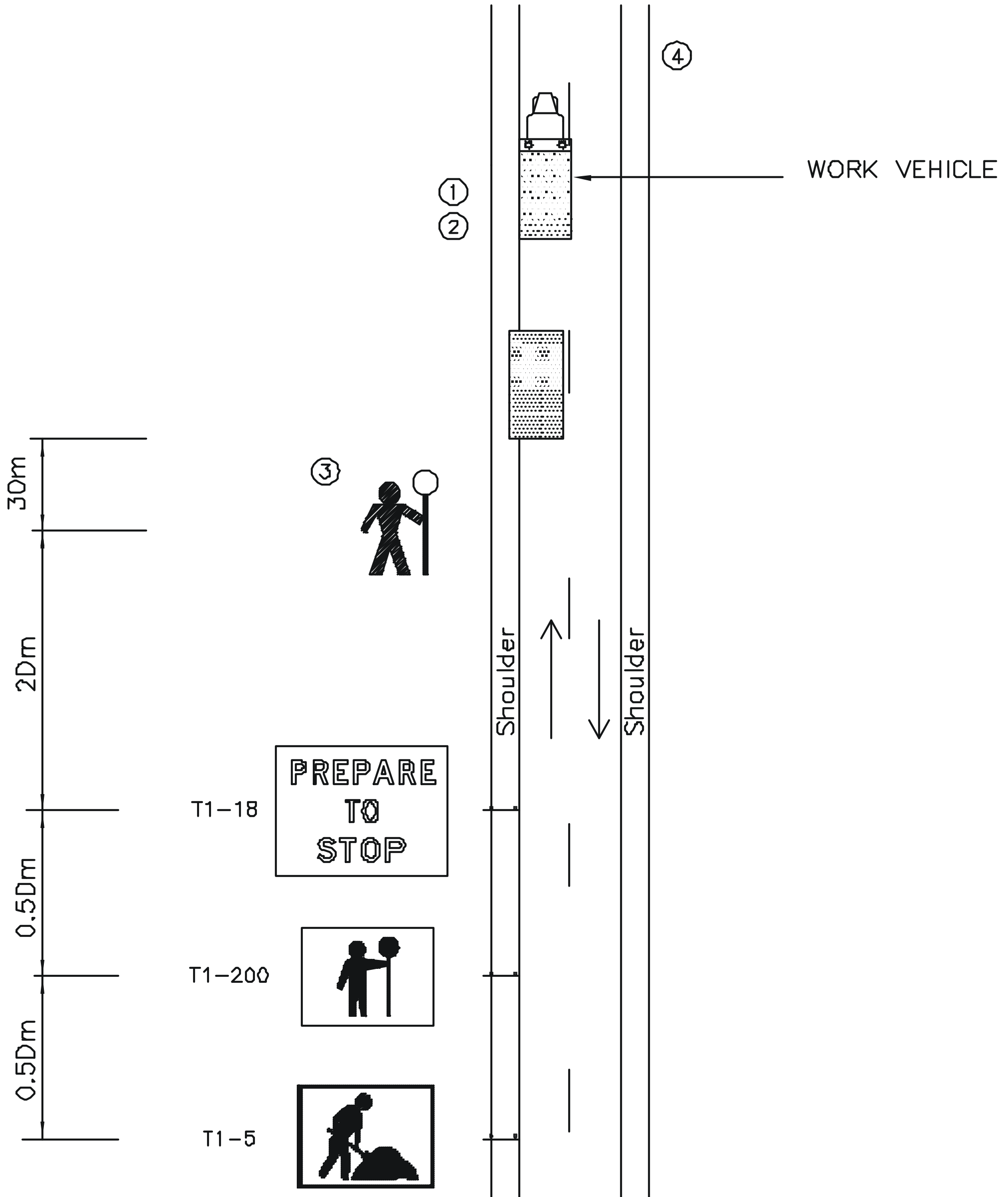
NOTE:

1. Advance Warning Vehicle and Work Vehicle must have two way radio communication.
2. Weed spraying should be carried in direction of traffic flow.
3. On crests and curves, ensure that sight distance to the Advance Warning Vehicle is not less than Dm
4. Advance Warning Vehicle not needed if weed spraying machine does not obstruct the road
5. Where Tail Vehicle is not used, display T1-3-1 sign on road shoulder maximum of 2km from spray unit if ADT is greater than 1,000 or a maximum of 5km from spray unit if ADT is less than 1,000.

MOBILE WORK
2 LANE / 2 WAY
WEED SPRAYING

T000076

TCP 76



NOTE:

① While setting up, park Work Vehicle on the shoulder and allow traffic to proceed.

② During work, park Work Vehicle in lane in front of the work to protect personnel from traffic in opposite direction.

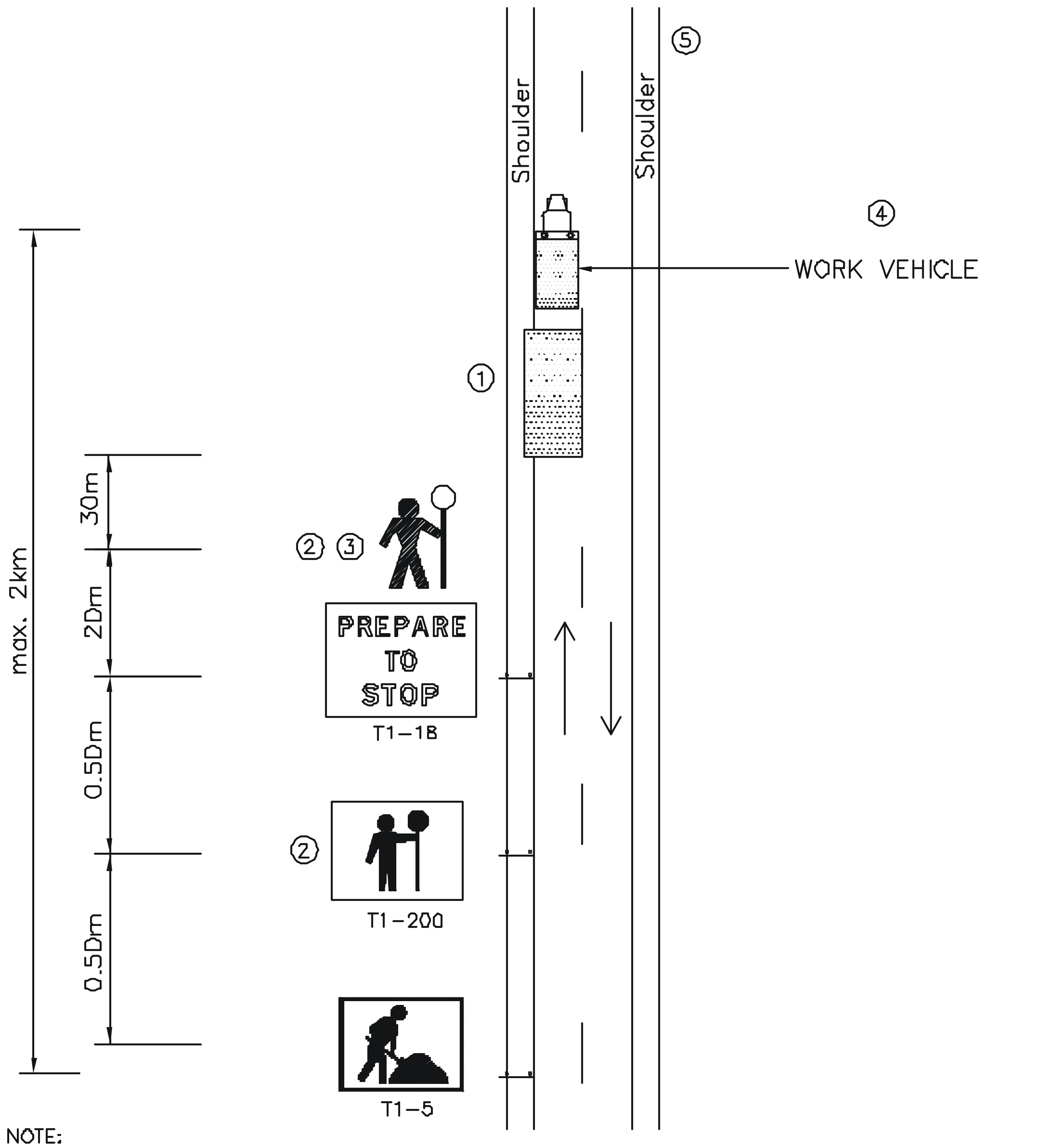
③ Traffic Controller to stop traffic for duration of work and then direct traffic through work area, once it has been cleared of personnel and the Work Vehicle.

④ Signs may be necessary facing the other direction of traffic.

SHORT TERM WORK (UP TO FIVE MINUTES)
2 LANE / 2 WAY (ADT ⩾ 3,000)
MINOR MANUAL WORK

T000077

TCP 77



NOTE:

1. Each stoppage less than 5 minutes. Work within specific limits set by signs T1–5.
2. If ADT is less than 300 vehicles per day Traffic Controller, T1–200 & T1–18 signs are optional.
3. Traffic Controller to stop traffic for duration of work and then direct traffic through work area, once it has been cleared of personnel and work vehicle.
4. During work, park Work Vehicle in lane in front of the work to protect personnel from traffic in the opposite direction.
5. Signs may be necessary facing the other direction of traffic.

SHORT TERM WORK (MOVING ALONG ONE SIDE PROGRESSIVELY)
2 LANE / 2 WAY
ADT < 3000

T000078

TCP 78

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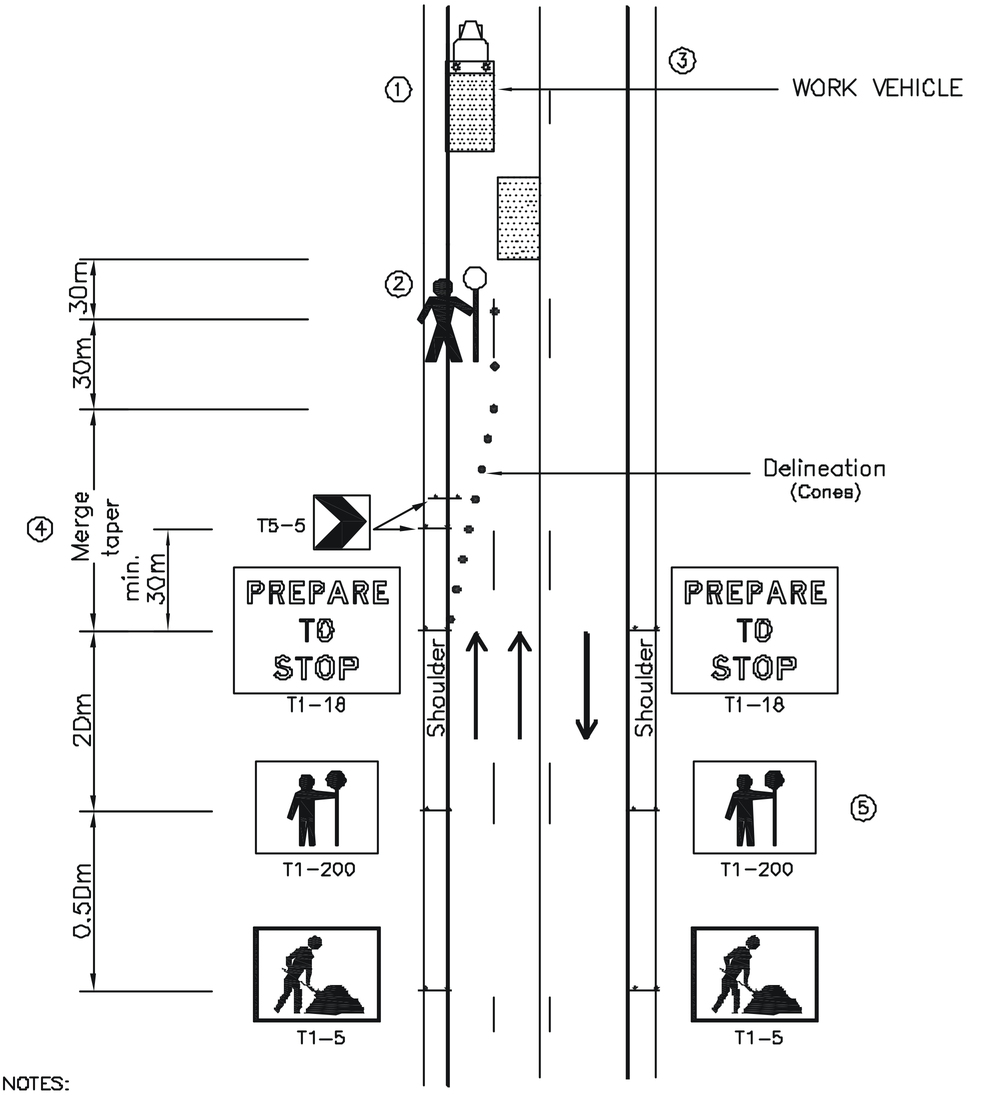


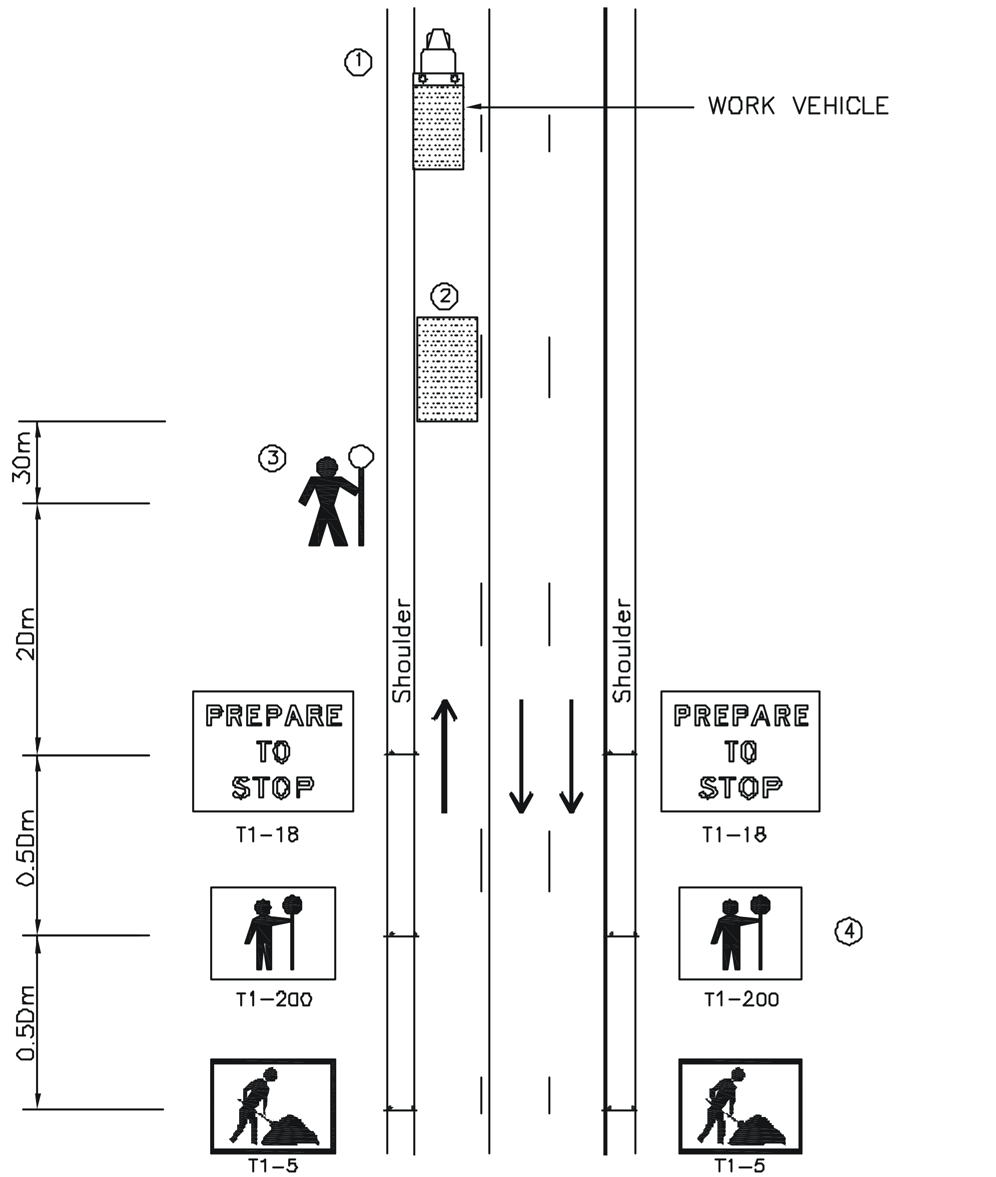
NOTES:

1. Work Vehicle to be parked in the kerbside lane.
2. Traffic Controller to stop traffic for the duration of work and then direct traffic through work area, once it is cleared of personnel.
3. Signs are necessary facing other direction of traffic to prevent overtaking.
4. The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.
5. T1-5, T1-200 and T1-18 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs*.

SHORT TERM WORK (UP TO FIVE MINUTES)
3 LANE / 2 WAY
WORK IN FAST LANE

T000080

TCP 80



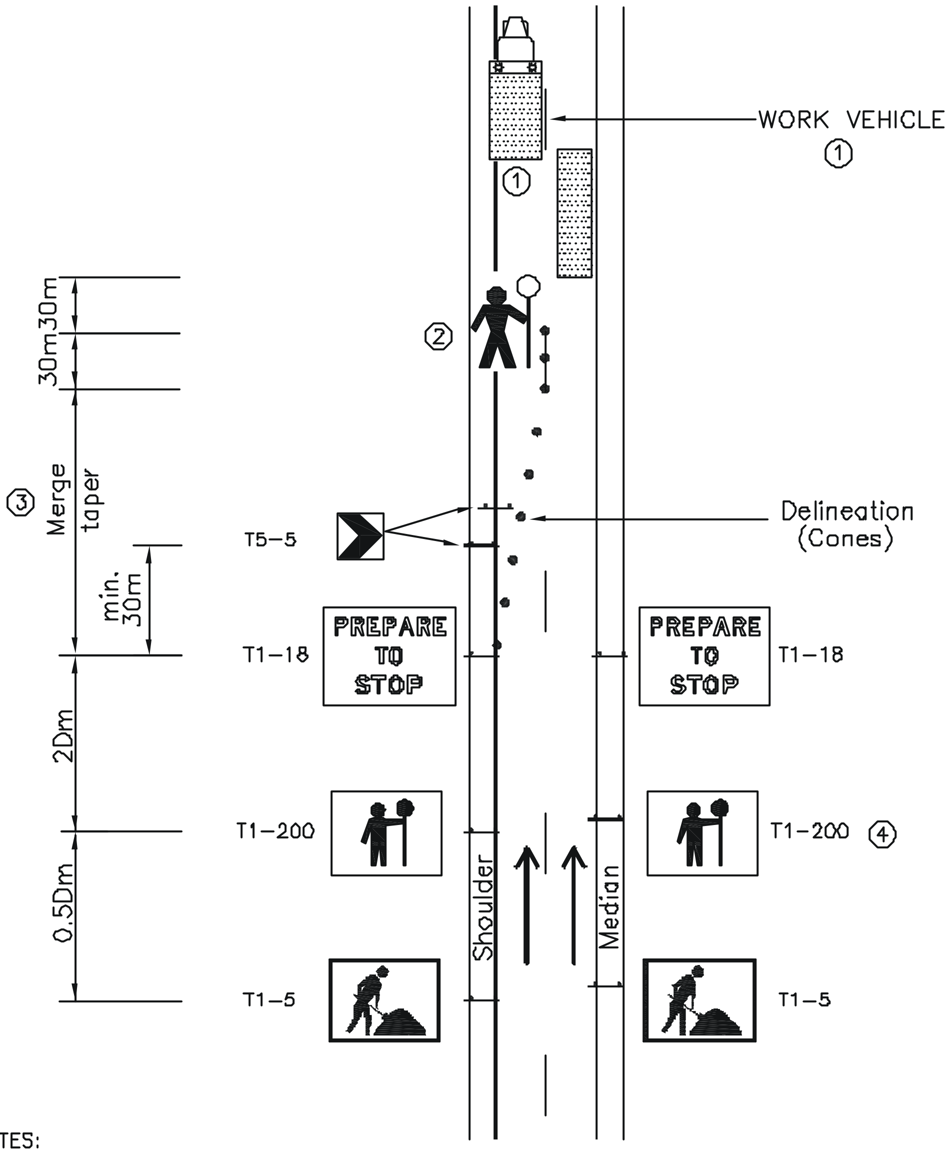
NOTE:

1. While setting up, park Work Vehicle on the shoulder, and allow traffic to proceed.
2. During work, park Work Vehicle in lane in front of work to protect workers from traffic in opposite direction.
3. Traffic Controller to stop traffic for duration of work and then direct traffic through work area, once it has been cleared of personnel.
4. T1-5, T1-200 and T1-18 signs may be duplicated in accordance with Section 3.2.4, ***Duplication of Signs***.

SHORT TERM WORK (UP TO FIVE MINUTES)
3 LANE / 2 WAY
WORK IN A SINGLE LANE

T000081

TCP 81



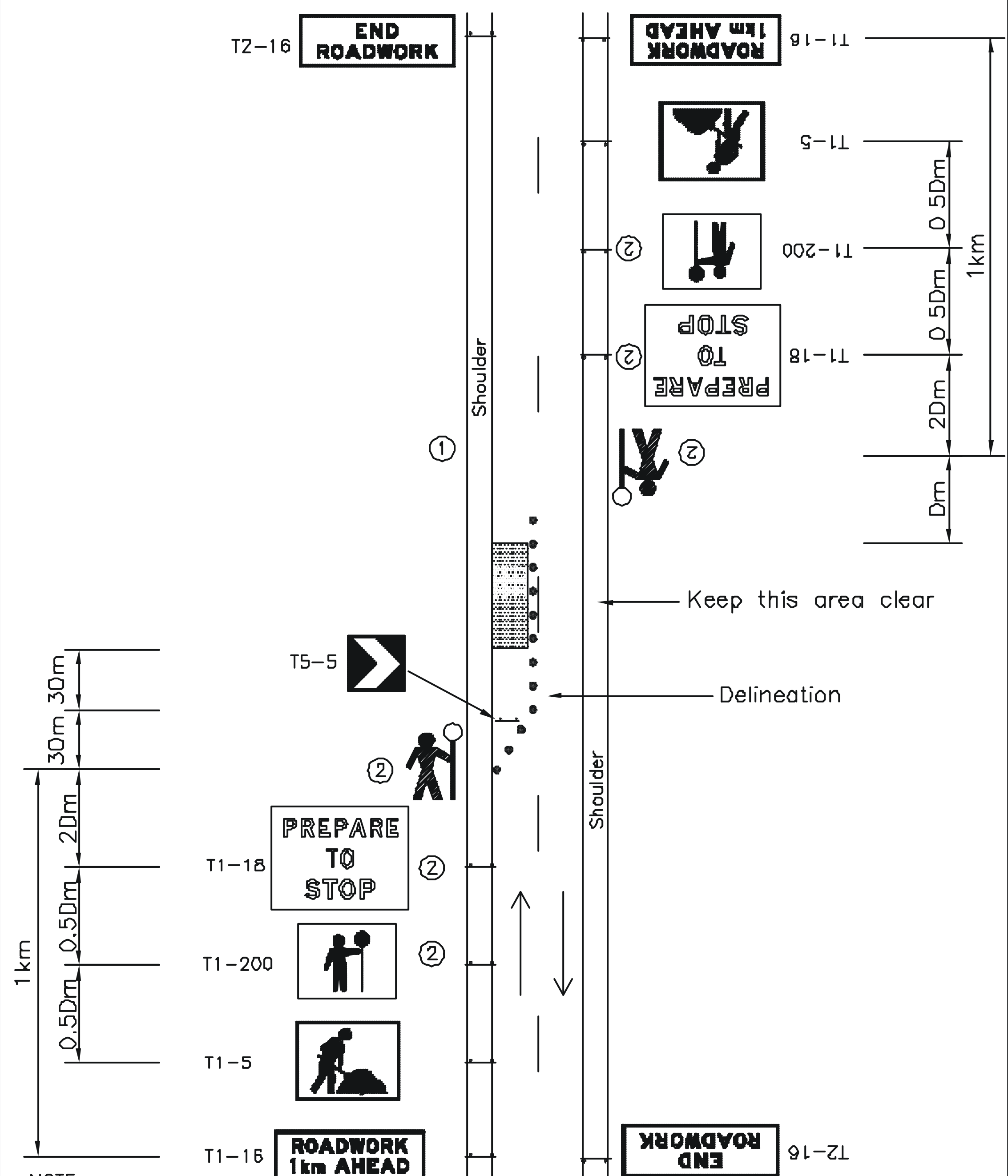
NOTES:

1. Work Vehicle to be parked in the slow lane.
2. Traffic Controller to stop traffic for duration of work and then direct traffic through work area, once it has been cleared of personnel.
3. The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths.*
4. T1-5, T1-200 and T1-18 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs.*

SHORT TERM WORK (UP TO FIVE MINUTES)
2 LANE / DIVIDED CARRIAGEWAY
ADT < 10,000

T000082

TCP 82



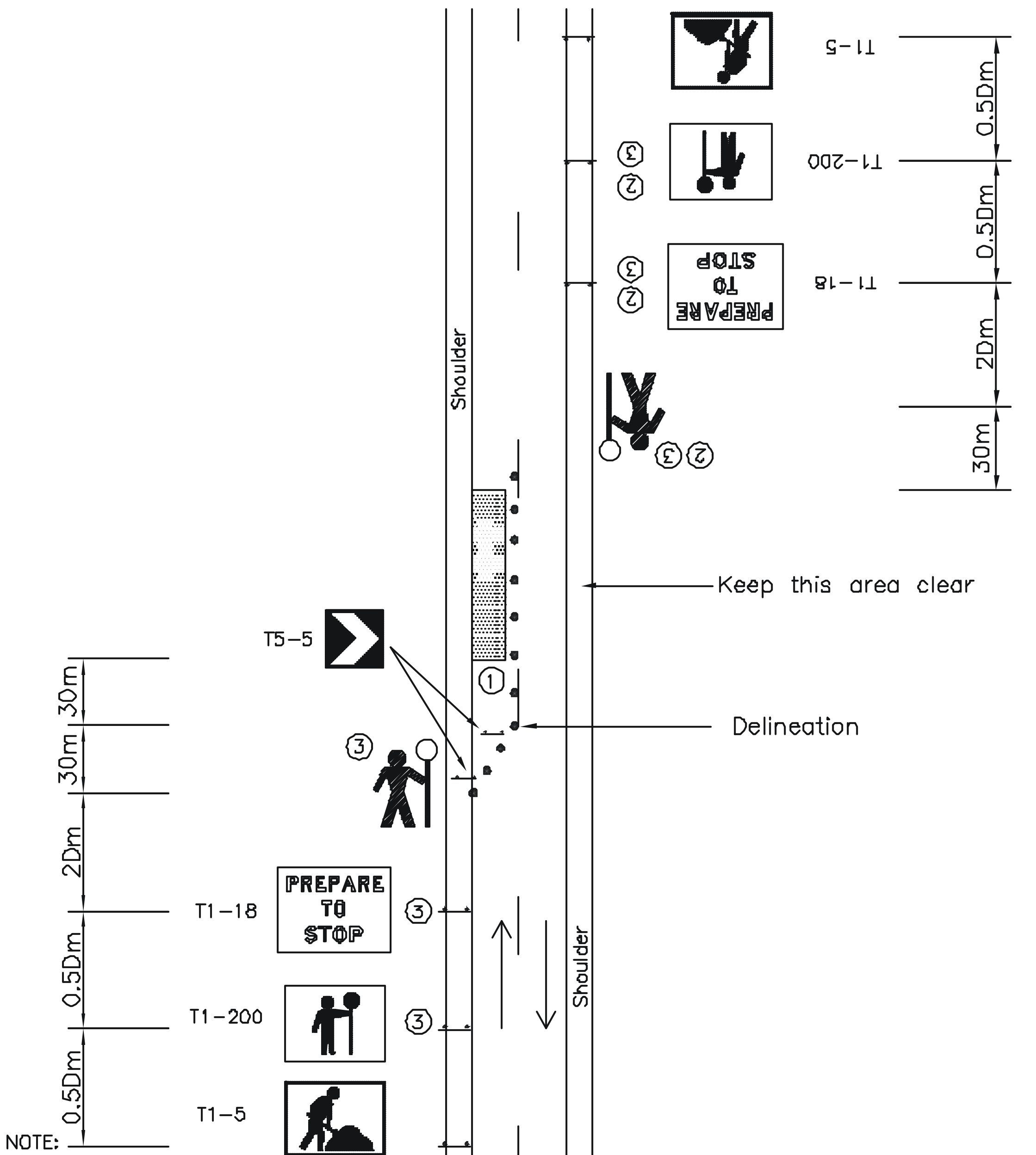
NOTE:

1. Work Vehicle to be parked on workside of the roadway.
2. T1-5, T1-200 and T1-18 signs must be covered when Traffic Controllers are absent.

SHORT TERM WORK (UP TO ONE DAY)
2 LANE / 2 WAY
ADT ⩾ 6,000

T000083

TCP 83



NOTE:
① Work Vehicle to be parked on workside of the roadway.
② Traffic Controller and T1–200 and T1–18 signs not required on unobstructed lane if ADT is less than 1,500 vehicles per day provided that the work area is shorter than 250m and sight distance between the Traffic Controller and traffic from the opposite direction exceeds the minimum shown in *Traffic Control at Work Sites*, Table 8·1.
③ T1–5, T1–200 and T1–18 signs must be covered when Traffic Controllers are absent.

SHORT TERM WORK (UP TO ONE DAY)
2 LANE / 2 WAY
ADT < 6,000

T000084

TCP 84

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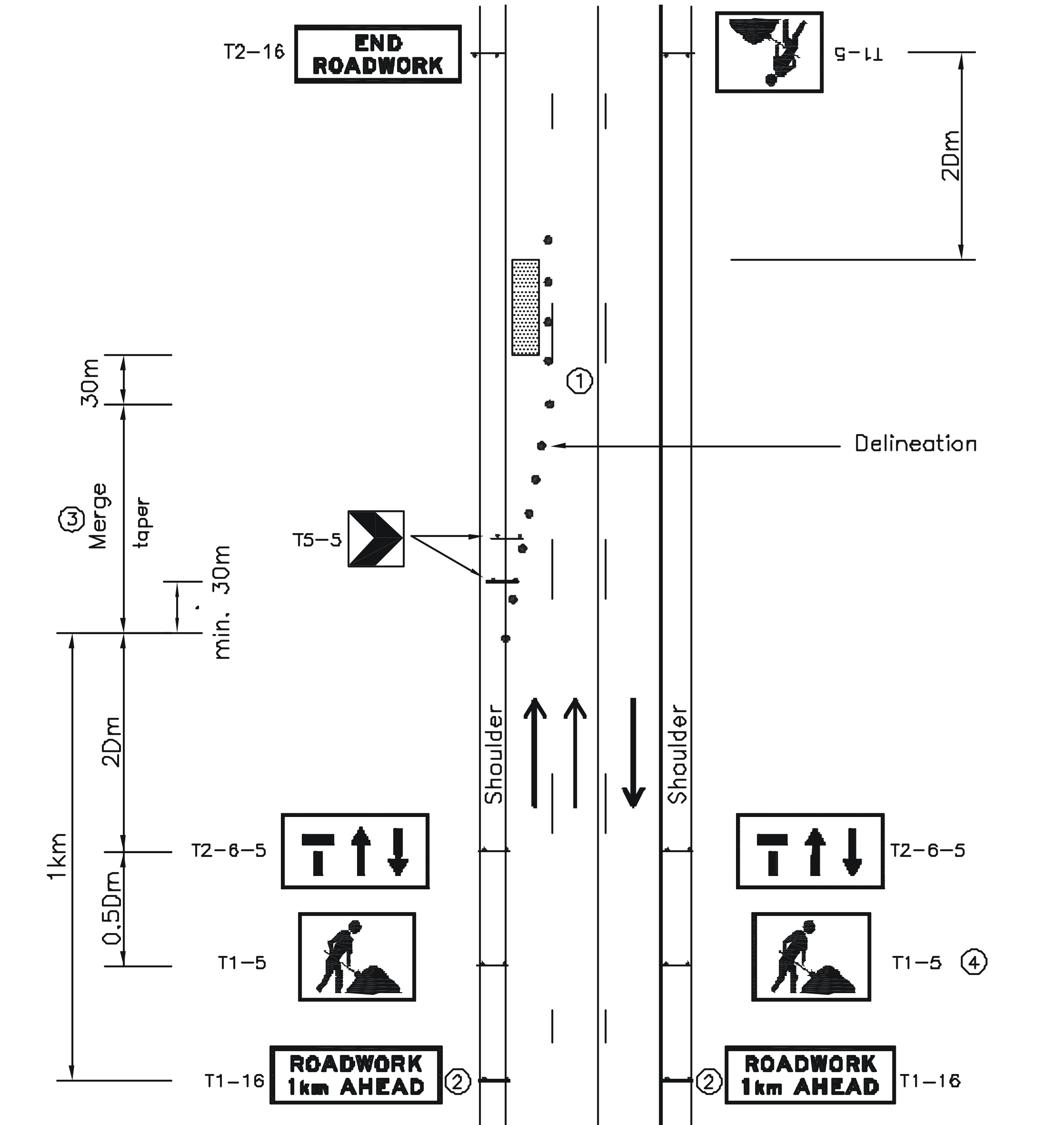

NOTES:

1. No crew movement into overtaking lane.
2. Sign T1–16 is only required if ADT is greater than 10,000 vehicles per day.
3. The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.
4. T1–16, T1–5 and T2–6–5 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs*.

SHORT TERM WORK (UP TO ONE DAY)
3 LANE / 2 WAY
WORK IN SLOW LANE

T000086

TCP 86

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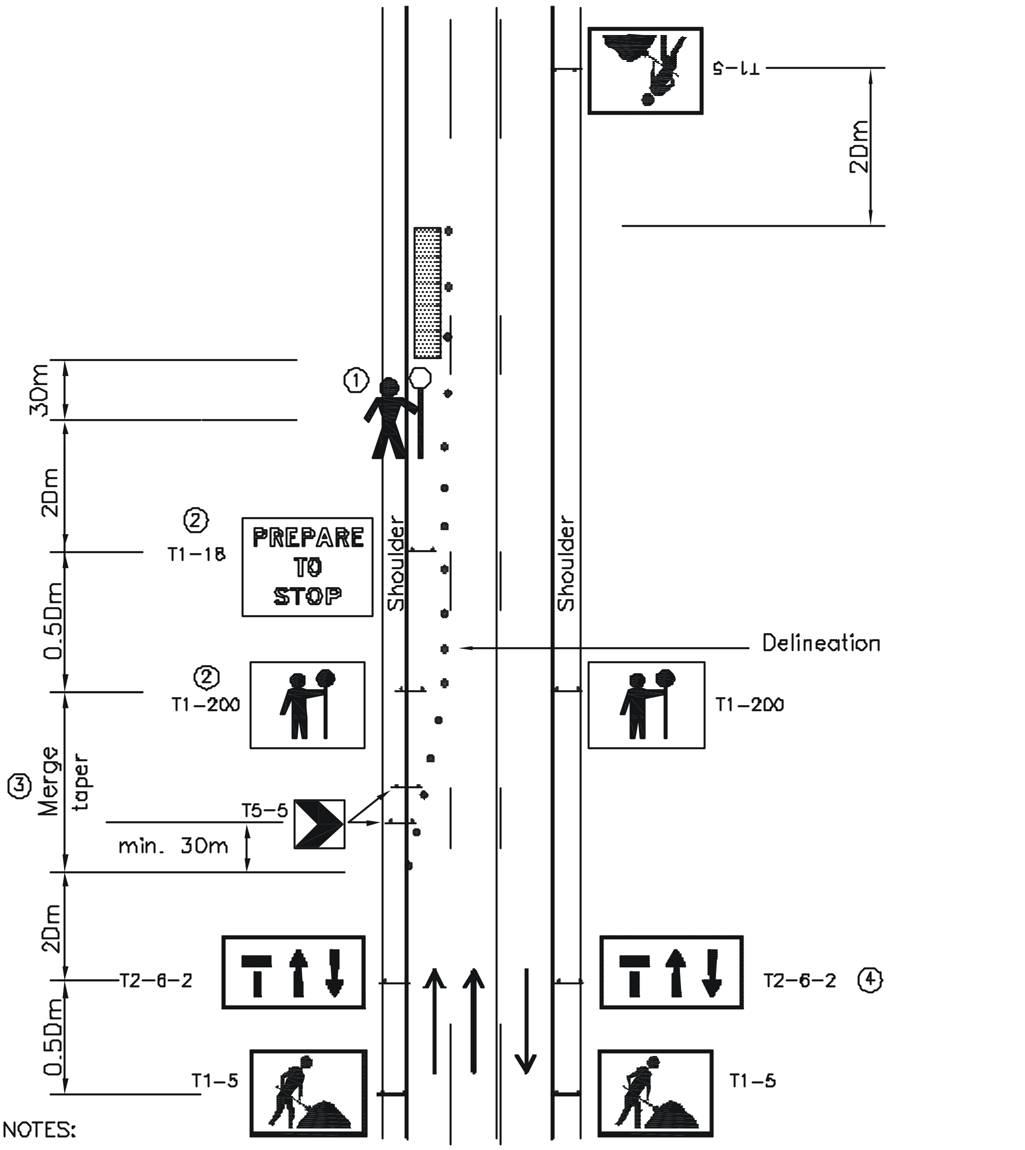


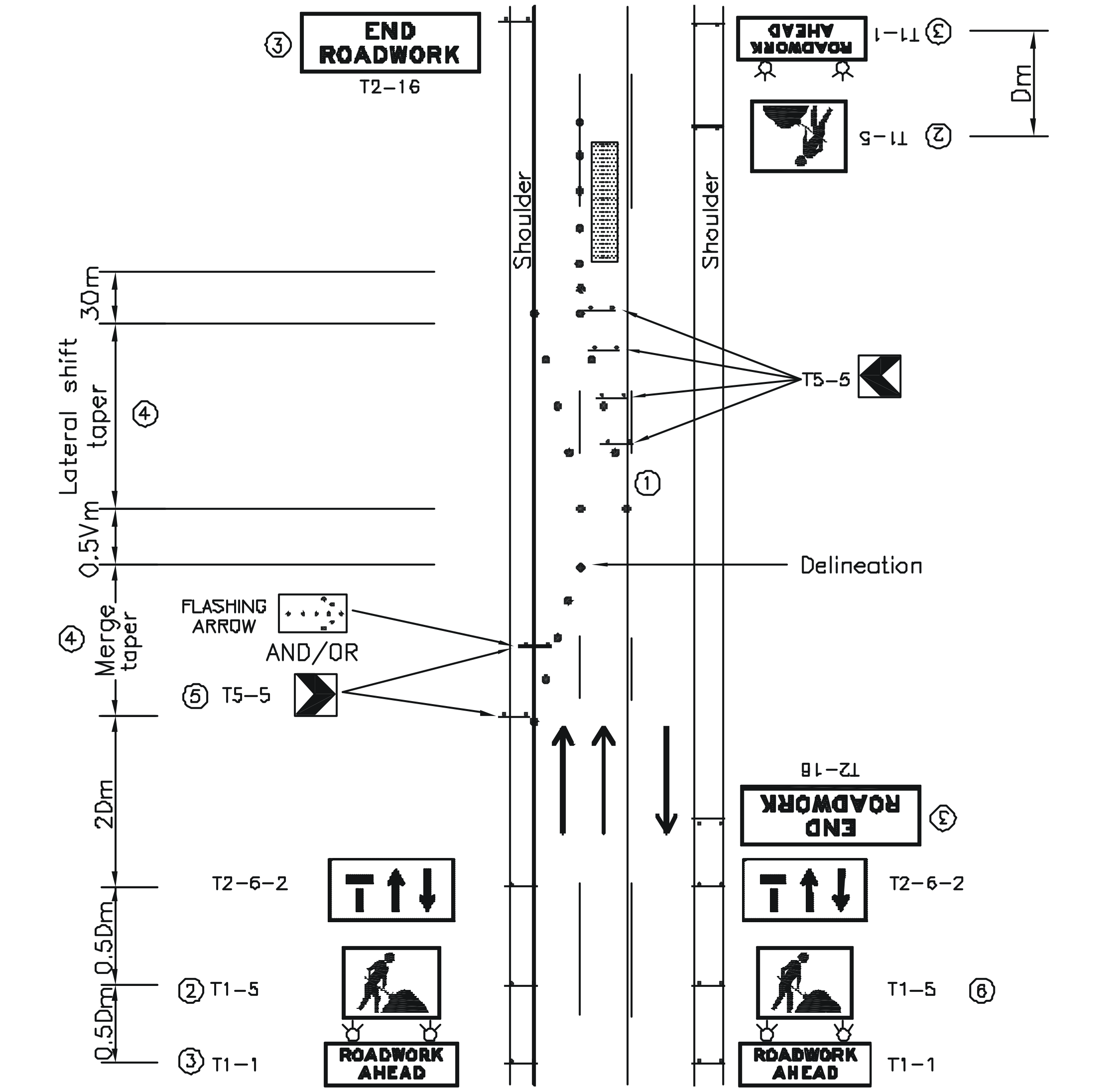
NOTES:

1. Traffic Controller stops traffic when plant or vehicles obstruct overtaking lane.
2. T1–5, T1–200 and T1–18 signs must be covered when Traffic Controller is absent.
3. The length of merge taper is to be determined from ***Traffic Control at Work Sites***, Table 5.2, ***Recommended taper lengths***.
4. T1–5, T2–6–2 and T1–200 signs may be duplicated in accordance with Section 3.2.4, ***Duplication of Signs***.

SHORT TERM WORK (UP TO ONE DAY)
3 LANE / 2 WAY
WHERE THERE IS REGULAR MOVEMENT
INTO THE FAST LANE

T000088

TCP 88



NOTES:

① Traffic cones must clearly delineate the chicane movement which is designed to slow speeds around the work area.

② Display T1–5 signs only while workers or machines are in the work area, remove or cover them between shifts.

③ T1–1 and T2–16 signs required only for long term work.

④ The length of merge and diverge tapers is to be determined from ***Traffic Control at Work Sites***, Table 5.2, Recommended taper lengths.

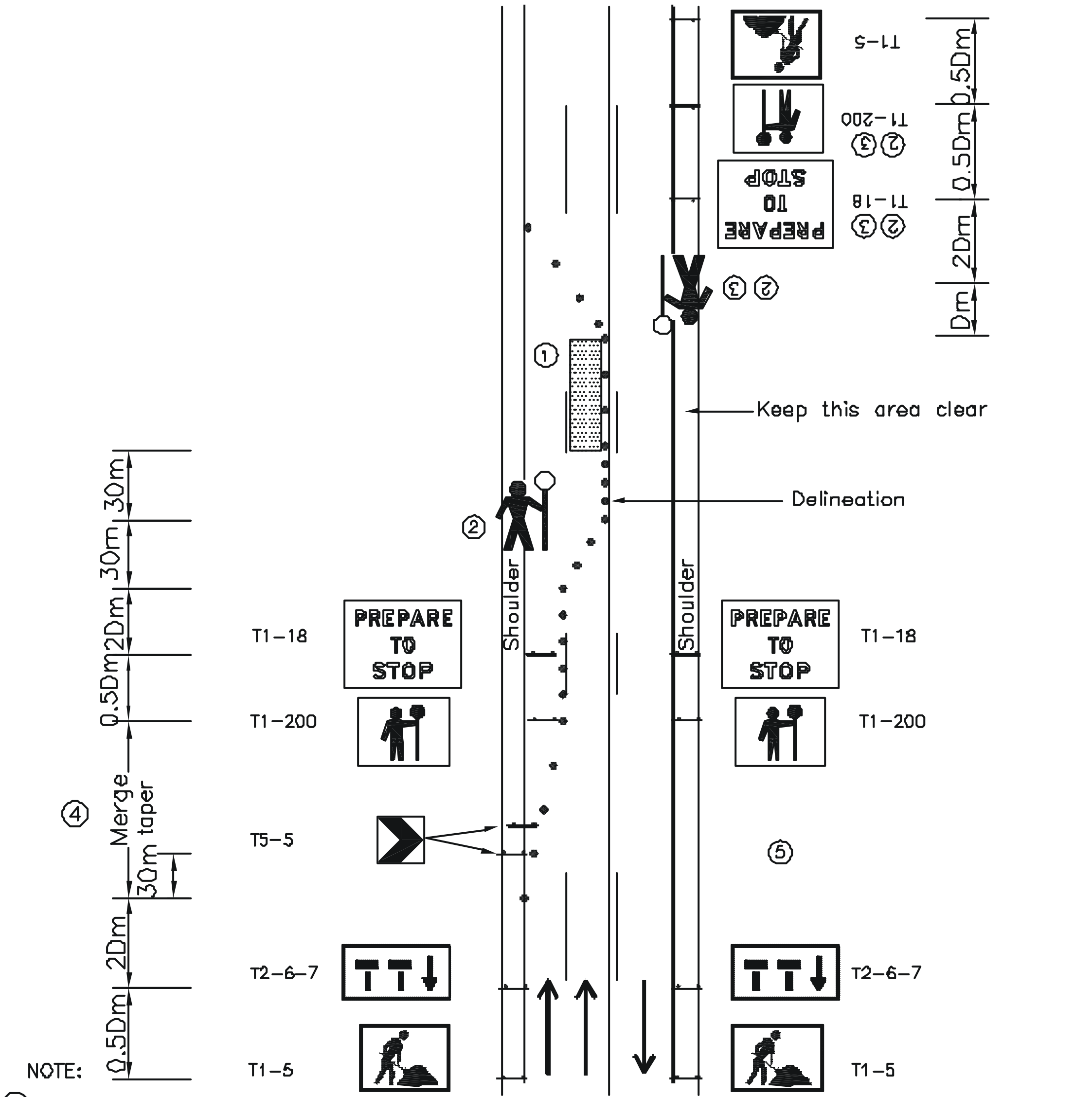
⑤ See Section 5.2.3, ***Requirements for specific signs***, 8th dot point.

⑥ T1–1, T1–5 and T2–6–2 signs may be duplicated in accordance with Section 3.2.4, ***Duplication of Signs***.

SHORT OR LONG TERM WORK
3 LANE / 2 WAY
WORK IN FAST LANE

T000089

TCP 89



NOTE:

1. Use when it is necessary to occupy both lanes to do the work.
2. Traffic Controller and T1-13 and T1-18 signs not required on unobstructed lane if ADT is less than 1,500 vehicles per day provided that the work area is shorter than 250m and sight distance between the Traffic Controller and traffic from the opposite direction exceeds the minimum shown in *Traffic Control at Work Sites*, Table 4·1.
3. T1-5, T1-200 and T1-18 signs must be covered and one lane must be available for each direction when Traffic Controllers are absent.
4. The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.
5. T1-5, T2-6-7, T1-200 and T1-18 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs*.

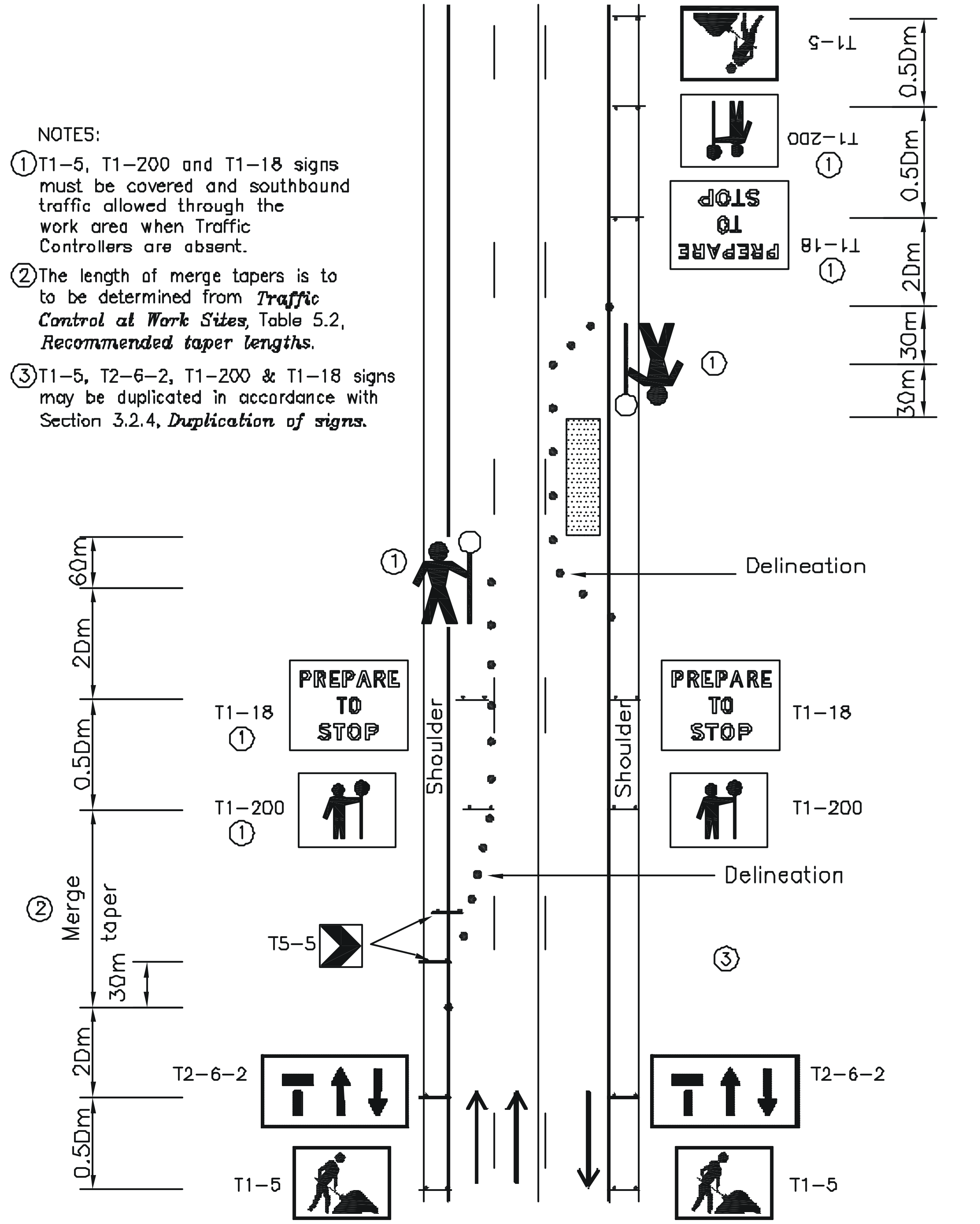
SHORT TERM WORK (UP TO ONE DAY)
3 LANE / 2 WAY
WORK IN FAST LANE

T000090

TCP 90

NOTES:

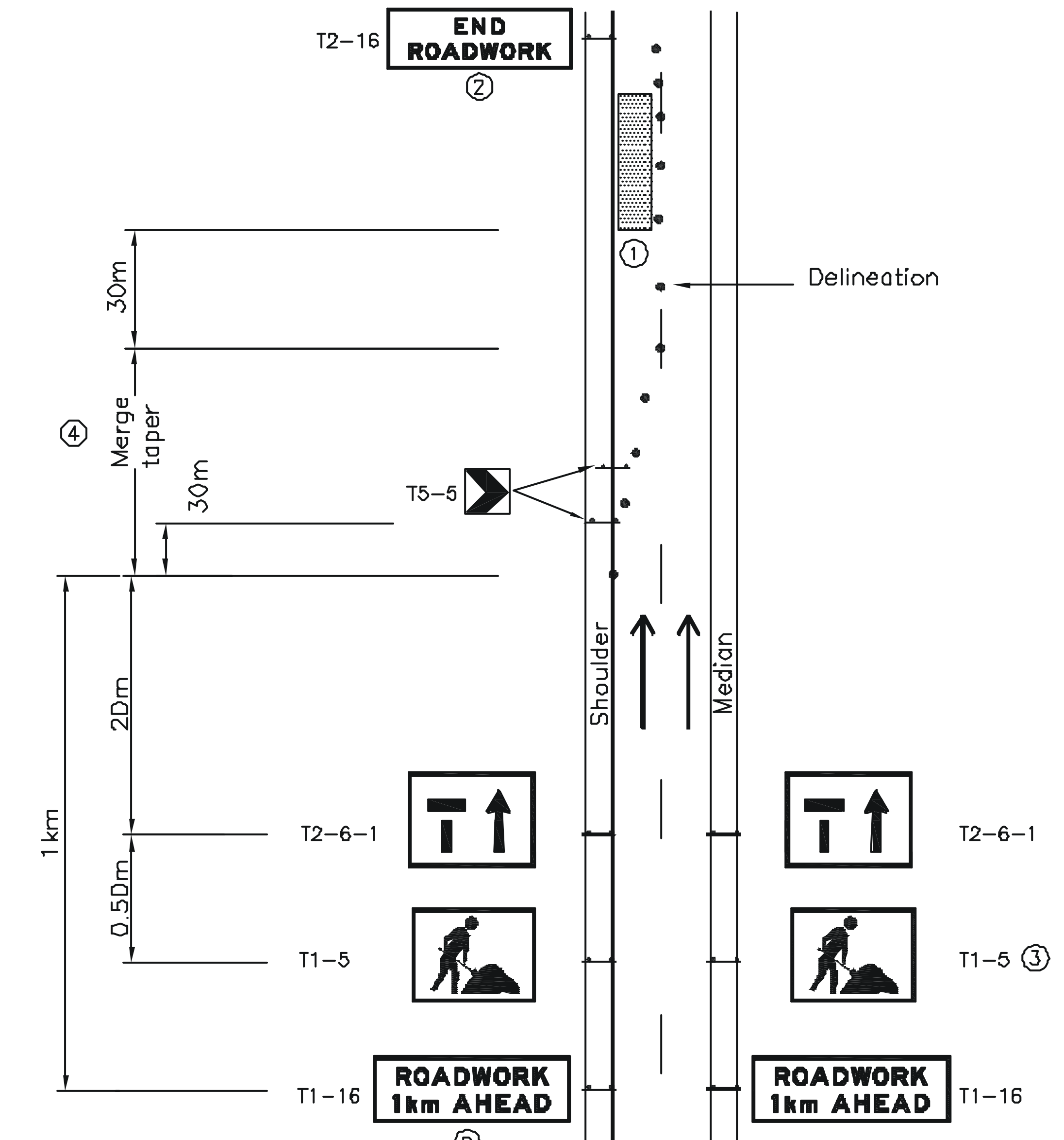
1. T1–5, T1–200 and T1–18 signs must be covered and southbound traffic allowed through the work area when Traffic Controllers are absent.
2. The length of merge tapers is to to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.
3. T1–5, T2–6–2, T1–200 & T1–18 signs may be duplicated in accordance with Section 3.2.4, *Duplication of signs*.



SHORT TERM WORK (UP TO ONE DAY)
3 LANE / 2 WAY
WORK IN SINGLE LANE

T000091

TCP 91



NOTES:

① No personnel movement into right–hand lane.

② Signs T1–16 and T2–16 are optional where ADT is less than 10,000 vehicles per day.

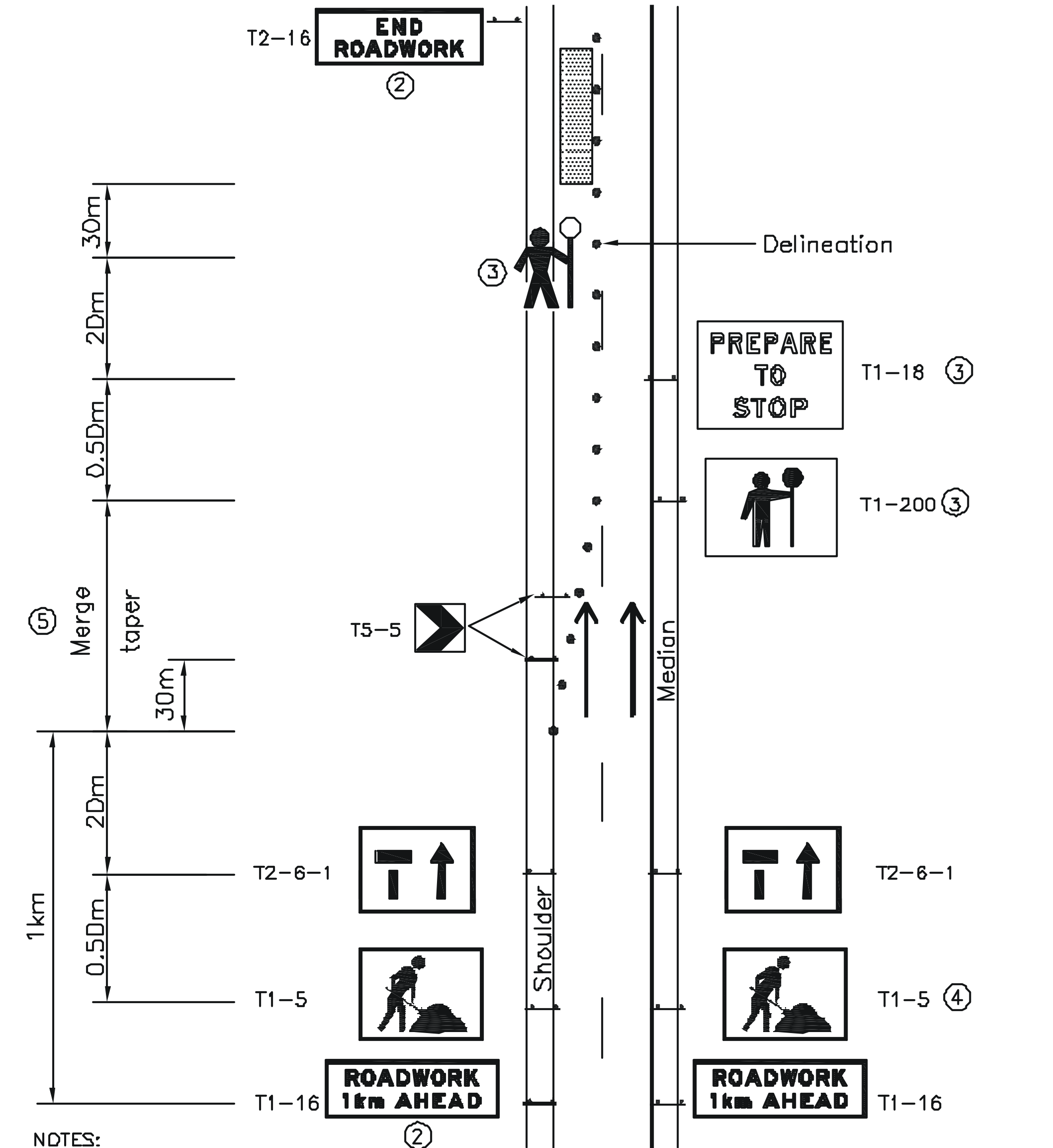
③ T1–16, T1–5 and T2–6–1 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs*.

④ The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.

SHORT TERM WORK (UP TO ONE DAY)
2 LANE / DIVIDED

TD00092

TCP 92



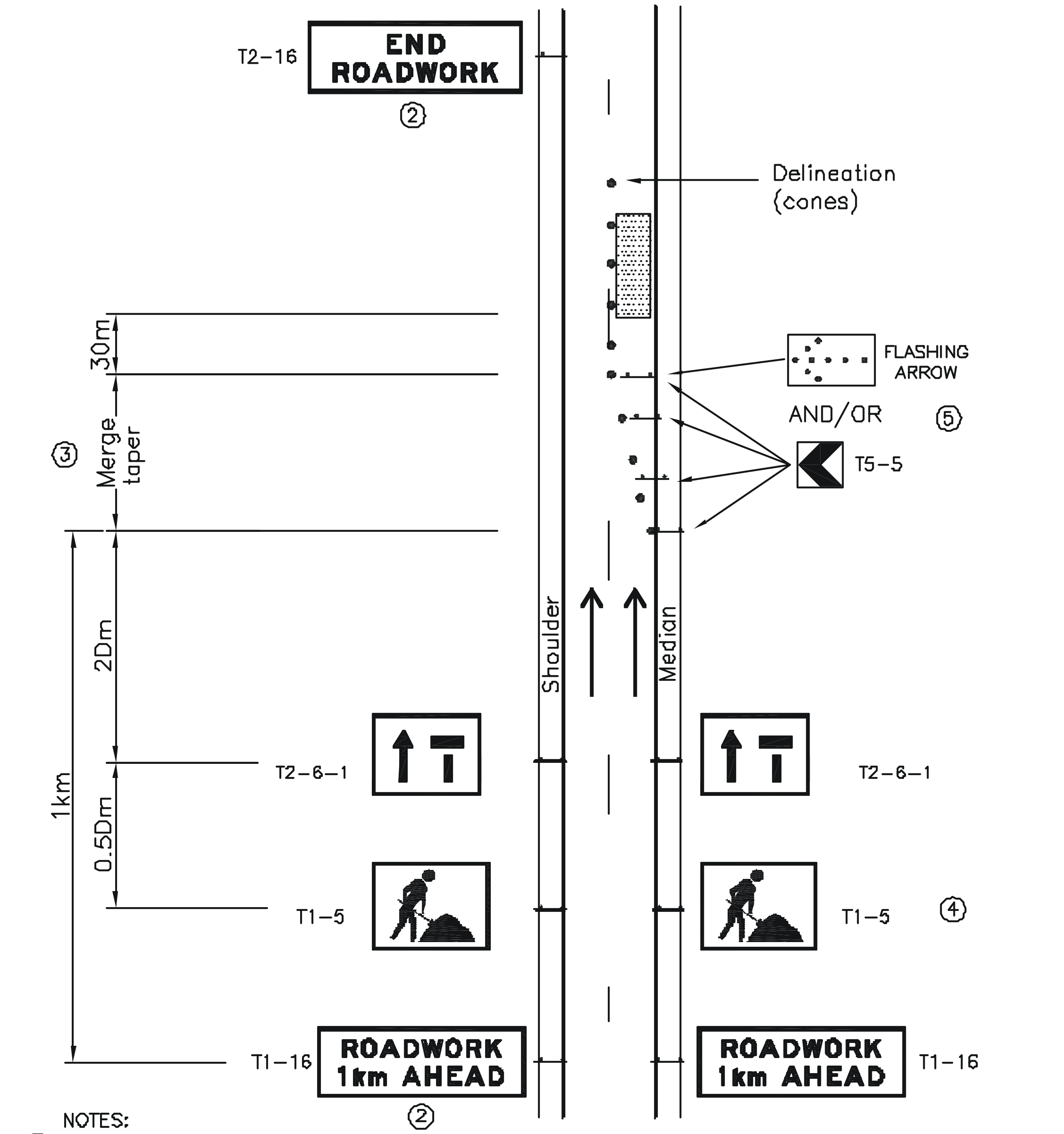
NOTES:

1. For use where workers and plant need to occupy the fast lane regularly as well as the work area.
2. Signs T1–16 and T2–16 are optional where ADT is less than 10,000 vehicles per day.
3. T1–200 and T1–18 signs must be covered while Traffic Controller is absent.
4. T1–16, T1–5 and T2–6–1 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs.*
5. The length of merge tapers is to be determined from *Traffic Control at Work Sites,* Table 5.2. *Recommended taper lengths.*

SHORT TERM WORK (UP TO ONE DAY)
2 LANE / DIVIDED

T000093

TCP 93



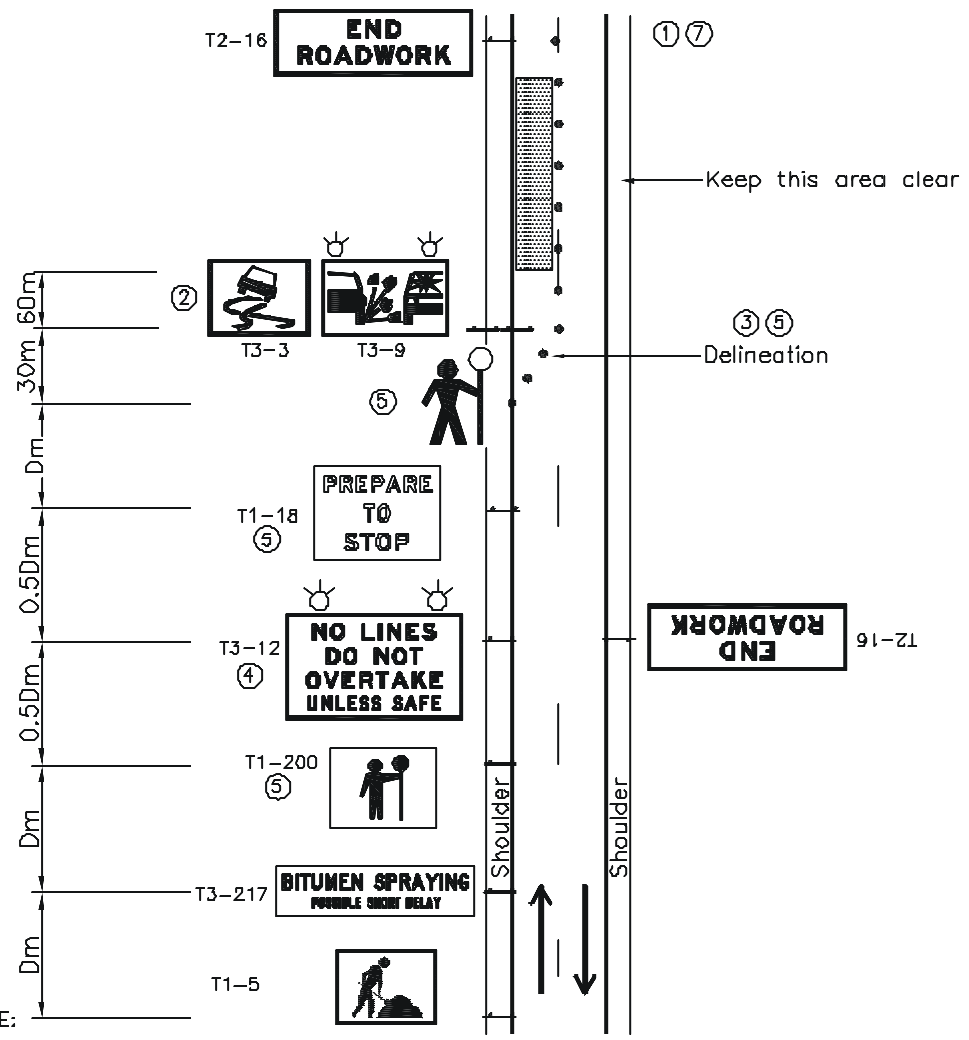
NOTES:

1. For use where workers and plant do not move into the left lane.
2. T1–16 and T2–16 signs are optional where ADT is less than 10,000 vehicles per day.
3. The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.
4. T1–16, T1–5 and T2–6–1 signs may be duplicated in accordance with Section 3.2.4, *Duplication of Signs*.
5. See Section 5.2.3, *Requirements for specific signs*, 8th dot point.

SHORT TERM WORK
2 LANE / DIVIDED

T000094

TCP 94



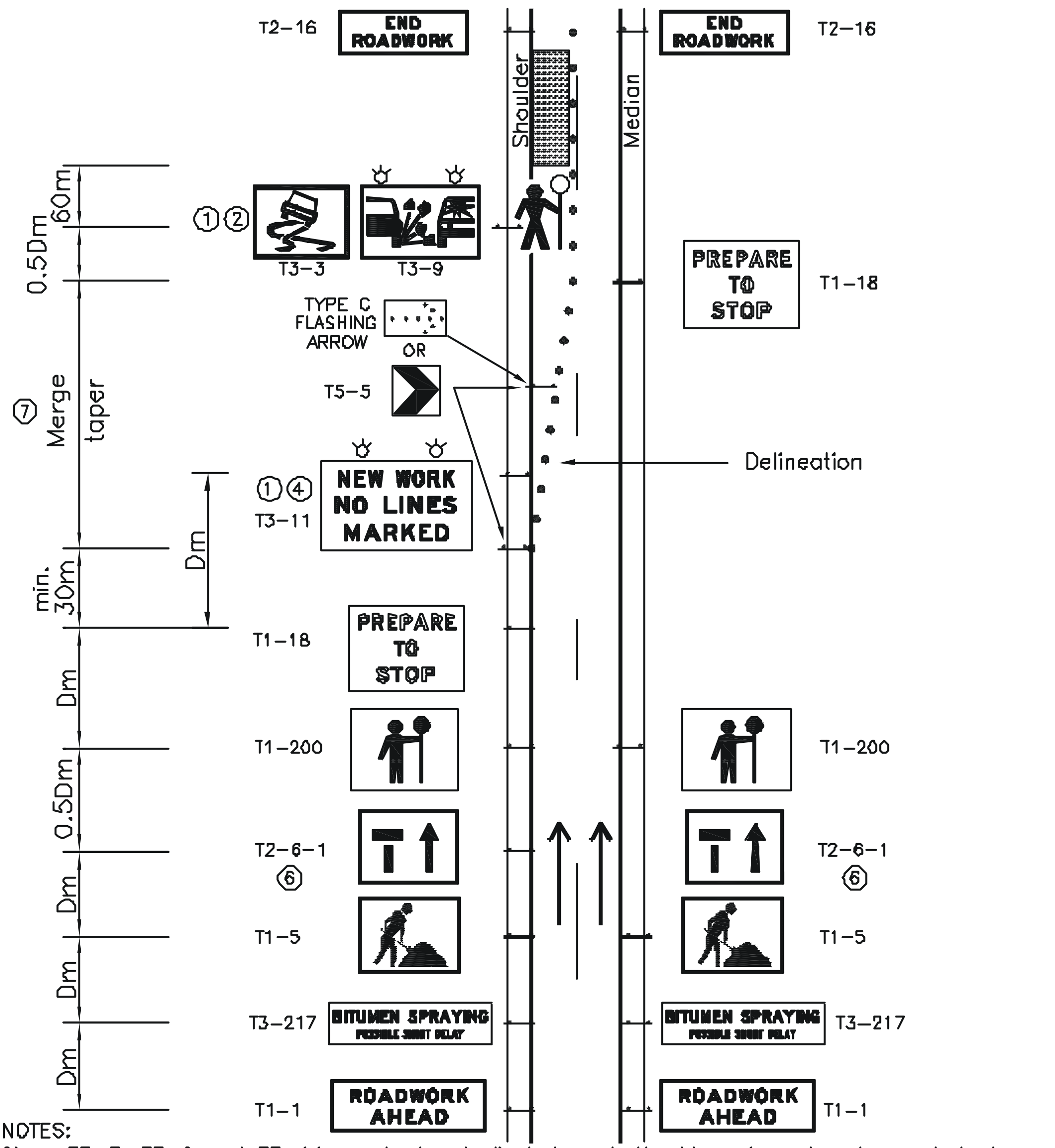
NOTE:

1. Signs T1–5, T3–217, T3–12 and T3–9 are also required on the opposite approach.
2. Signs T3–3 and T3–9 to remain until all loose aggregate removed.
3. Cones to be used to keep traffic off new work, where necessary.
4. Sign T3–12 to remain until line marking is finished.
5. T1–5, T1–200 and T1–18 signs must be covered and cones removed while Traffic Controller is absent
6. Use TCP 353 for full width sealing where speed limit exceeds 60km/h and ADT exceeds 5,000 vehicles per day. Speed limit repeater signs are to be erected in accordance with Section 8.2.4(c)
7. A Traffic Controller and signs T1–200 and T1–18 are required on the opposite approach where the work area is longer than 250m or ADT exceeds 1,500 vehicles per day or if sight distance from the Traffic Controller to traffic from the opposite direction is less than the minimum shown in ***Traffic Control at Work Sites***, Table 9·1.

SHORT TERM WORK
2 LANE / 2 WAY
BITUMEN SEALING
SPEED LIMIT 60km/h OR LESS

T000095

TCP 95



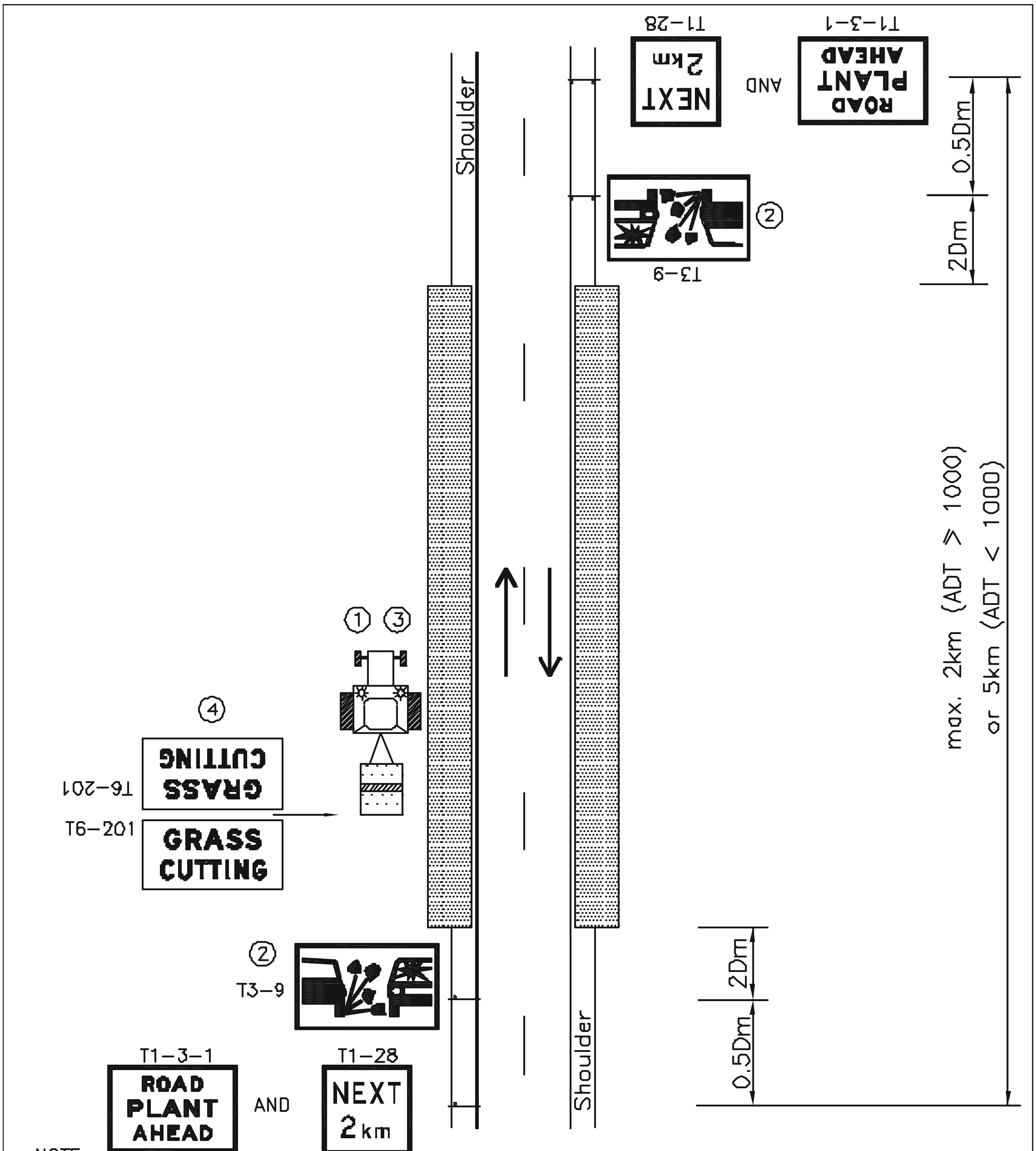
NOTES:

1. Signs T3–3, T3–9 and T3–11 are to be duplicated on both sides of road and repeated at intervals as appropriate.
2. Signs T3–3 and T3–9 to remain until all loose aggregate removed.
3. Cones to be used to direct traffic into the right–hand lane when it is not stopped for work.
4. Sign T3–11 is to remain until line marking is completed.
5. T1–200 and T1–18 signs must be covered while Traffic Controller is absent.
6. Whenever practicable sign T2–6–1 should be placed on both sides of the road.
7. The length of merge tapers is to be determined from ***Traffic Control at Work Sites***, Table 5.2, ***Recommended taper lengths***.
8. Where existing speed limit exceeds 60 km/h install roadwork speed limit as in TCP353.

LONG TERM WORK
2 LANE / DIVIDED
BITUMEN SEALING

T000096

TCP 96



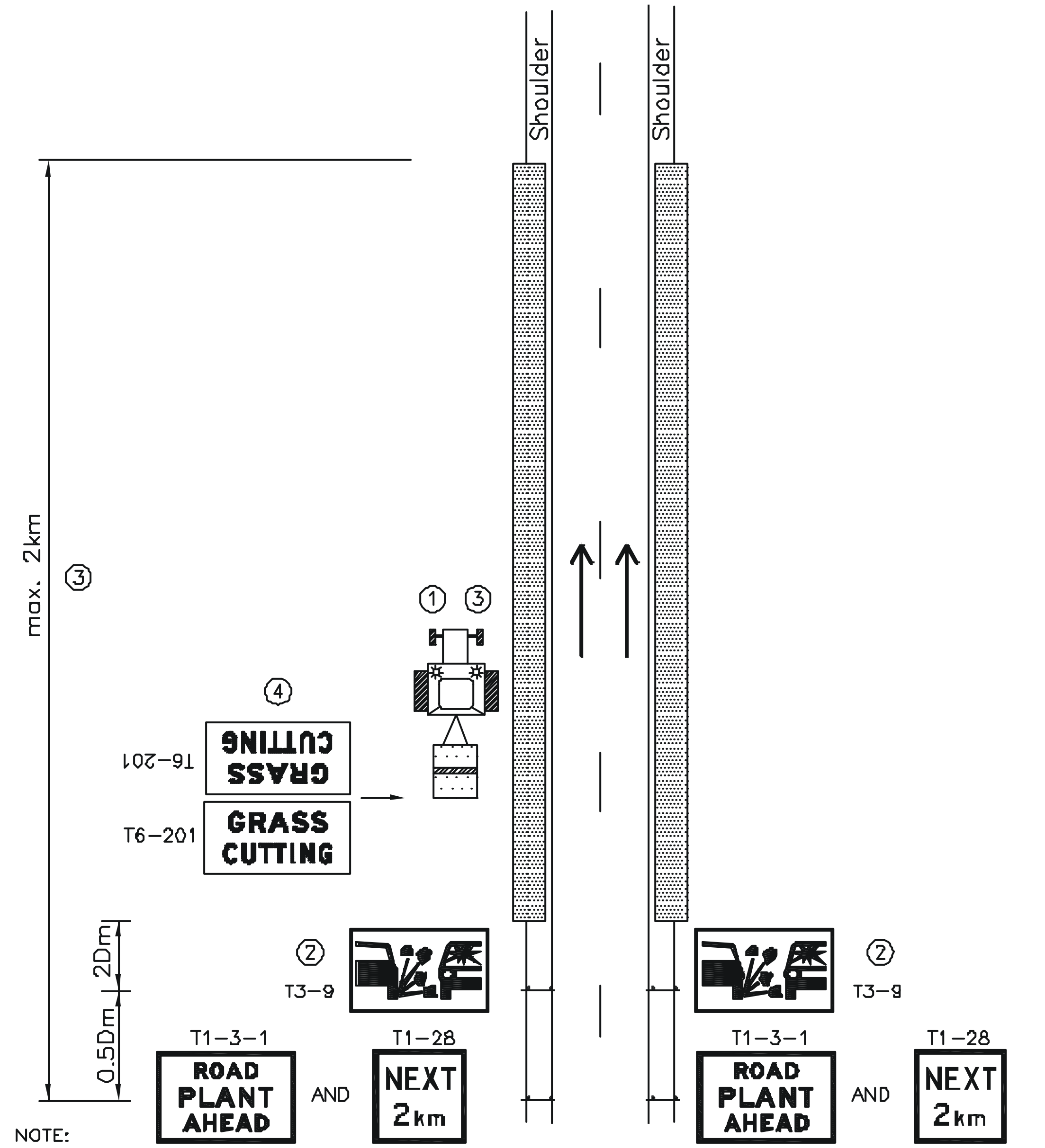
NOTE:

1. Plant item working off the road and clear of traffic. Obstructions in the shoulder may be passed by travelling on the road using gaps in traffic.
2. Sign T3–9 is required where mowing may throw loose stones onto the road.
3. Mowing to be carried out in direction of traffic flow.
4. Use of signs T6–201 is optional. If used they shall be mounted so that they do not obscure the rotating flashing yellow lamps which are to be monted as high as possible on the tractor.

MOBILE WORK
2 WAY CARRIAGEWAY
MOWING

T000097

TCP 97



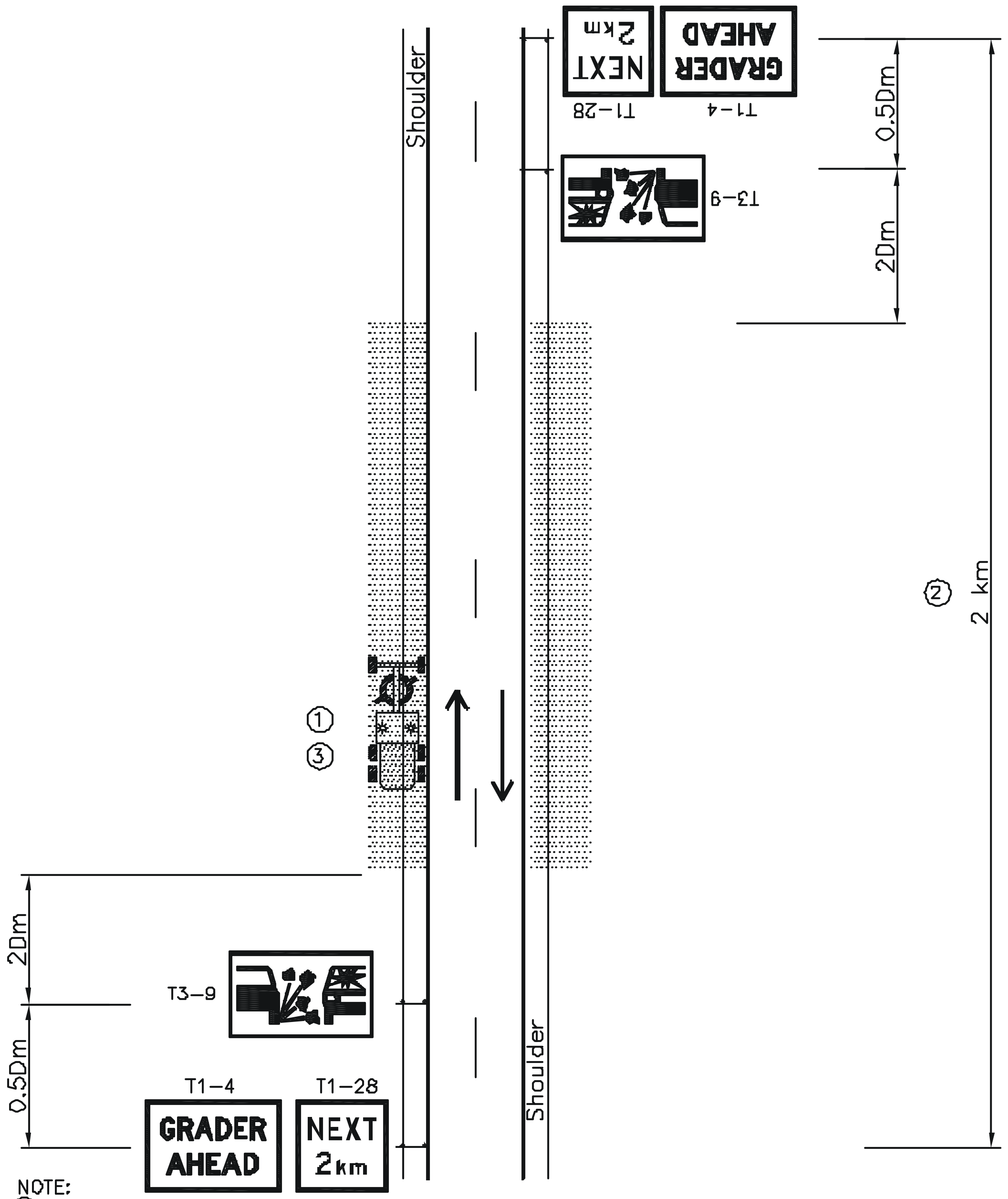
NOTE:

1. Plant item working off the road and clear of traffic. Obstructions in the shoulder may be passes by travelling on the road using gaps in traffic.
2. Sign T3–9 is required where loose stones may be thrown onto the road.
3. Mow and travel only in the direction of traffic flow. Use approved locations to cross median and other carriageway to return.
4. Use of signs T6–201 is optional. If used they shall be mounted so that they do not obscure the rotating flashing yellow lamps which are to be mounted as high as possible on the tractor.

MOBILE WORK
ONE WAY CARRIAGEWAY
MOWING

T00009B

TCP 98

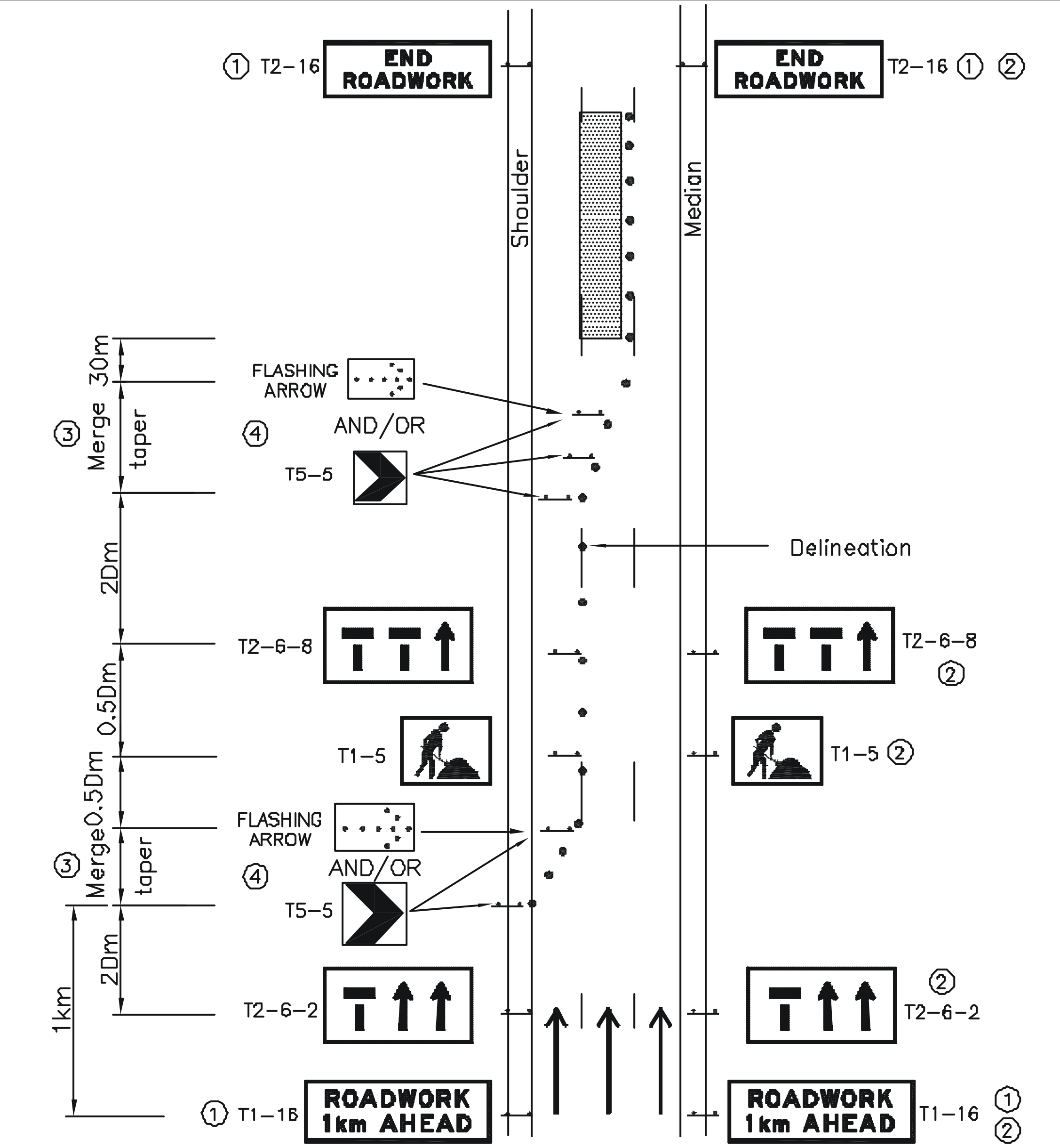


NOTE:
1. For road plant only, provided the road is not obstructed.
2. Work may be extended to a length of 5km in areas of low traffic flow and good sight distance subject to approval of the Project Manager.
3. Grading to be carried out in direction of traffic flow.

SHORT TERM WORK
2 LANE / 2 WAY
SHOULDER GRADING

T000099

TCP 99



NOTES:

① T1–16 and T2–16 signs are optional where ADT is less than 10,000 vehicles per day.

② Duplicate signs should be omitted on multilane undivided roads.

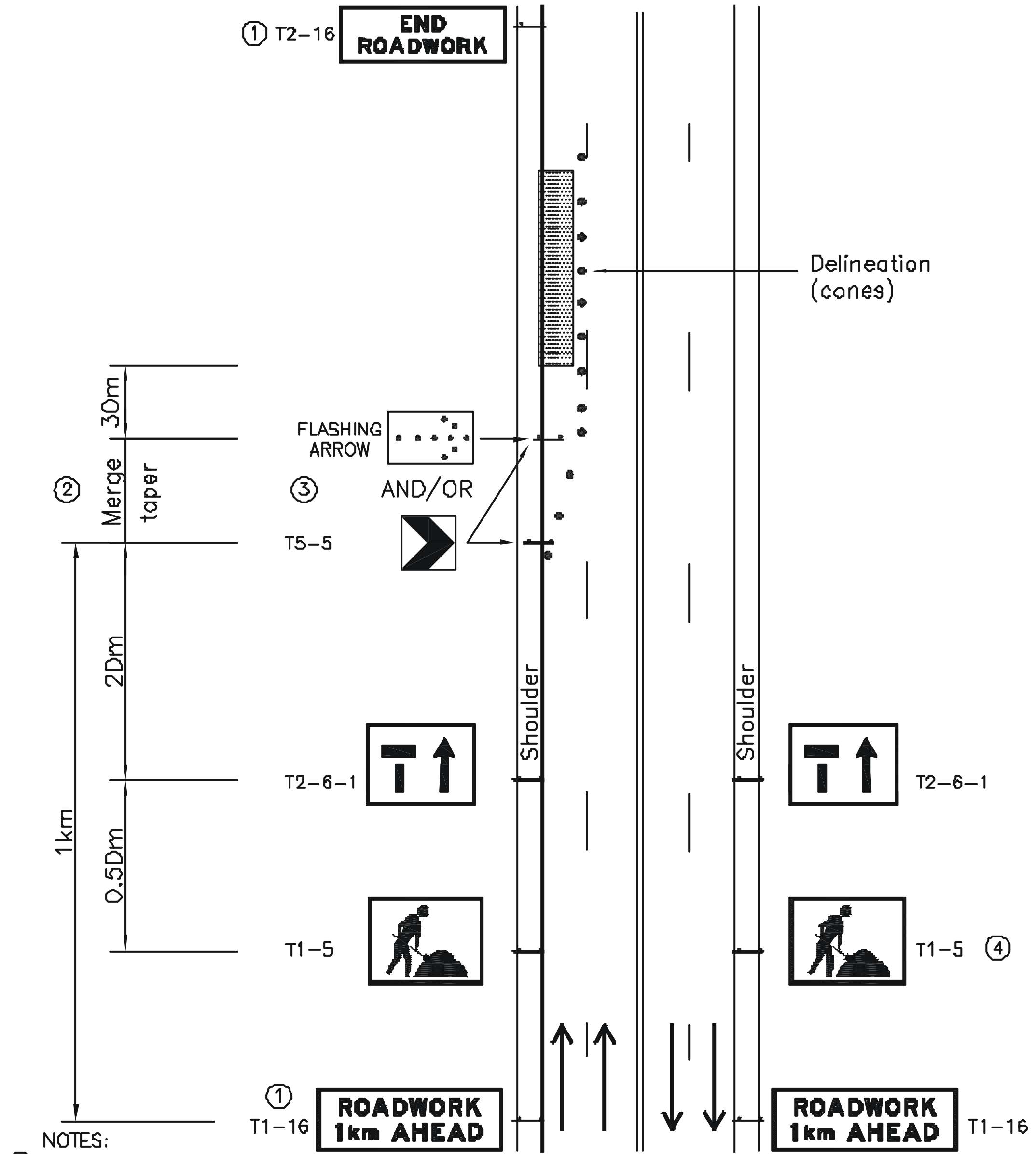
③ The length of merge tapers is to be determined from ***Traffic Control at Work Sites***, Table 5.2, ***Recommended taper lengths***.

④ See Section 5.2.3, ***Requirements for specific signs***, 8th dot point.

SHORT TERM WORK
3 LANE / DIVIDED

T000100

TCP 100



NOTES:

① T1–16 and T2–16 signs are optional where ADT is less than 10,000 vehicles per day.

② The length of merge tapers is to be determined from ***Traffic Control at Work Sites***, Table 5.2, ***Recommended taper lengths***.

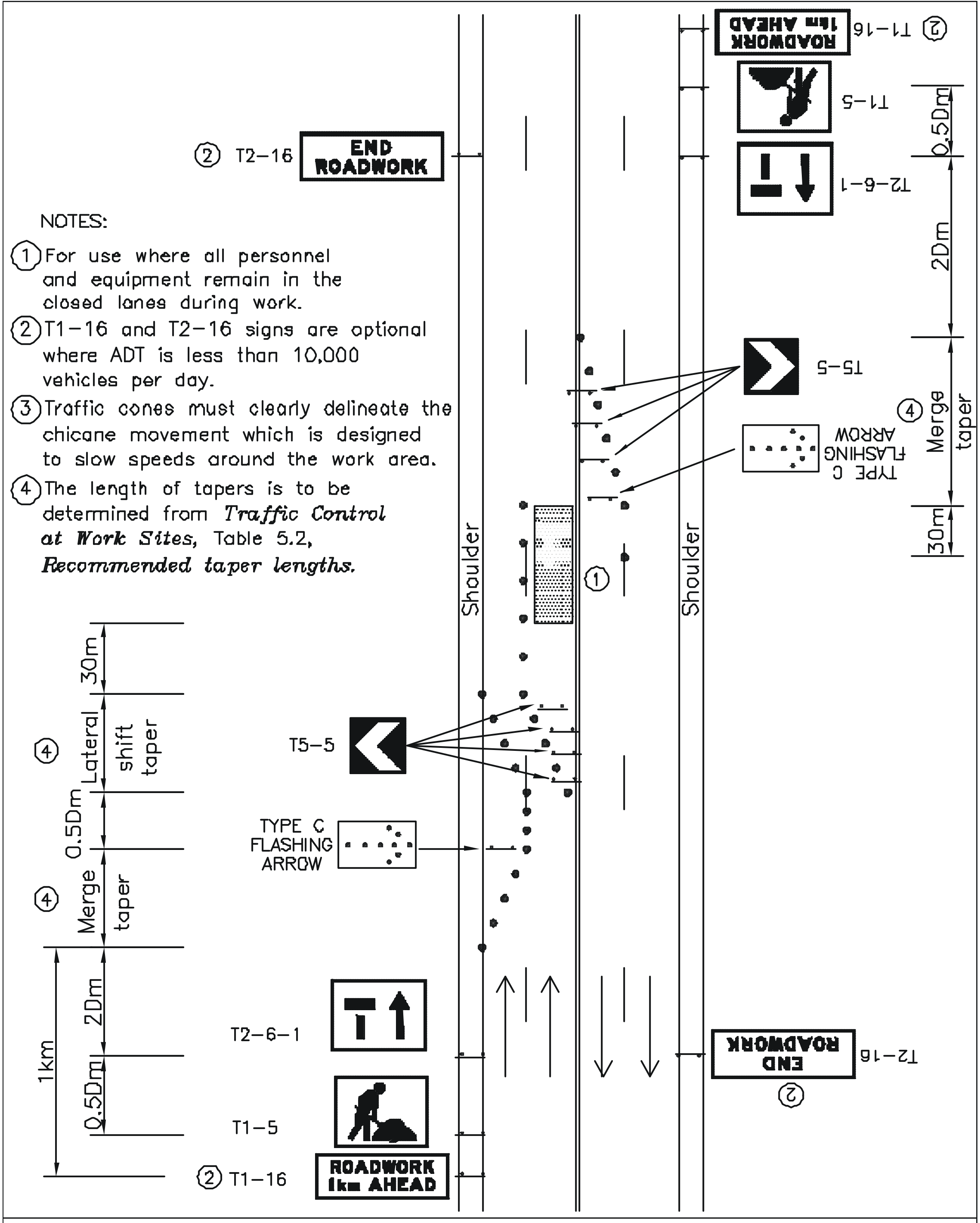
③ See Section 5.2.3, ***Requirements for specific signs***, 8th dot point.

④ T1–16, T1–5 and T2–6–1 signs may be duplicated in accordance with Section 3.2.4, ***Duplication of Signs***.

SHORT TERM WORK
4 LANE / 2 WAY

T0001D1

TCP 101



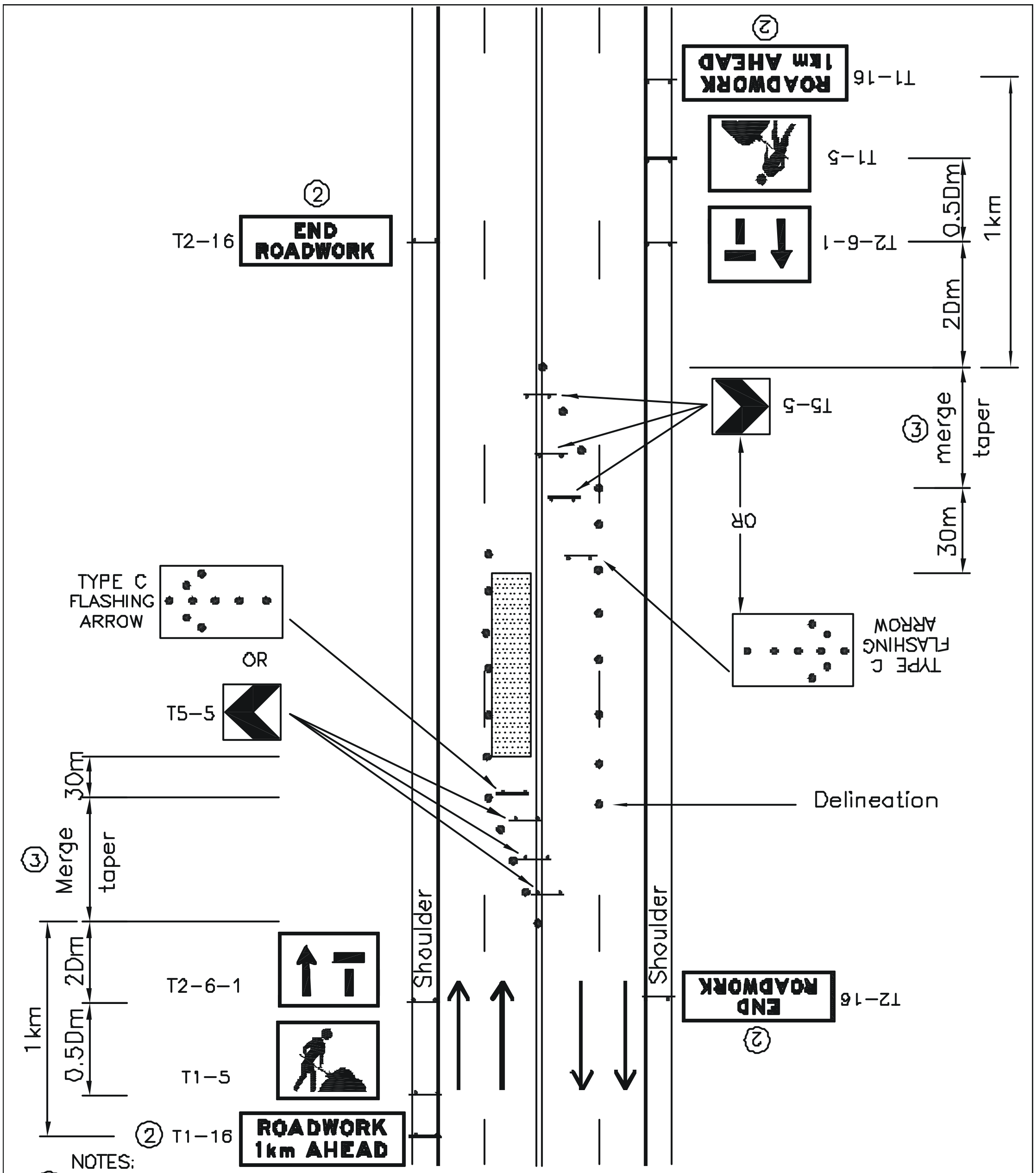
NOTES:

1. For use where all personnel and equipment remain in the closed lanes during work.
2. T1–16 and T2–16 signs are optional where ADT is less than 10,000 vehicles per day.
3. Traffic cones must clearly delineate the chicane movement which is designed to slow speeds around the work area.
4. The length of tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths.*

SHORT TERM WORK
4 LANE / 2 WAY

T000102

TCP 102

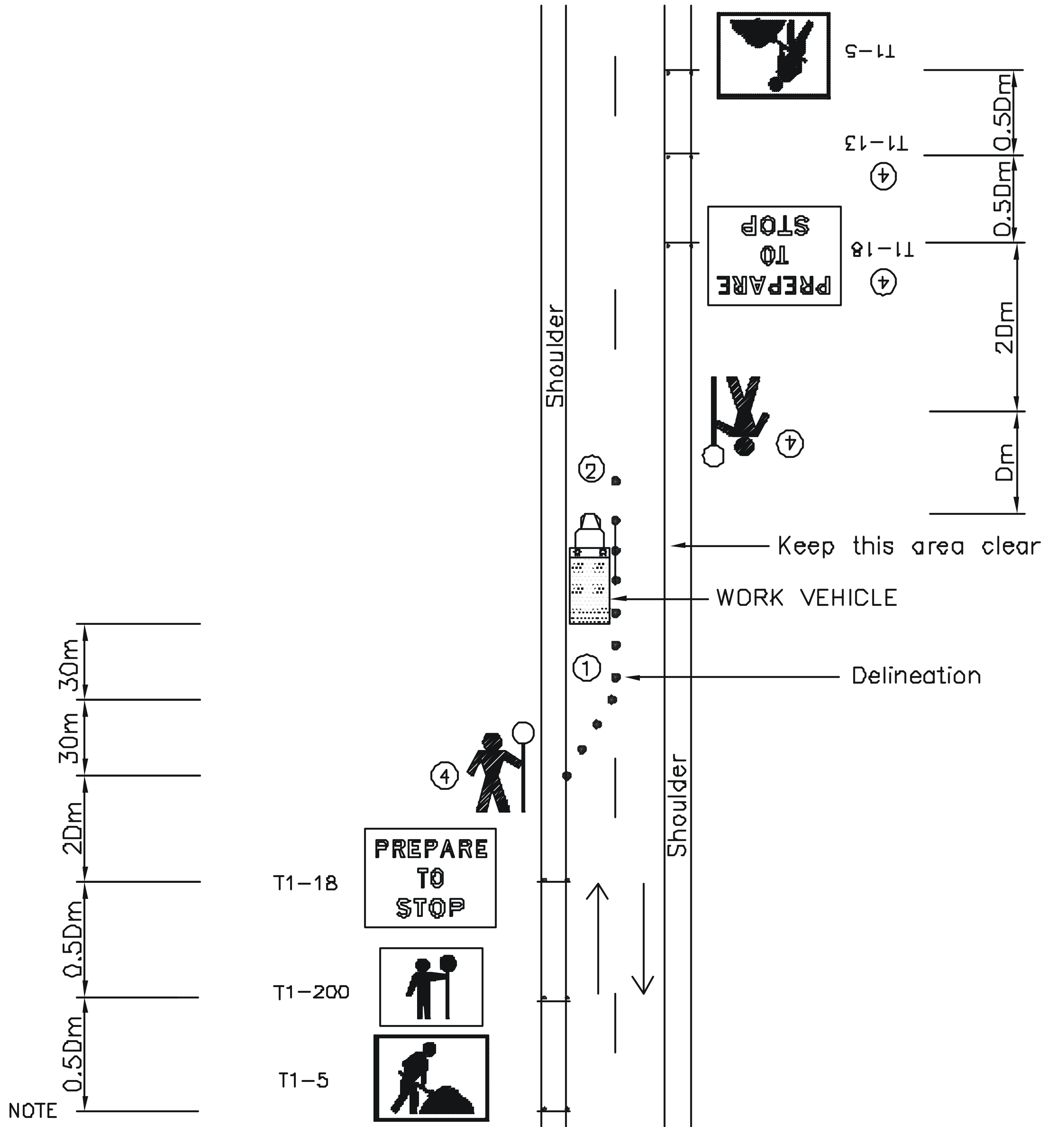


NOTES:
① For use where all personnel and equipment remain in the closed lanes during the work.
② T1-16, T2-16 signs are optional where ADT is less than 10,000 vehicles per day.
③ The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.

SHORT TERM WORK
4 LANE / 2 WAY

T000103

TCP 103



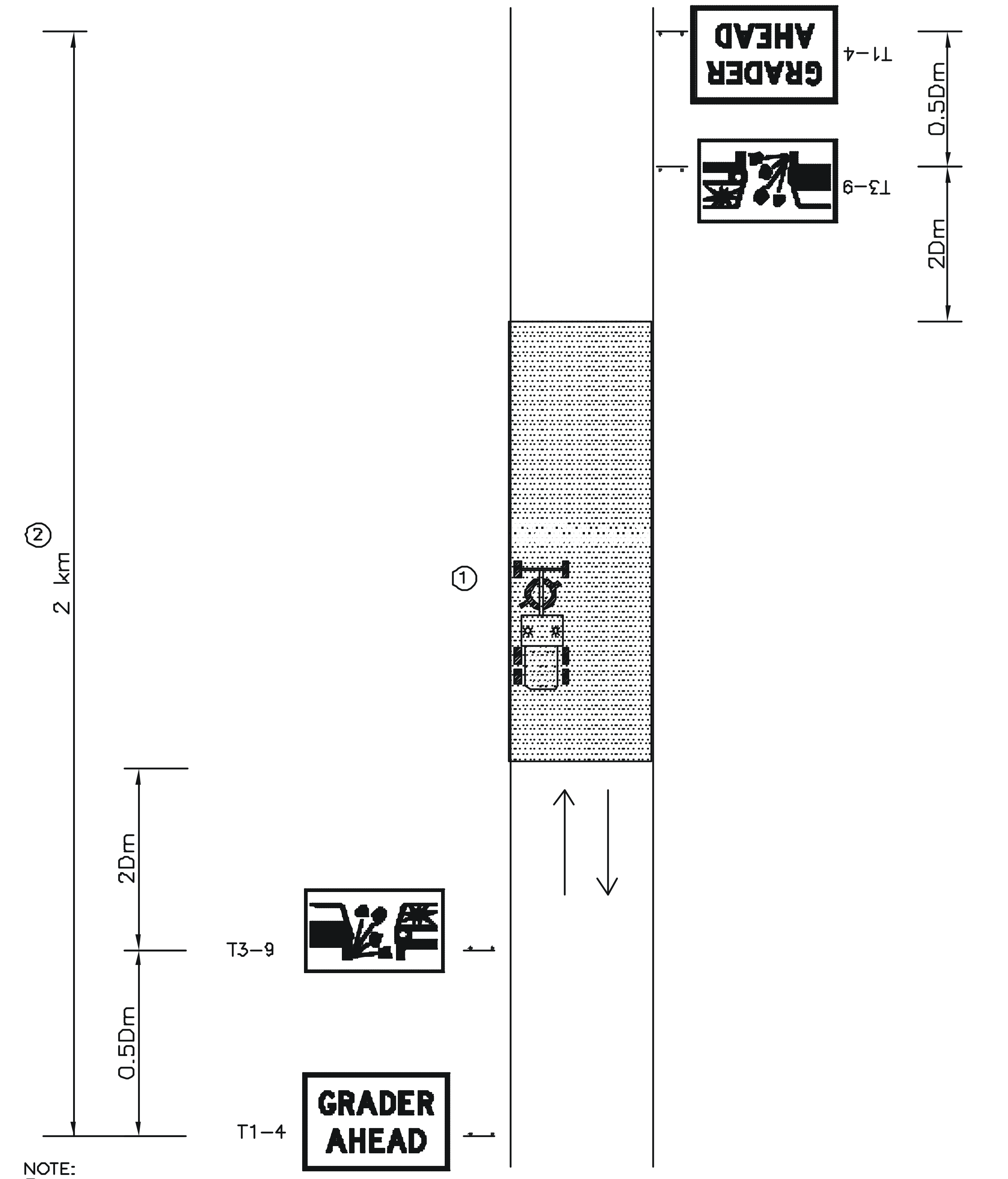
NOTE

1. Work Vehicle to be parked on the roadway while carrying out the test.
2. Work to be carried out in direction of traffic.
3. Where ADT is greater than 6,000 vehicles per day, use T1-16 and T2-16 signs as shown on TCP 83.
4. Traffic Controller and T1-200 and T1-18 signs not required on unobstructed lane if ADT is less than 1,500 vehicles per day provided that the work area is shorter than 250m and sight distance between the Traffic Controller and traffic from the opposite direction is more than the minimum shown in ***Traffic Control at Work Sites***, Table 8·1.

SHORT TERM WORK
2 LANE / 2 WAY
BENKELMAN BEAM

T000104

TCP 104

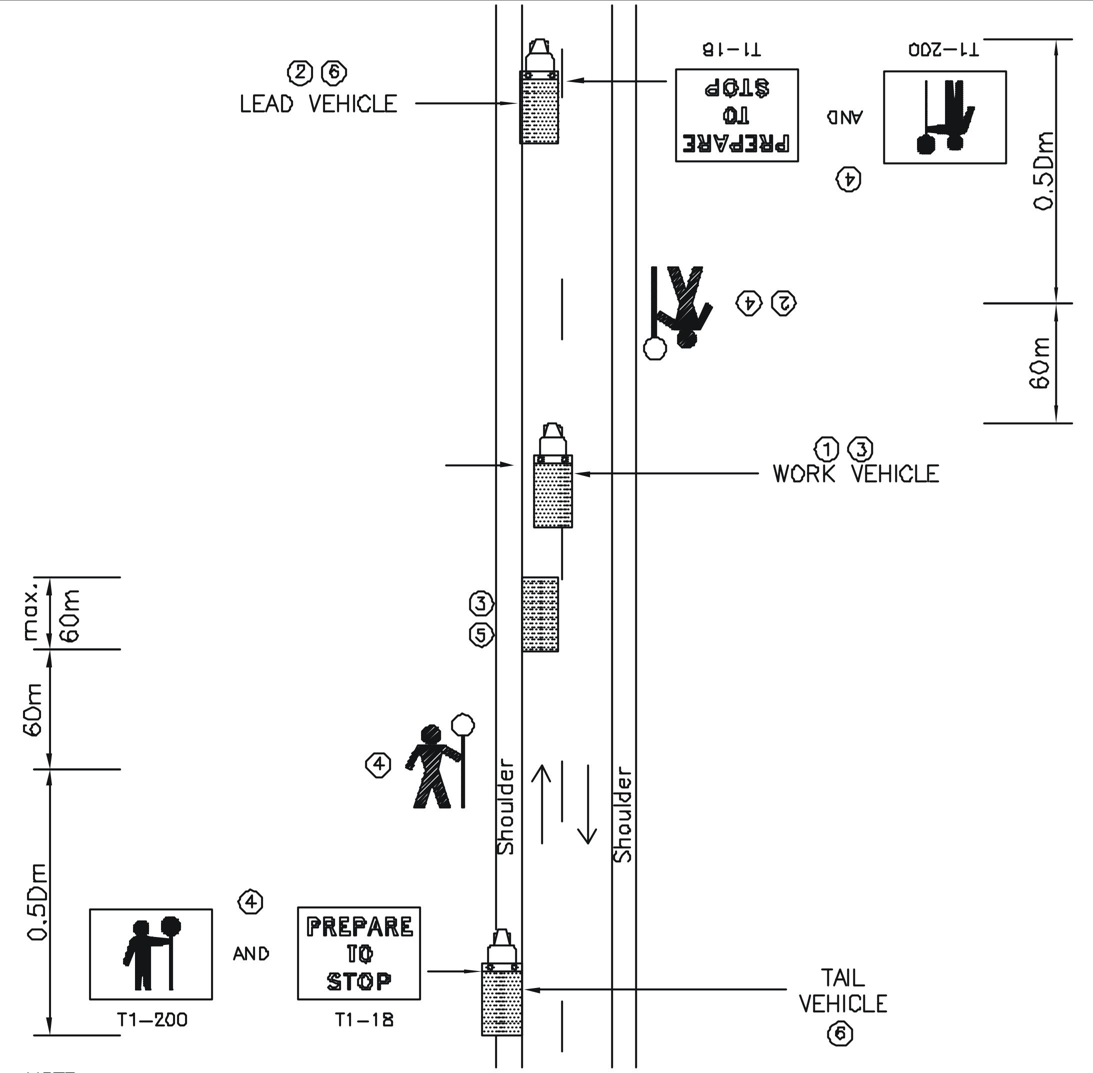


NOTE:
① For road plant only, provided roadway is not obstructed.
② Work may be extended to a length of 5 km on lightly trafficked road with good sight distance subject to approval of the Project Manager.

SHORT TERM WORK
2 LANE / 2 WAY
FORMATION GRADING

T000105

TCP 105



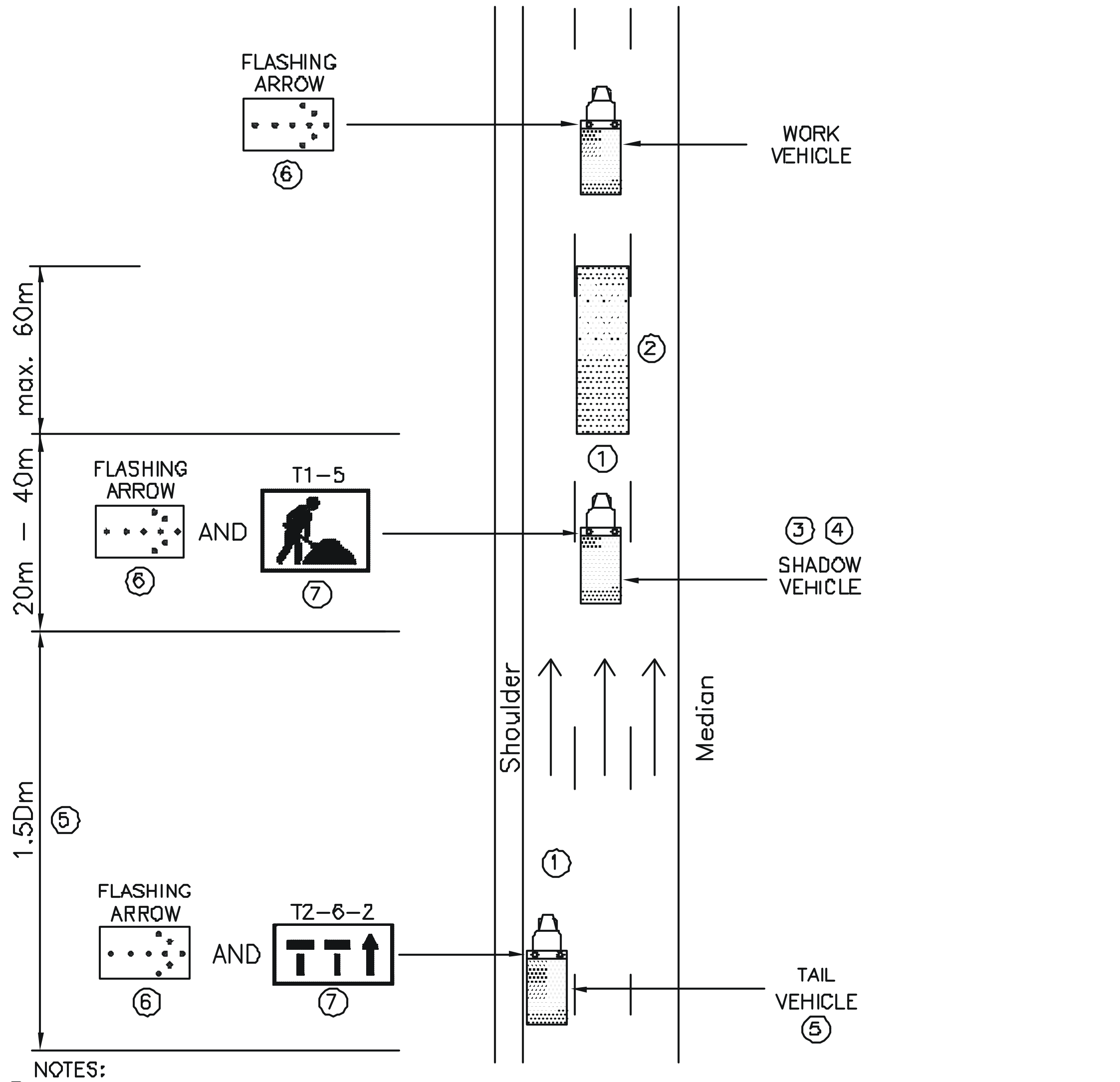
NOTE:

1. The Work Vehicle should overlap the centre line by up to 1/3 the width of the vehicle.
2. Lead Vehicle and Traffic Controller on unobstructed lane are not required where shoulder on unobstructed side has at least a 1m seal, ADT is less than 1,500 vehicles per day, and sight between the Traffic Controller and traffic from the opposite direction exceeds 300m (400m where travel speeds exceed 100 km/h).
3. All work should be from the Work Vehicle.
4. T1-200 and T1-18 signs must be covered while Traffic Controller is absent.
5. For work wholly within the lane or on edgeline use TCP 68.
6. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.

PROGRESSIVELY MOVING WORK
2 LANE / 2 WAY
PAVEMENT MARKERS ON CENTRE LINE

T000106

TCP 106



NOTES:

(1) The Advance Warning Vehicle blocks the left lane and the Shadow Vehicle blocks the middle lane.

(2) If the work area is towards the right lane, a mirror image of the advance arrangement is used with sign T2–6–2.

(3) For work carried out on lane line the Shadow Vehicle should overlap the lane line by up to 1/3 the width of the Shadow Vehicle.

(4) For work wholly within the lane the Shadow Vehicle shall travel close to, but not overlap the lane line.

(5) On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.

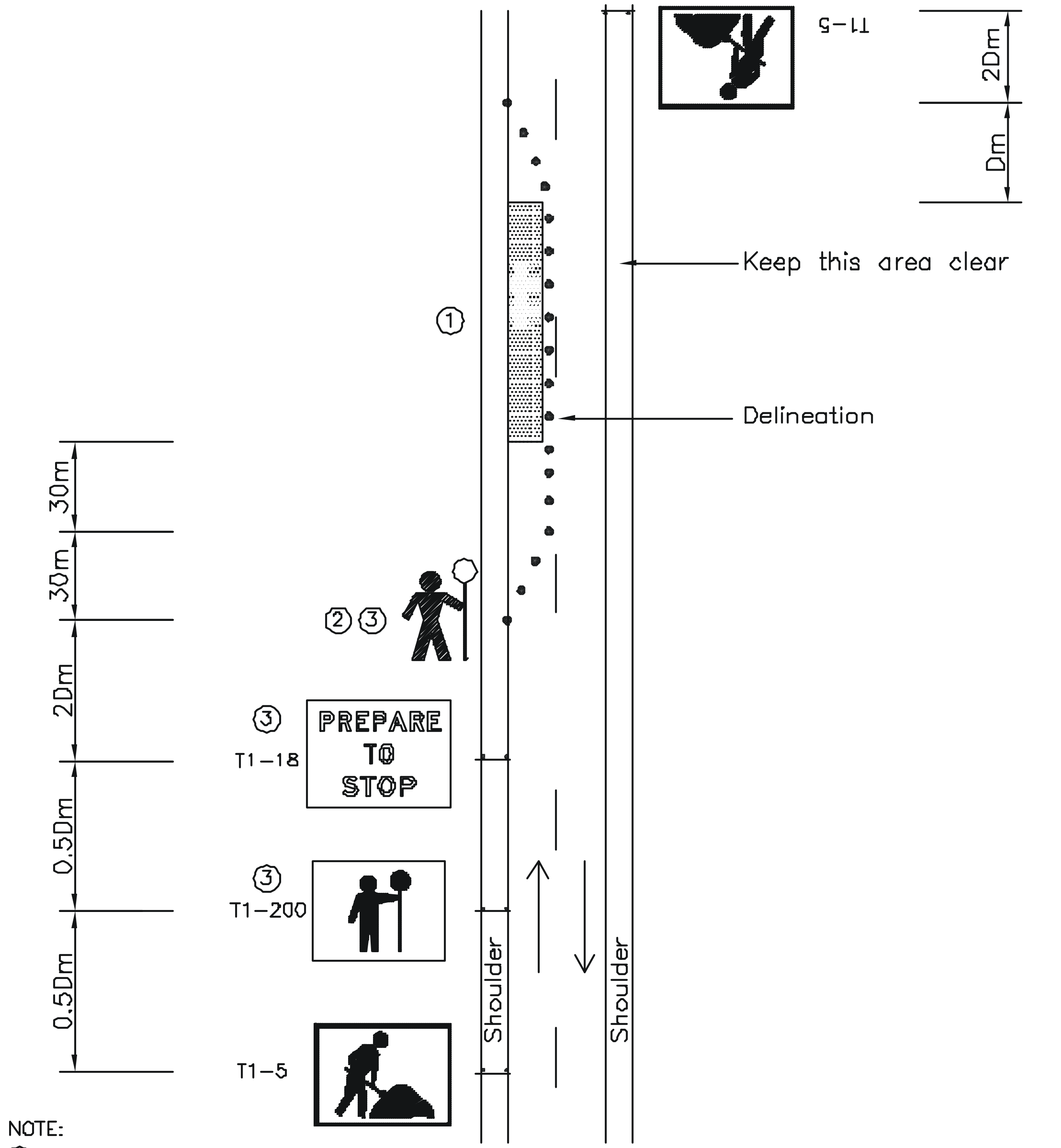
(6) Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment

(7) Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / DIVIDED
MIDDLE LANE CLOSED

T000107

TCP 107



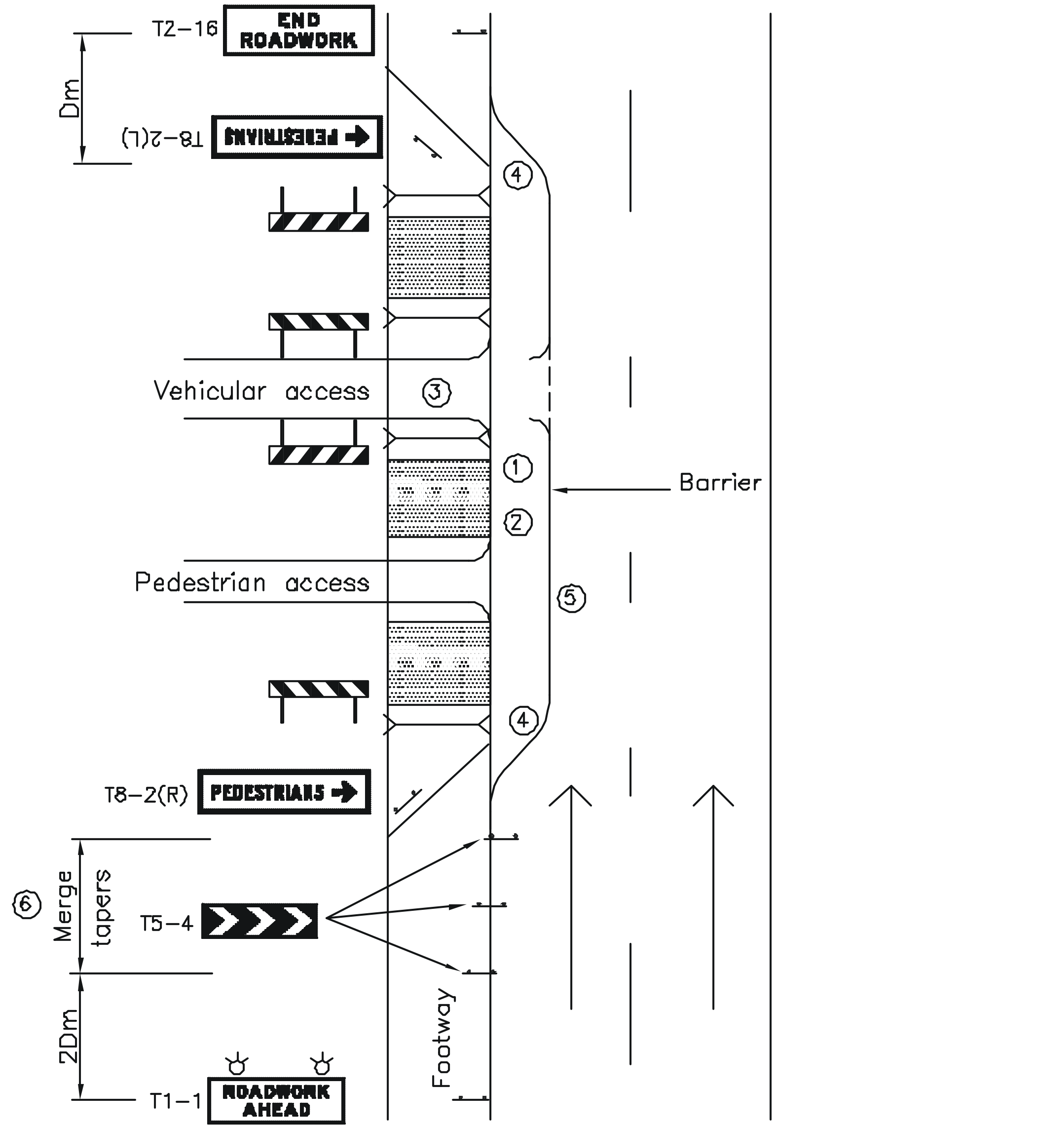
NOTE:

1. Suitable only where the work area is shorter than 250m, ADT is less than 1,500 vehicles per per day, and sight distance from the Traffic Controller to approaching traffic on the unobstructed approach exceeds the minimum shown in *Traffic Control at Work Sites*, Table 8 -1. If necessary, consider TCP 437.
2. Traffic Controller to hold northbound traffic until there are sufficient gaps in the southbound traffic flow.
3. T1-5, T1-200 and T1-18 signs must be covered and traffic allowed through the work area while Traffic Controller is absent.

SHORT TERM WORK
2 LANE / 2 WAY
ADT LESS THAN 1,500

T000108

TCP 108



NOTE:

① Prohibit vehicles stopping along the length of narrowed carriageway.

② Provide a minimum clear width of 1.2m (desirable 2.0m) for pedestrian traffic and a minimum traffic lane width of 3.0m (desirable 3.5m).

③ Arrange vehicular access across the work area using portable barriers or plastic mesh fencing.

④ Provide a full width temporary ramp for prams and an all–weather surface on all pedestrian areas.

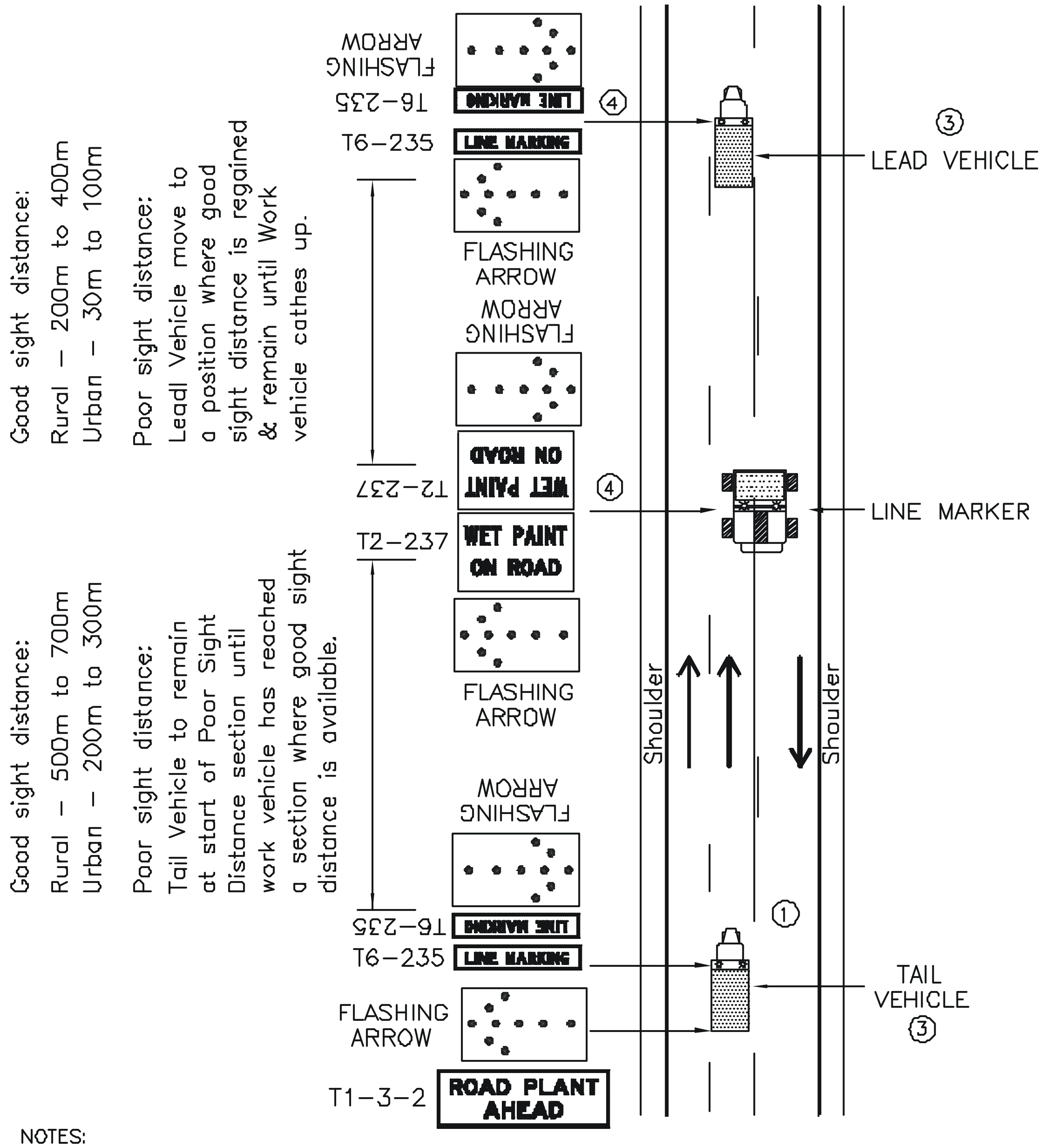
⑤ Ensure that the requirements of *Traffic Control at Work Sites*, Section 3.6, *Safe clearances between workers and through traffic*, are met for pedestrians.

⑥ The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, *Recommended taper lengths*.

LONG TERM WORK
ALL ROADS
WORK OCCUPY THE FULL WIDTH OF A FOOTWAY

T000109

TCP 109



NOTES:

① Traffic cones to be laid along the line of the wet line where traffic conditions dictate.

② Line marking should be carried out in the direction with 2 lanes. Use only right or centre mounted guns.

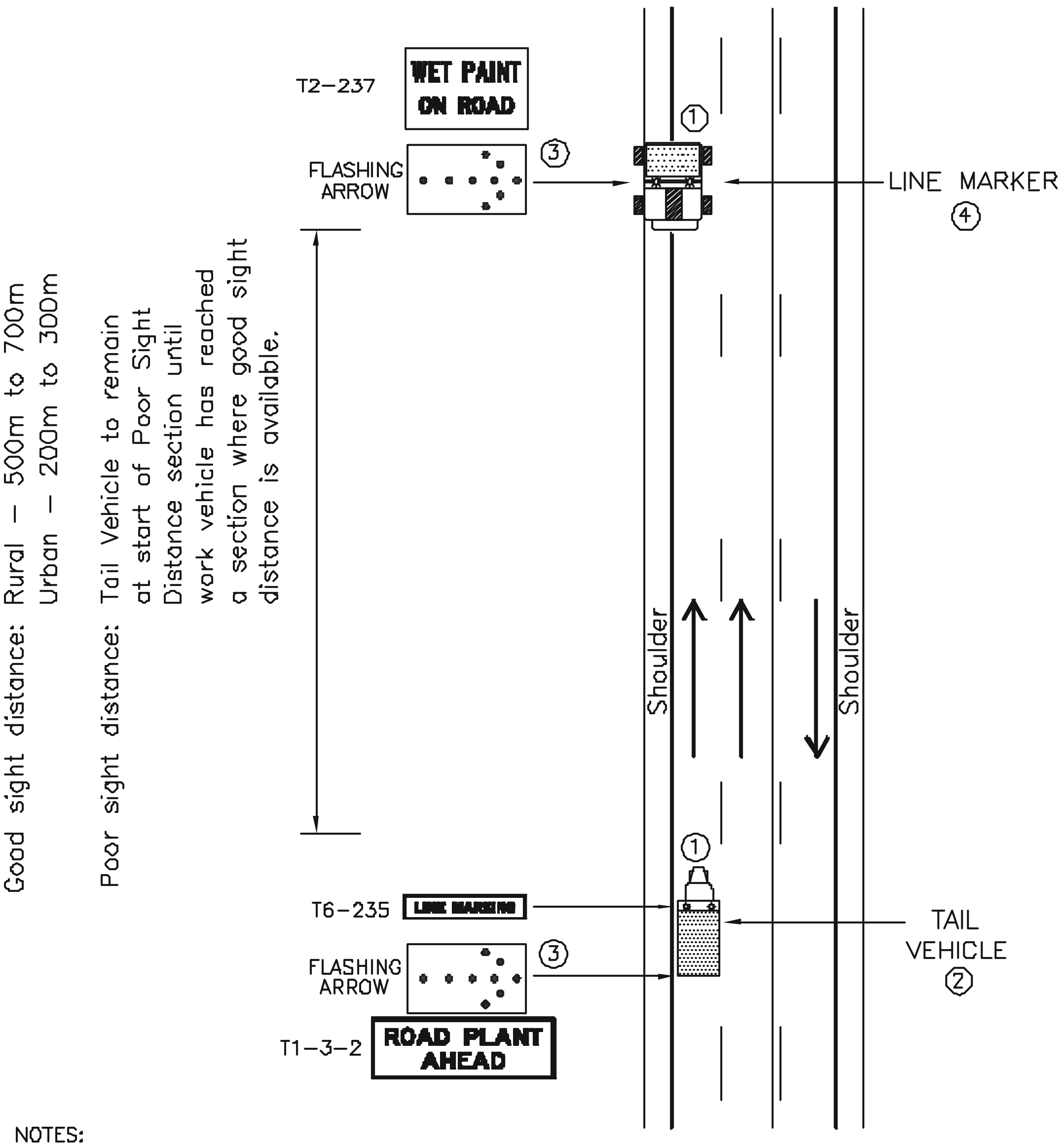
③ On crests and curves, ensure that sight distances to Lead Vehicle and Advance Warning Vehicle are not less than Dm.

④ Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.

MOBILE WORK
3 LANE / 2 WAY
LINE MARKING – CENTRE LINE

T000110

TCP 110



NOTES:

1. Line marking should be carried out in direction of traffic flow.
2. On crests and curves, ensure that sight distance to Vehicle is not less than Dm.
3. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
4. Diagram shows use of centre–mounted guns. Where keft hand guns are used line marker travels within the lane of same travel direction.

MOBILE WORK
3 LANE / 2 WAY
LINE MARKING – LEFT EDGE LINE

T000111

TCP 111

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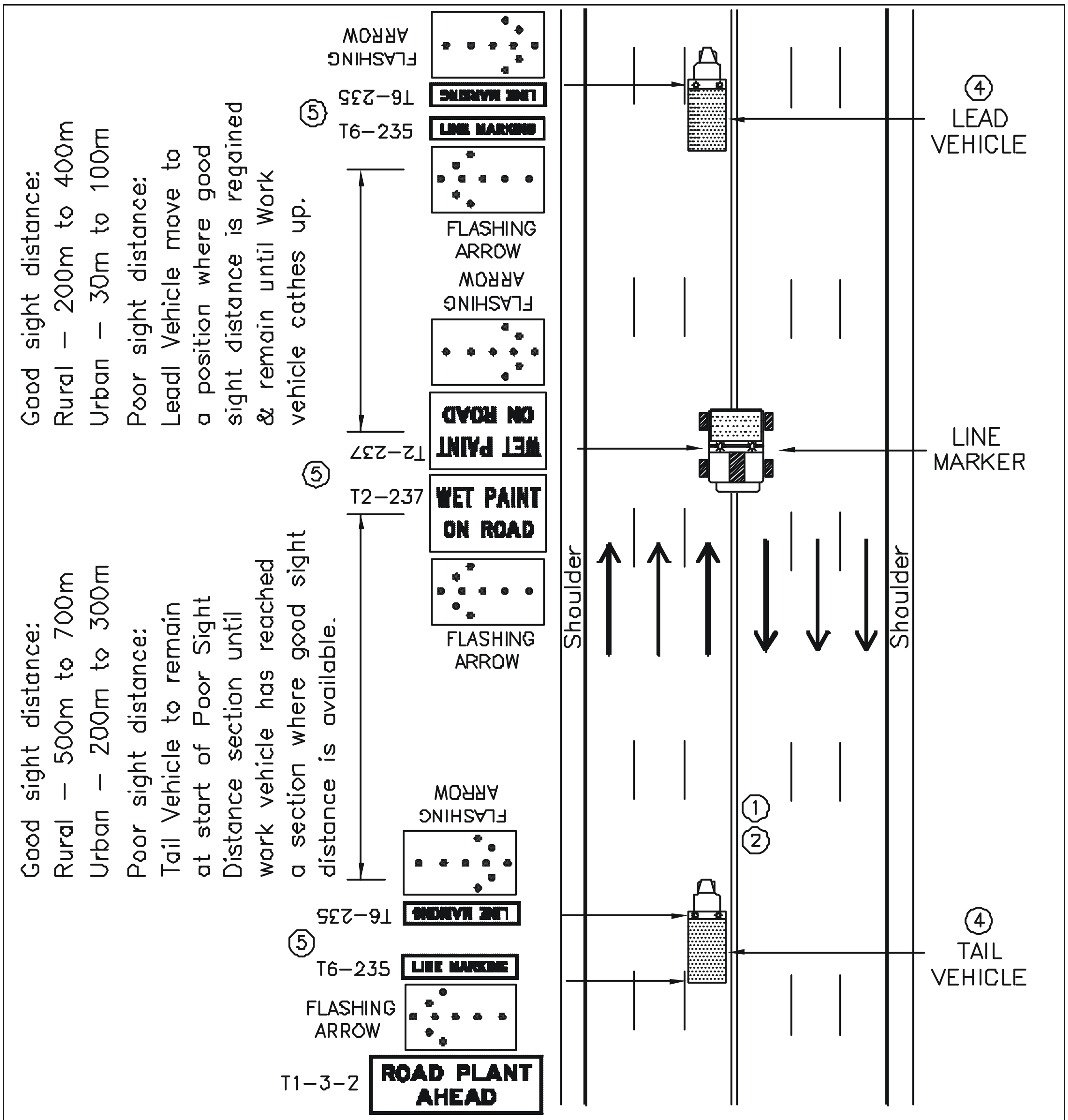


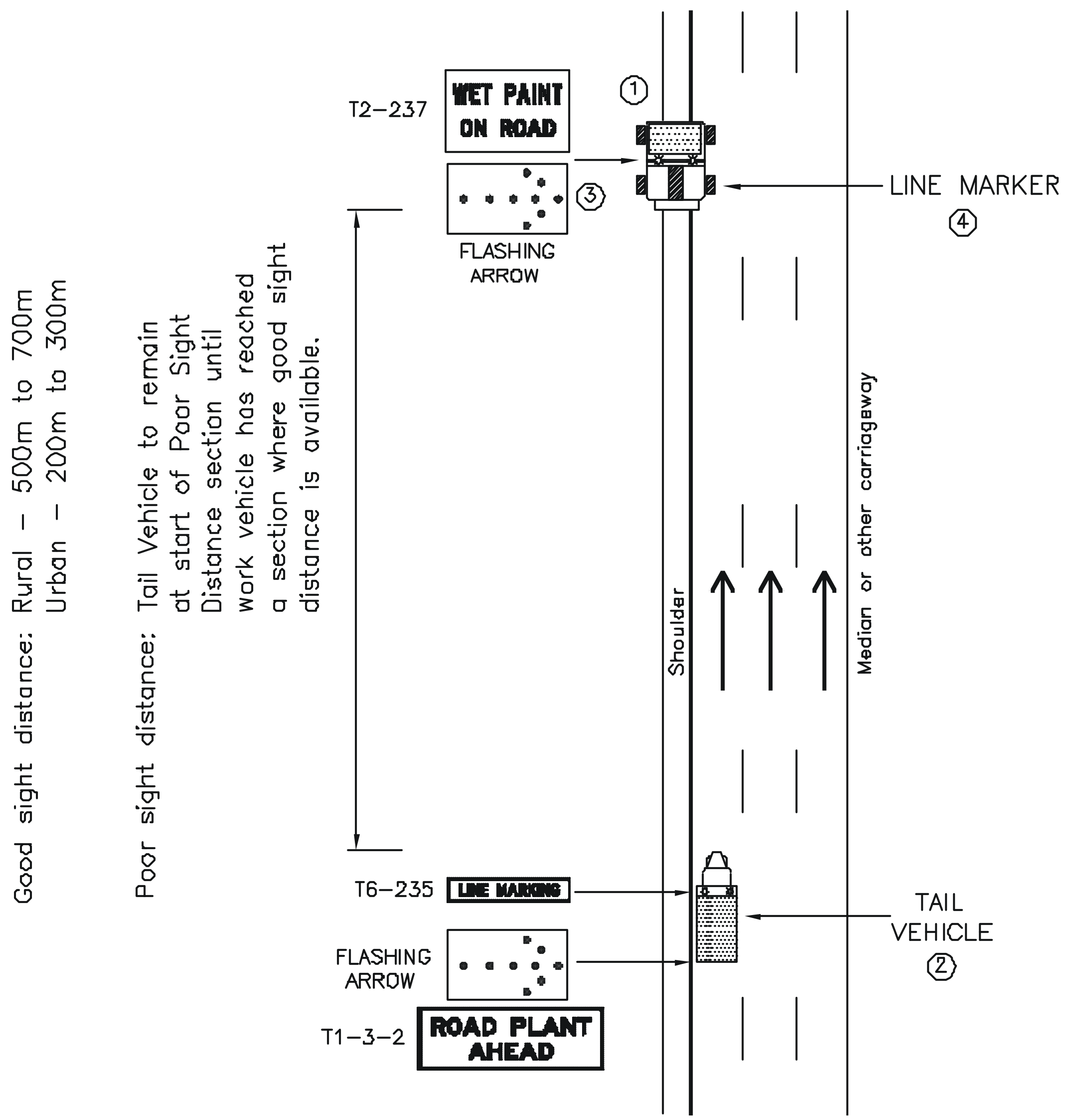
NOTES:

1. Traffic cones to be laid along the line of the wet line where traffic conditions dictate.
2. Where traffic cones are used, an additional tail Vehicle shall be used to provide warning of the cone recovery operation.
3. Use only right or centre mounted guns.
4. On crests and curves, ensure that sight distances to Lead Vehicle and Vehicle are not less than Dm.
5. Reference should be made to ***Traffic Control at Work Sites,*** Section 3.2.2, ***Sign Sizes*** and Section 11.4.1. ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.

MOBILE WORK
6 LANE / 2 WAY
LINE MARKING – CENTRE LINE

T000113

TCP 113



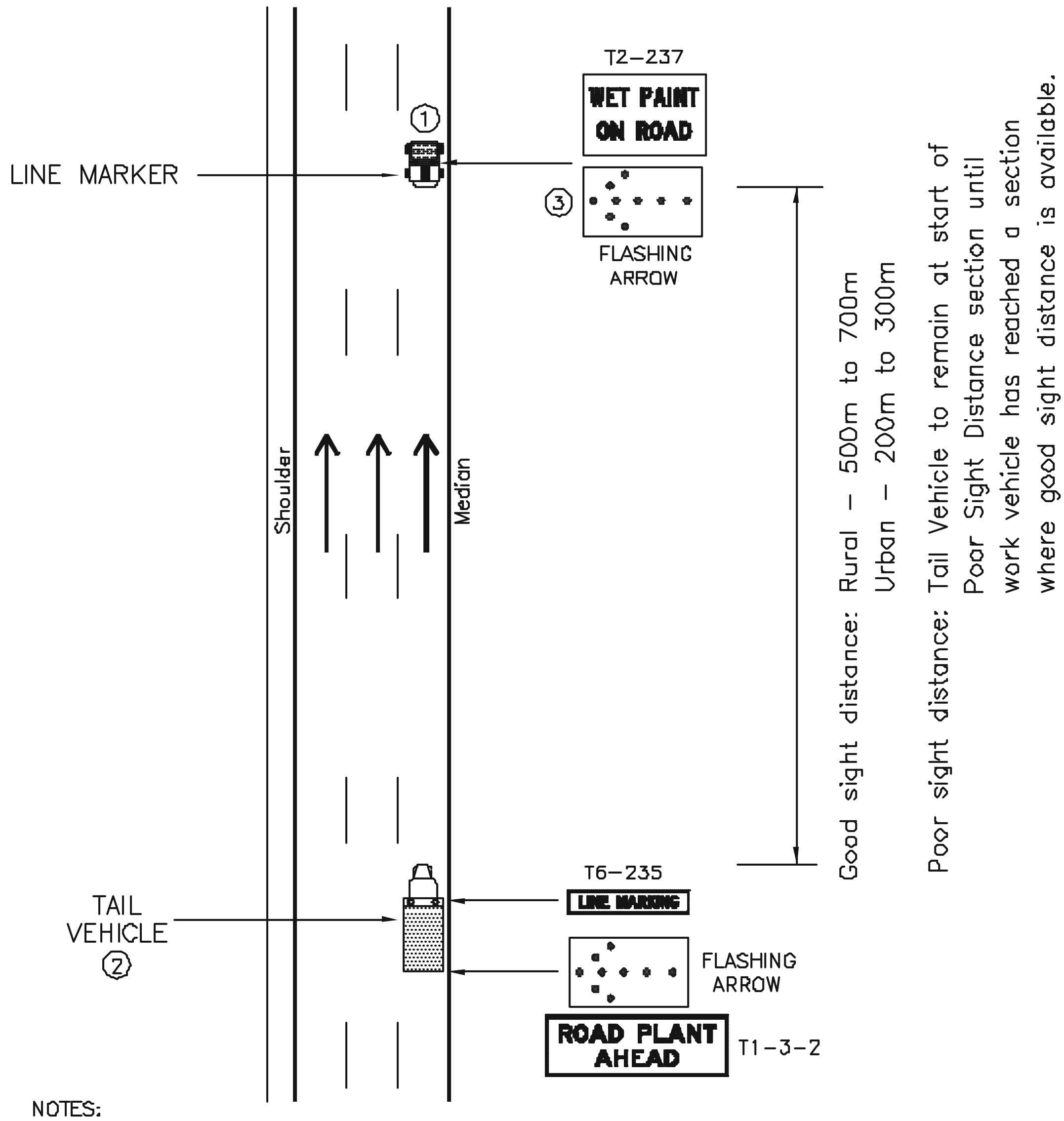
NOTES:

1. Line marking should be carried out in direction of traffic flow.
2. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.
3. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
4. Diagram shows use of centre–mounted guns. Where left hand guns are used line marker travels within the lane of same travel direction.

MOBILE WORK
2 LANE / DIVIDED and 4 LANE / 2 WAY
LINE MARKING – LEFT EDGE LINE

T000114

TCP 114



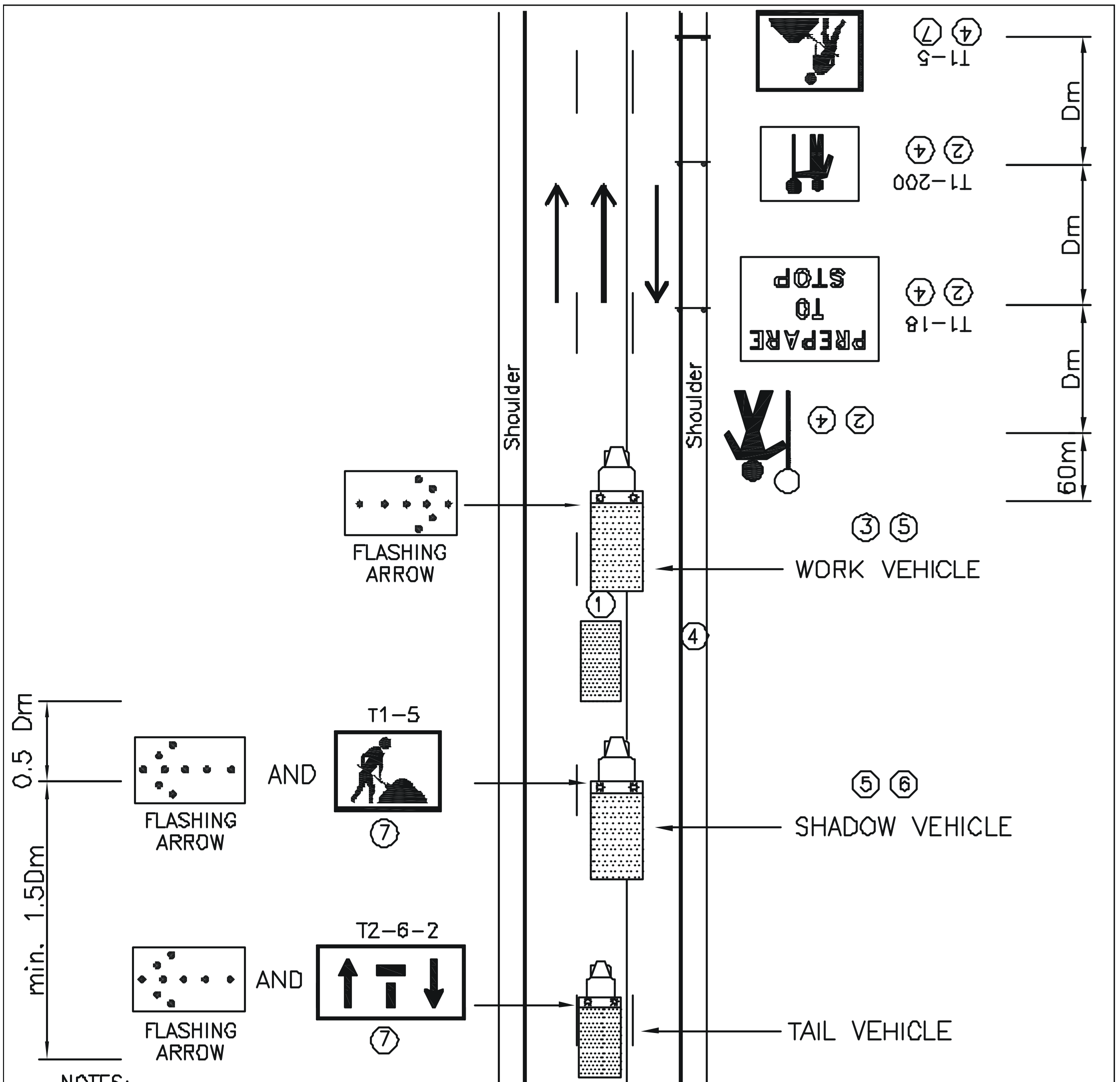
NOTES:

1. Line marking should be carried in direction of traffic flow.
2. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm. less than Dm.
3. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
4. For raised median work, use right mounted guns and remain fully in lane adjacent to median.

MOBILE WORK
2 LANE / DIVIDED
LINE MARKING – RIGHT EDGE LINE

T000115

TCP 115



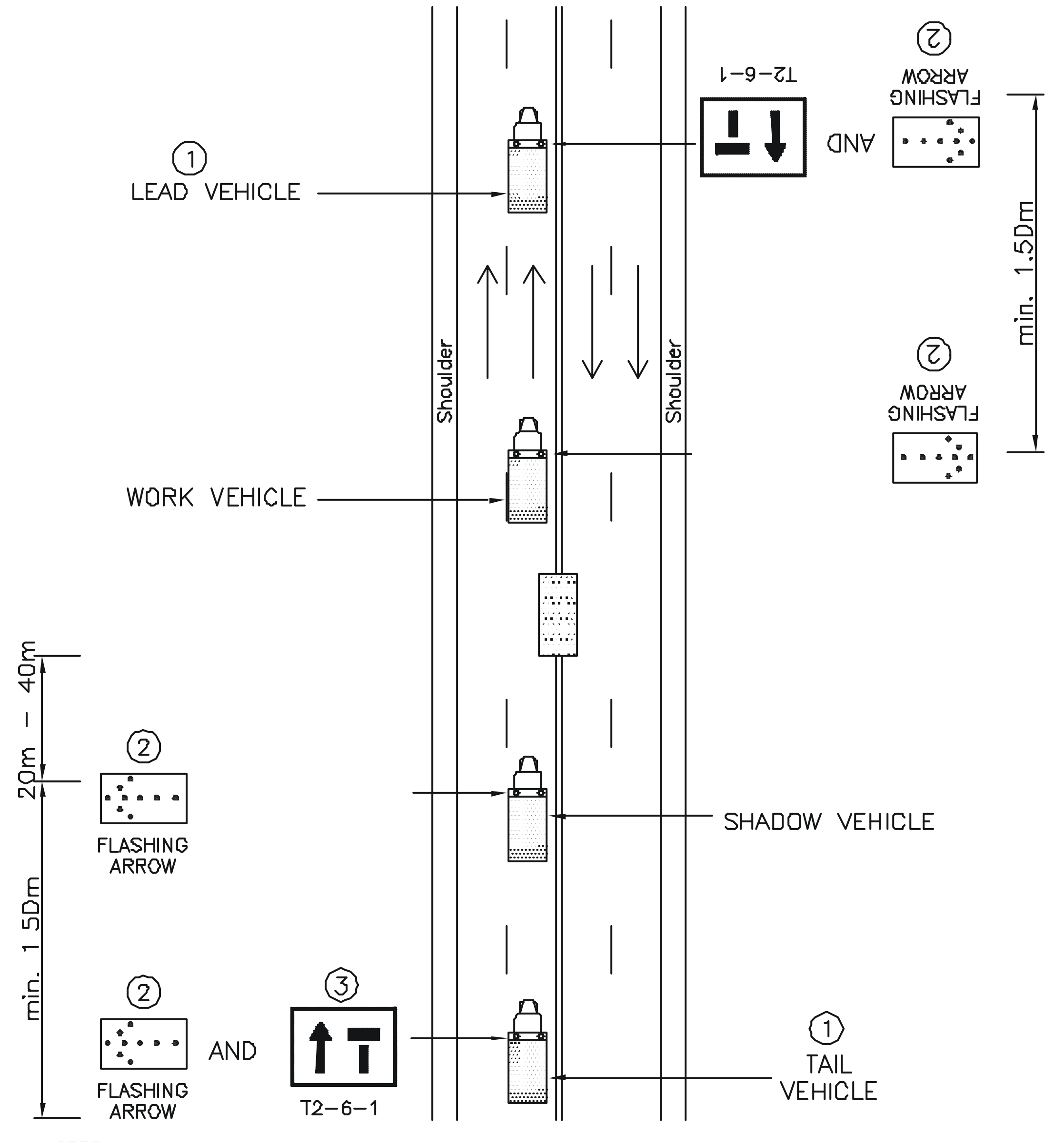
NOTES:

1. For work in overtaking lane and on centre line where right shoulder is narrow or unsealed.
2. Although southbound traffic is not blocked, signs and Traffic Controller should be used to stop traffic and then direct the traffic platoon past the work area.
3. All work should be carried out from the Work Vehicle.
4. Where seal in right shoulder is at least 1m wide, roadside signs and Traffic Controller for opposing traffic flow may be replaced by a Lead Vehicle displaying T1–200 and T1–18 signs.
5. For work on centre line, the Work Vehicle and Shadow Vehicle should overlap the centre line by up to 1/3 the width of the vehicle.
6. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
7. Ensure that static signs, used with flashing arrow sign, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / 2 WAY
PAVEMENT MARKERS

T000116

TCP 116



NOTES:

1. On crests and curves, ensure that sight distance to Lead Vehicle and Work Vehicle is not less than Dm.
2. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use size A, B or C equipment.
3. Ensure that static signs, used with flashing arrow signs, are mounted on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
4 LANE / 2 WAY
PAVEMENT MARKERS ON CENTRE LINE

T000117

TCP 117

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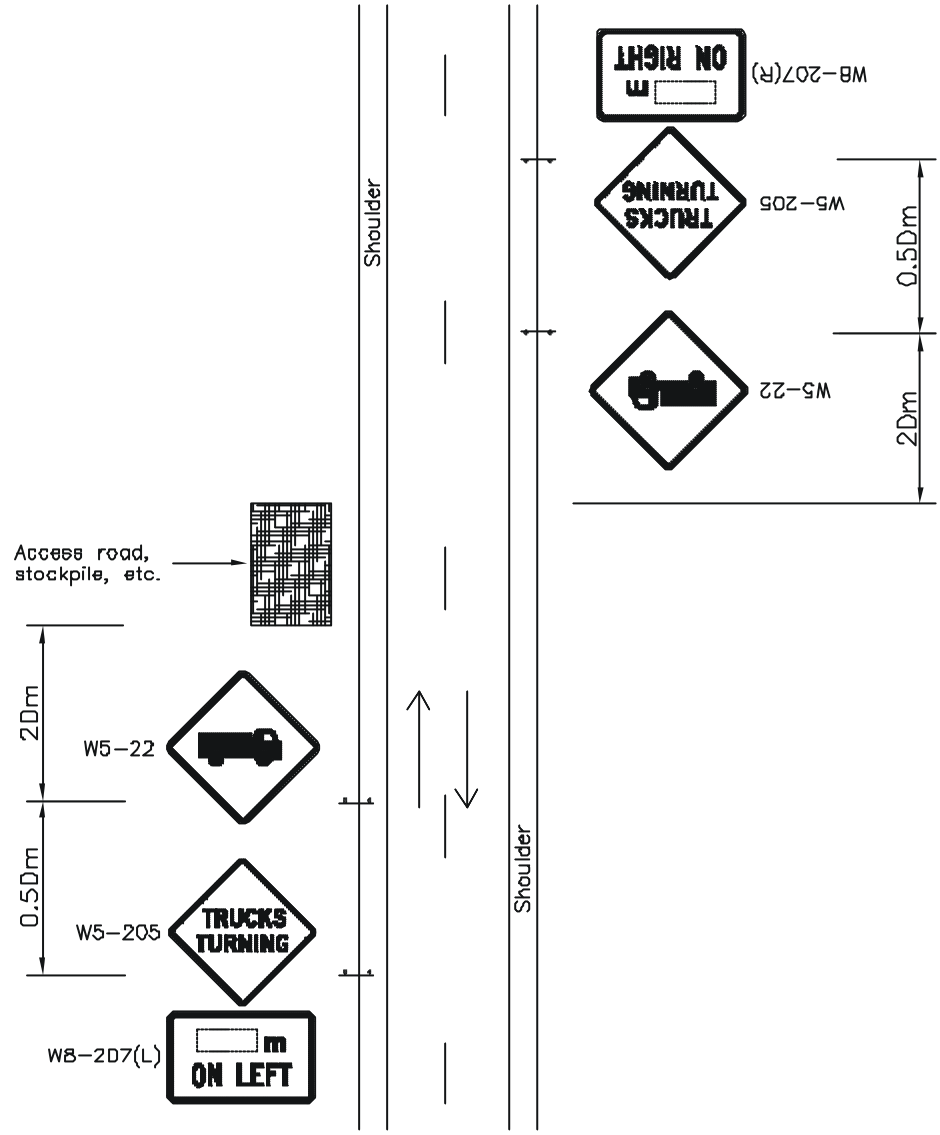

NOTE:

1. For use where roadside is generally undeveloped, ADT is more than 1,500 vehicles per day, sight distance is restricted and there are more than 20 truck movements per shift.
2. See *Traffic Control at Work Sites*, Section 7, *Providing for works traffic*.
3. See *Traffic Engineering Manual*, Section 19, *Miscellaneous devices*.

ACCESS TO DEPOT, STOCKPILE, QUARRY, GRAVEL PIT ETC.
ALL ROADS

T000195

TCP 195

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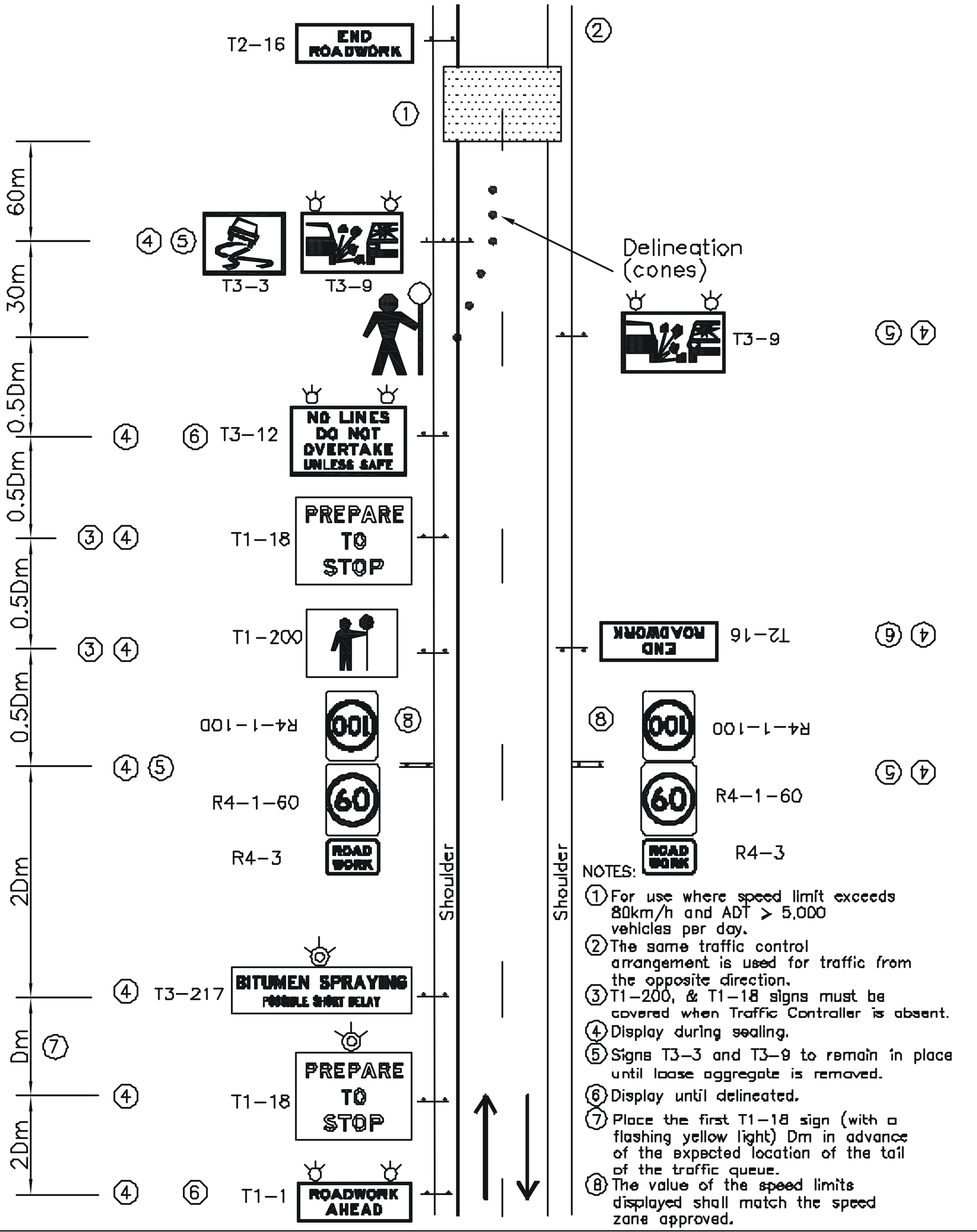

NOTES:

① For use where speed limit exceeds 80km/h and ADT > 5,000 vehicles per day.

② The same traffic control arrangement is used for traffic from the opposite direction.

③ T1–200, & T1–18 signs must be covered when Traffic Controller is absent.

④ Display during sealing.

⑤ Signs T3–3 and T3–9 to remain in place until loose aggregate is removed.

⑥ Display until delineated.

⑦ Place the first T1–18 sign (with a flashing yellow light) Dm in advance of the expected location of the tail of the traffic queue.

⑧ The value of the speed limits displayed shall match the speed zone approved.

LONG TERM WORK
2 LANE / 2 WAY
SPRAY SEALING

T000353

TCP 353

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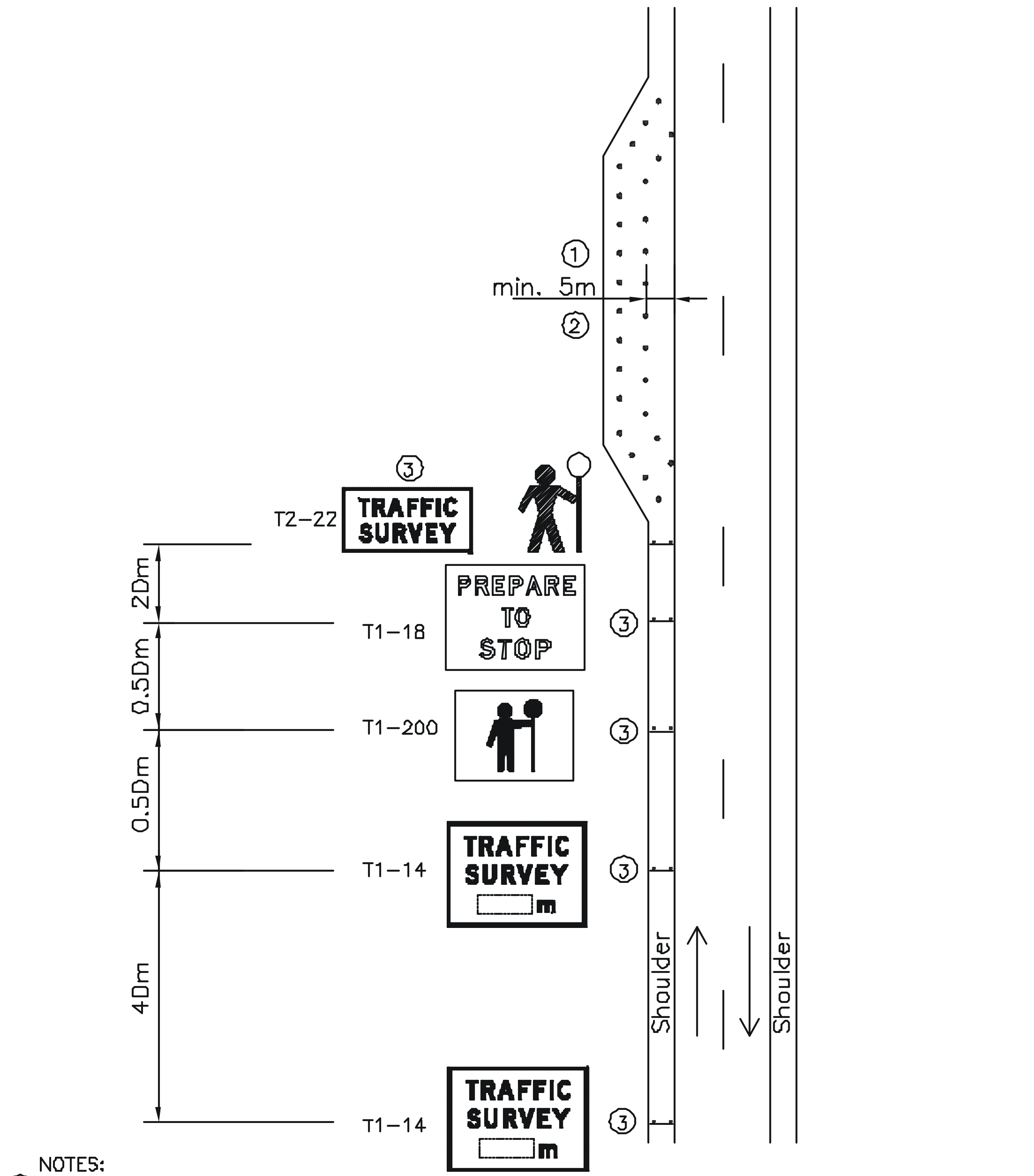

NOTES:

1. Floodlighting of survey area is necessary at night. See ***Traffic Control at Work Sites***, Section 9.2, ***Working at night.***
2. Cones at 5–15m spacing.
3. All signs must be covered while survey is not in progress.

TRAFFIC SURVEY

T000385

TCP 385

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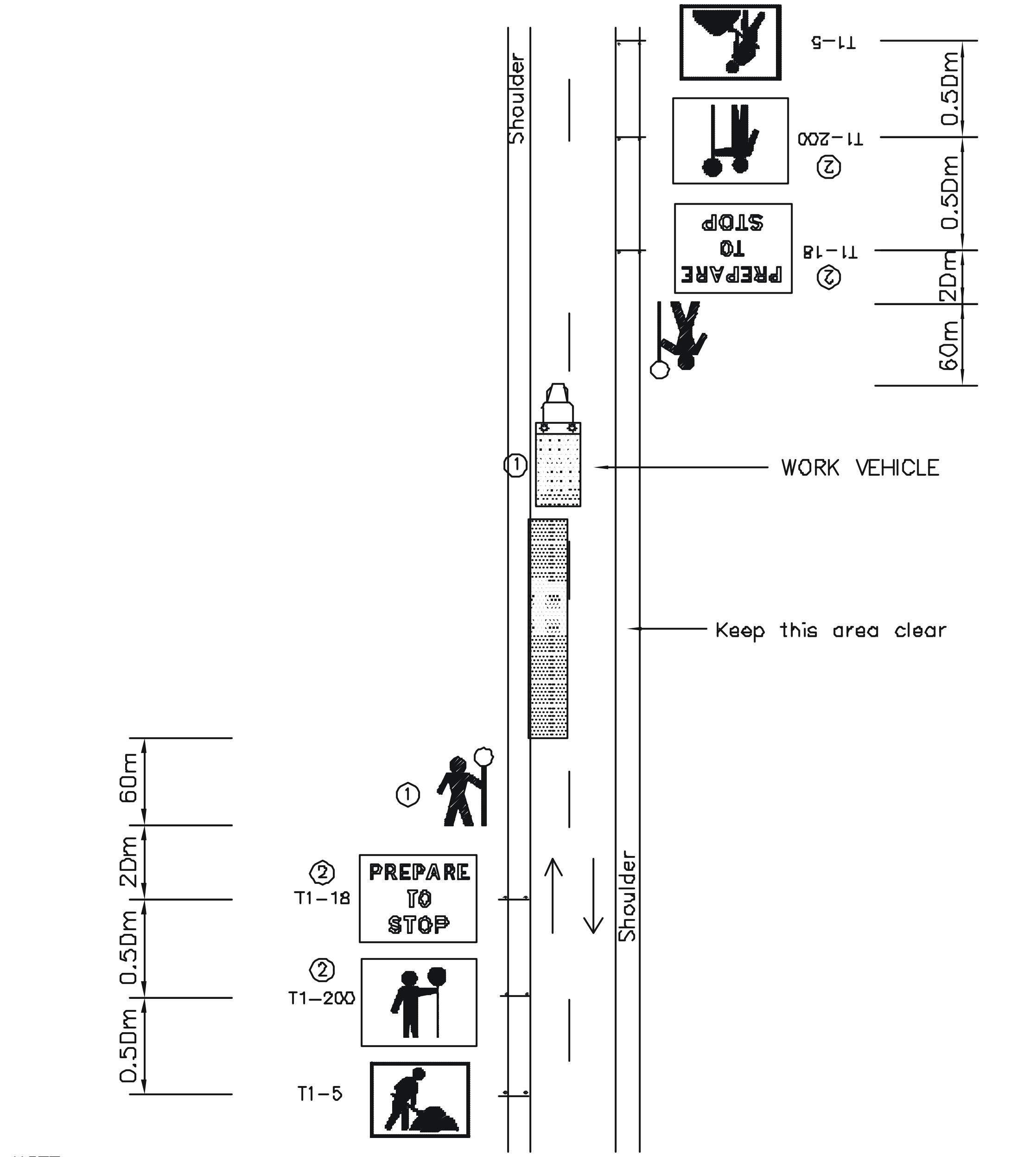


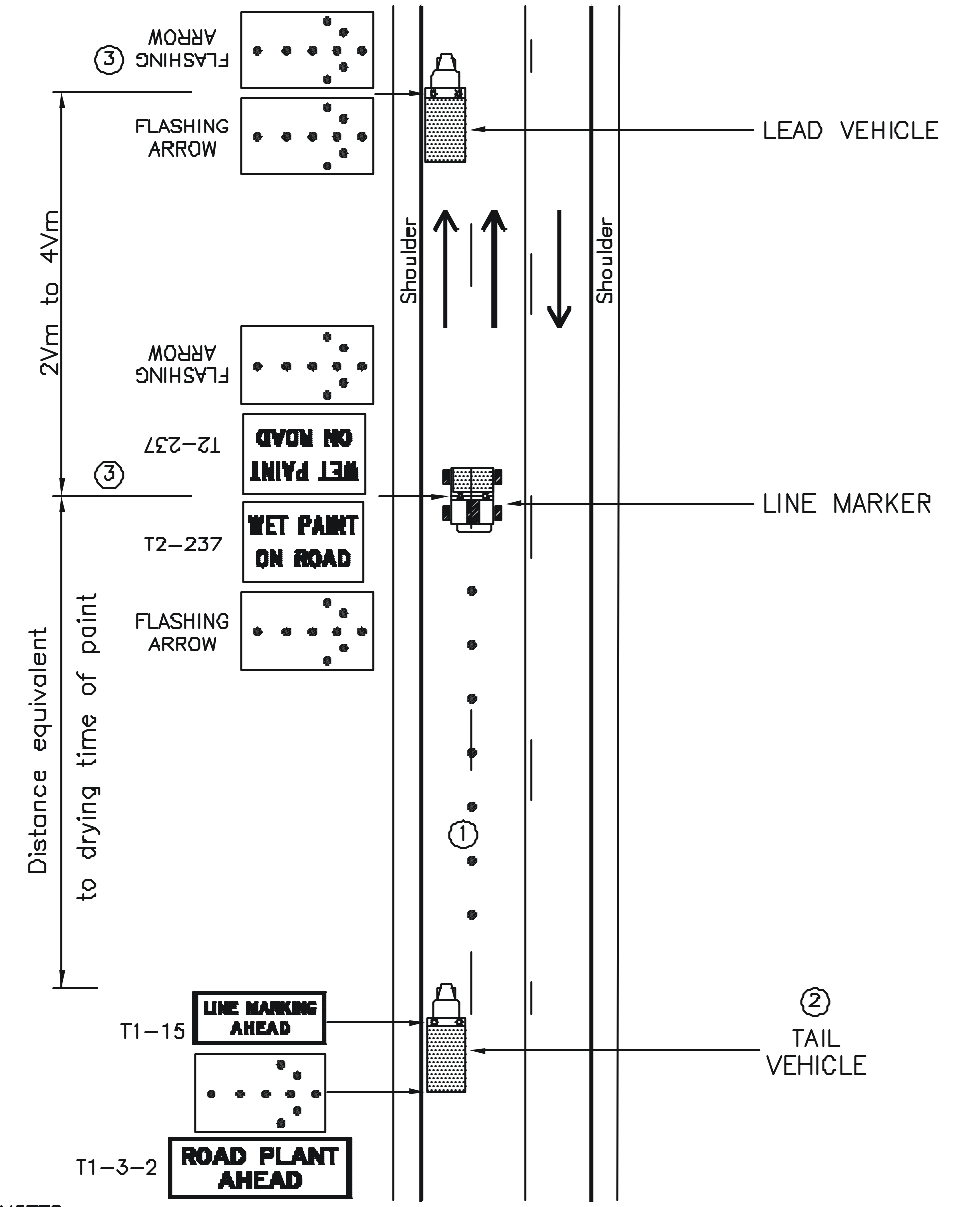
NOTE:

1. Use TCP 108 if the work area is shorter than 250m, ADT is less than 1,500 vehicles per day and sight distance from the northbound Traffic Controller to southbound traffic is more than the minimum shown in *Traffic Control at Work Sites*, Table 9·1.
2. T1-5, T1-200 and T1-18 signs must be covered while Traffic Controller is absent.

SHORT TERM WORK
2 LANE / 2 WAY
ADT ≥ 1500

T000437

TCP 437



NOTES:

① Traffic cones to be laid along the line of the wet line where traffic conditions dictate.

② On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.

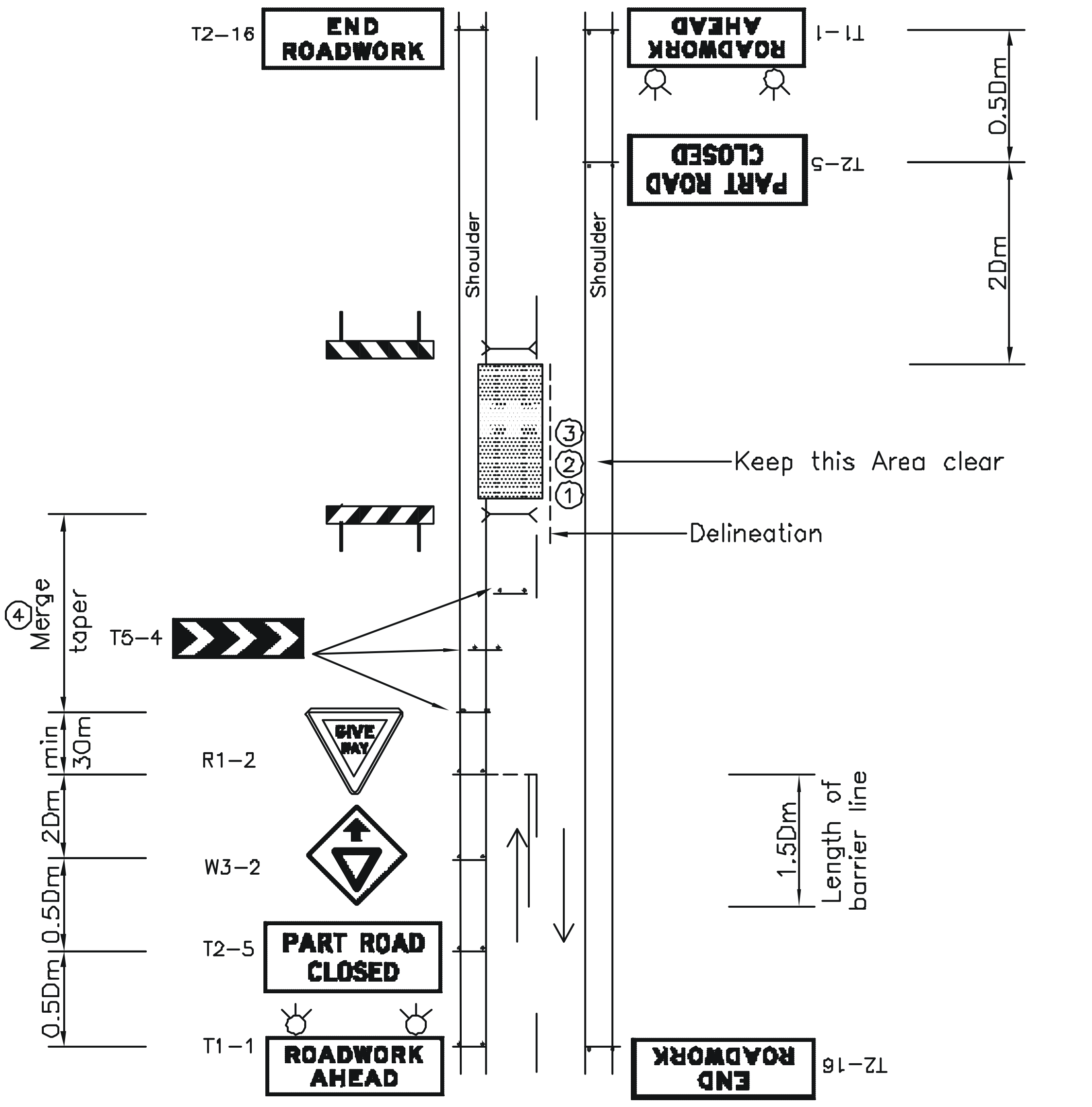
③ Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1. *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment.

④ Diagram shows use of centre-mounted guns. Where left hand guns are used line marker travels within the lane of same travel direction.

MOBILE WORK
3 LANE / 2 WAY
LINE MARKING — LANE LINE

T000438

TCP 438



NOTES:

(1) Remaining clear carriageway width should be 3.5m min. but may be reduced to an absolute minimum of 2.5m where ADT is less than 100 vehicles per day.

(2) Check need for safety barrier. See *Traffic Control at Work Sites*, Section 9.6, *Safety barriers*

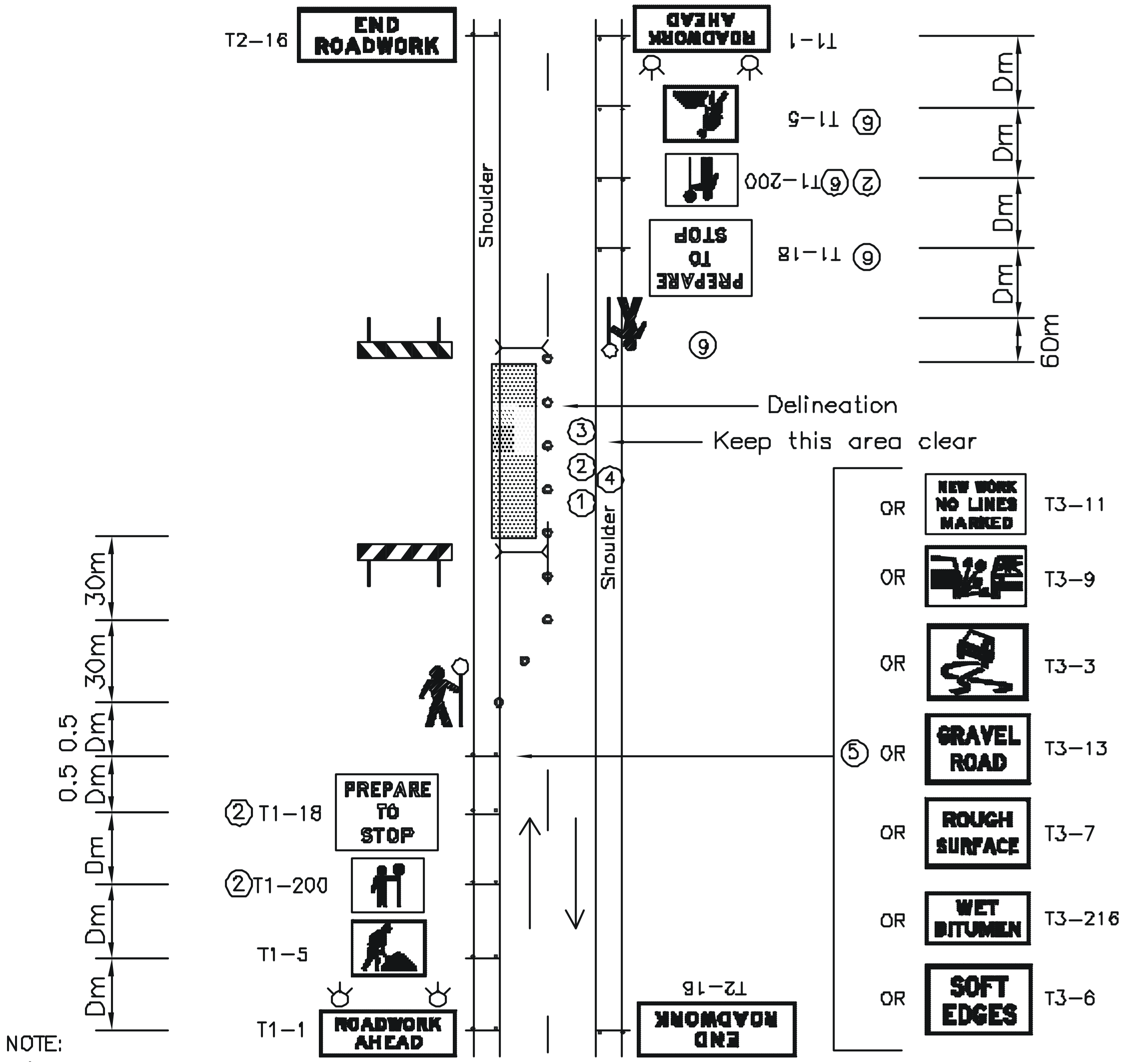
(3) For use only where the road is sealed and ADT is less than 1,500 vehicles per day and the forward sight distance is at least 5Dm from the GIVE WAY (R1-2) sign and the shoulders are too narrow too use TCP 45 and the work area is less than 100m long.

(4) The length of merge tapers is to be determined from *Traffic Control at Work Sites*, Table 5.2, Recommended taper lengths.

LONG TERM WORK
2 LANE / 2 WAY
LANE CLOSURE

T000439

TCP 439



NOTE:

(1) Remaining clear carriageway width should be 3.5m min but may be reduced to an absolute minimum of 2.5m where ADT is less than 100 vehicles per day.

(2) T1–5, T1–200 and T1–18 signs must be covered, cones must be removed and traffic allowed through the work area when Traffic Controllers are absent.

(3) Check need for safety barrier. See ***Traffic Works at Work Sites***, Section 9·6, ***Safety barriers at work sites***

(4) For use only where shoulders are too narrow to use TCP 45 and traffic flows through the work area between shifts.

(5) If the surface at the work area between shifts is noticeably different from the surface on the approaches to the work area, use up to two signs to warn of road conditions.

(6) Traffic Controller and T1–200 and T1–18 signs not required on unobstructed lane if ADT is less than 1,500 vehicles per day provided that the work area is shorter than 250m and sight distance between the Traffic Controller and traffic from the opposite direction exceeds the minimum shown in ***Traffic Control at Work Sites***, Table 9.1

(7) T1–1 and T2–16 signs required only for long term work.

SHORT OR LONG TERM WORK
2 LANE / 2 WAY
LANE CLOSURE

T000440

TCP 440

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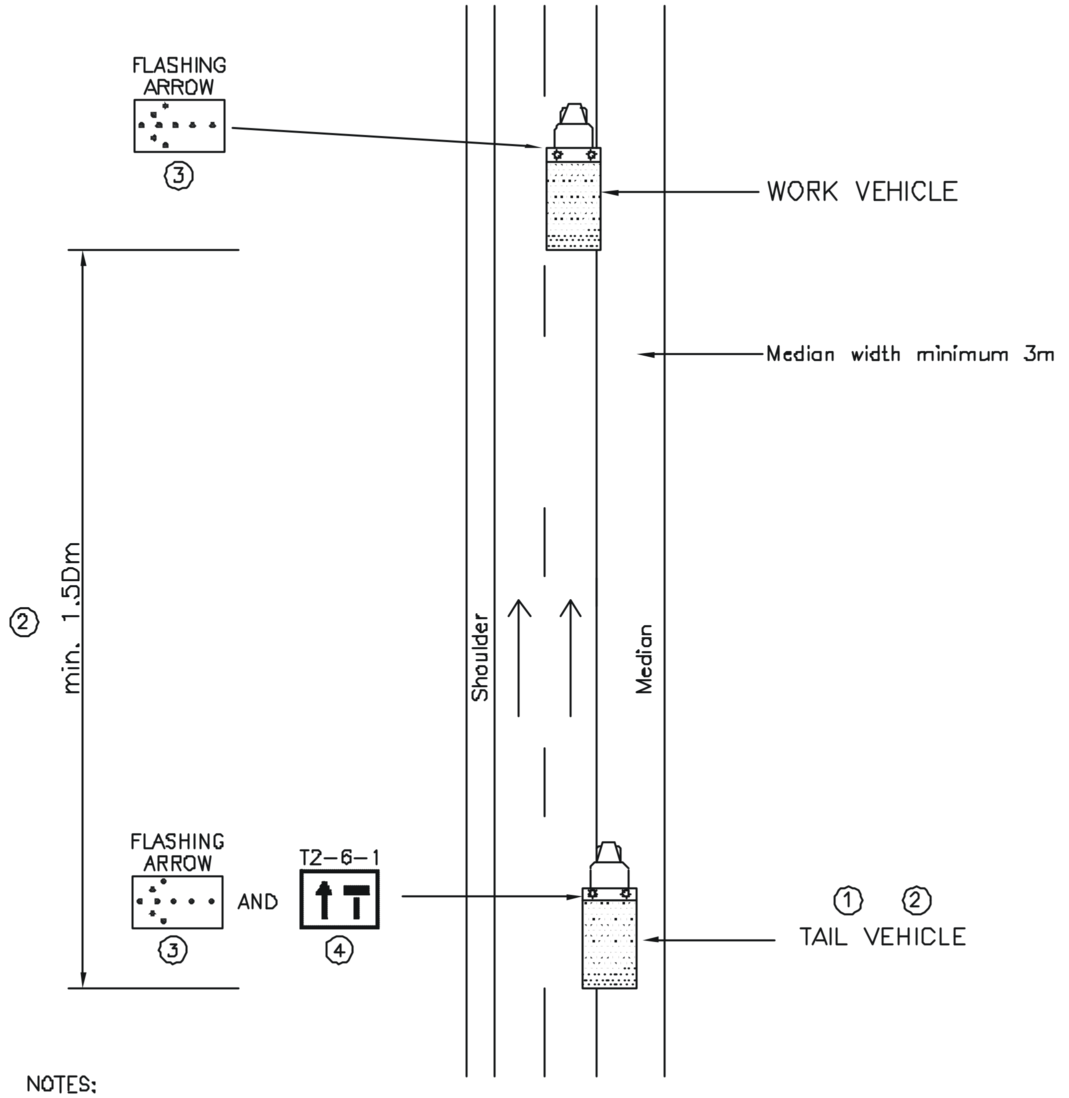


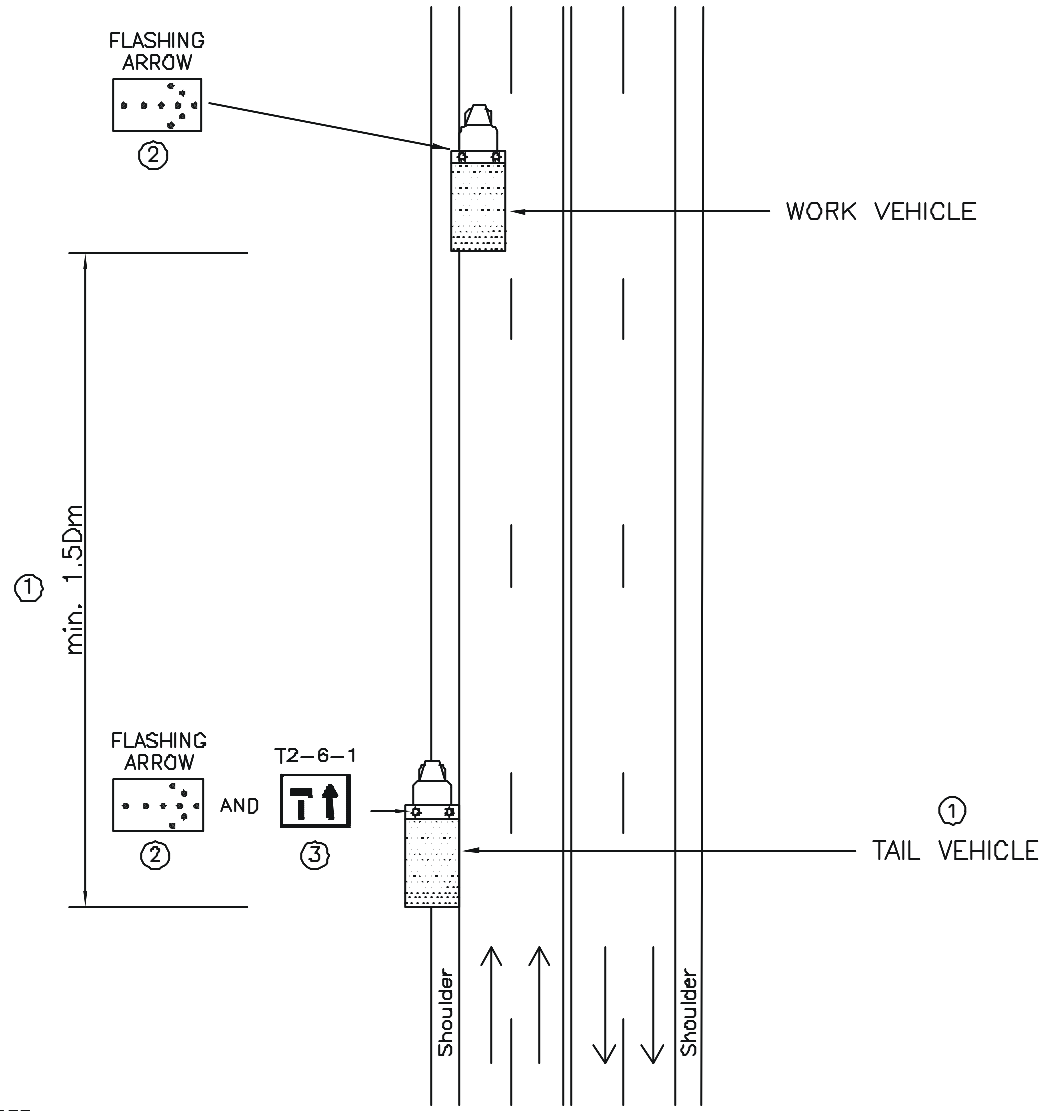
NOTES:

1. The Tail Vehicle should be on the shoulder or median with at least 2/3 of the right lane available for traffic. Where this is not possible (eg. near a safety barrier), use TCP 447
2. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
3. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.
4. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
2 LANE / DIVIDED
DEFLECTOGRAPH OR FWD TESTING IN RIGHT LANE (WIDE MEDIAN)

T000444

TCP 444



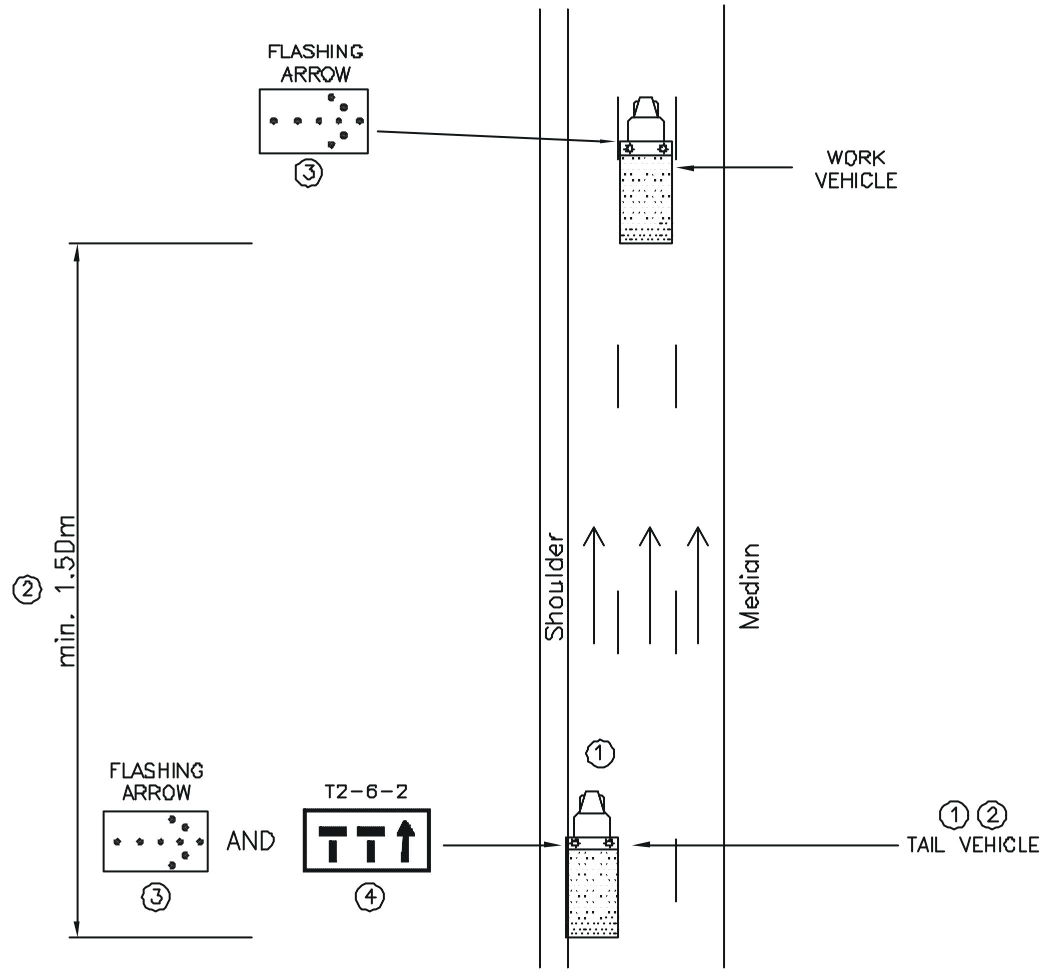
NOTE:

1. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
2. Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment
3. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
4 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING IN LEFT LANE

T000445

TCP 445



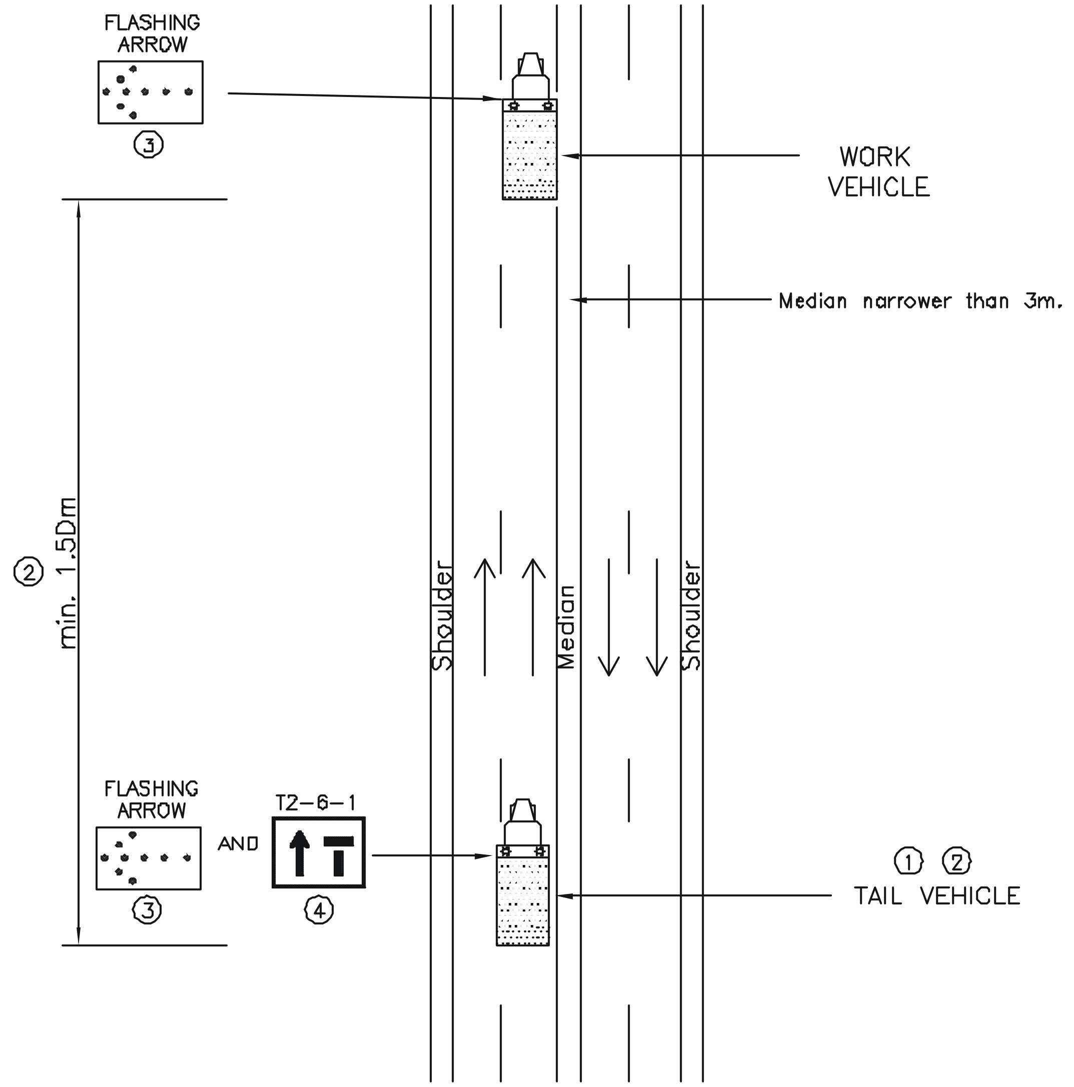
NOTES:

1. The Tail Vehicle blocks the left lane.
2. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.
3. Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment.
4. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / DIVIDED
DEFLECTOGRAPH OR FWD TESTING IN MIDDLE LANE

T000446

TCP 446



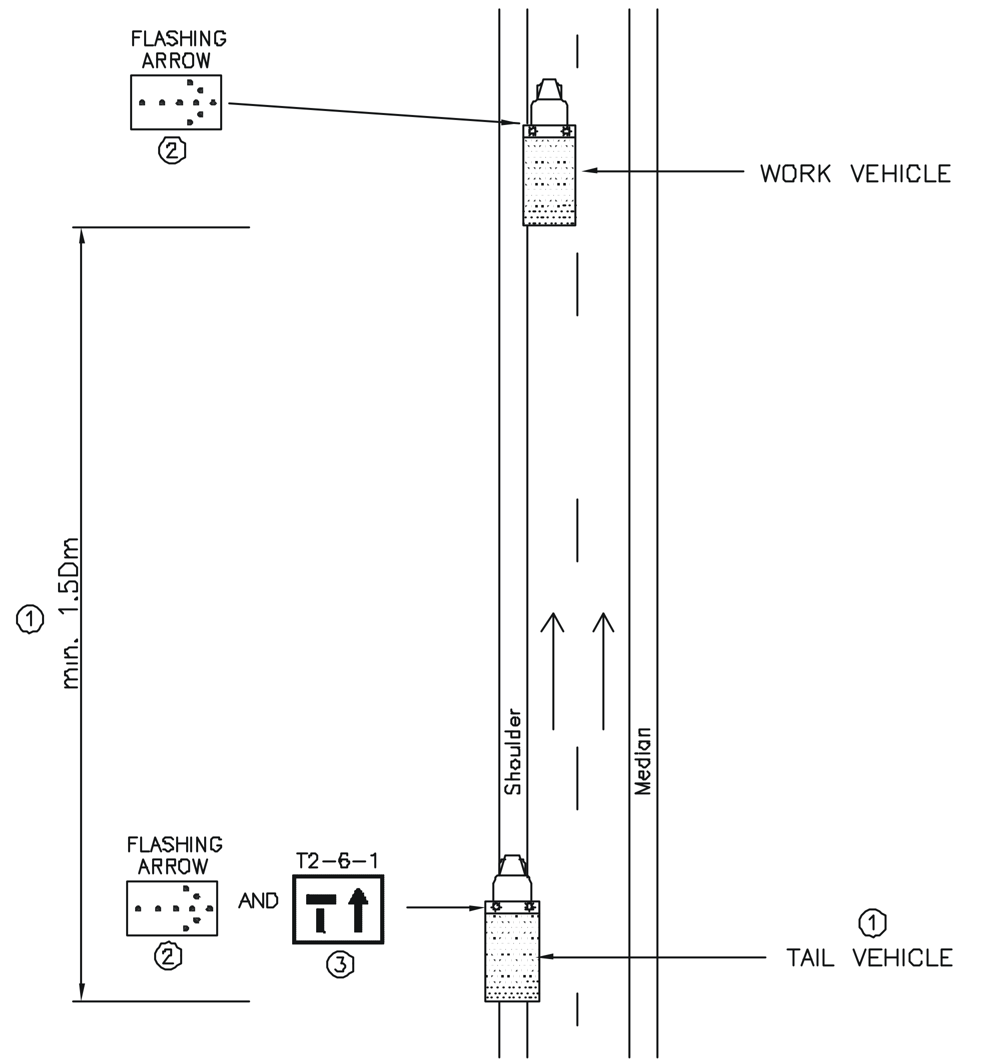
NOTES:

1. The Tail Vehicle shall travel close to the right edge line.
2. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
3. Reference should be made to *Traffic Control at Work Sites*, Section 3.2.2, *Sign Sizes* and Section 11.4.1, *Flashing arrow sign equipment* in determining whether to use Type A, B or C equipment.
4. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
4 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING IN RIGHT LANE (NARROW MEDIAN)

T000447

TCP 447



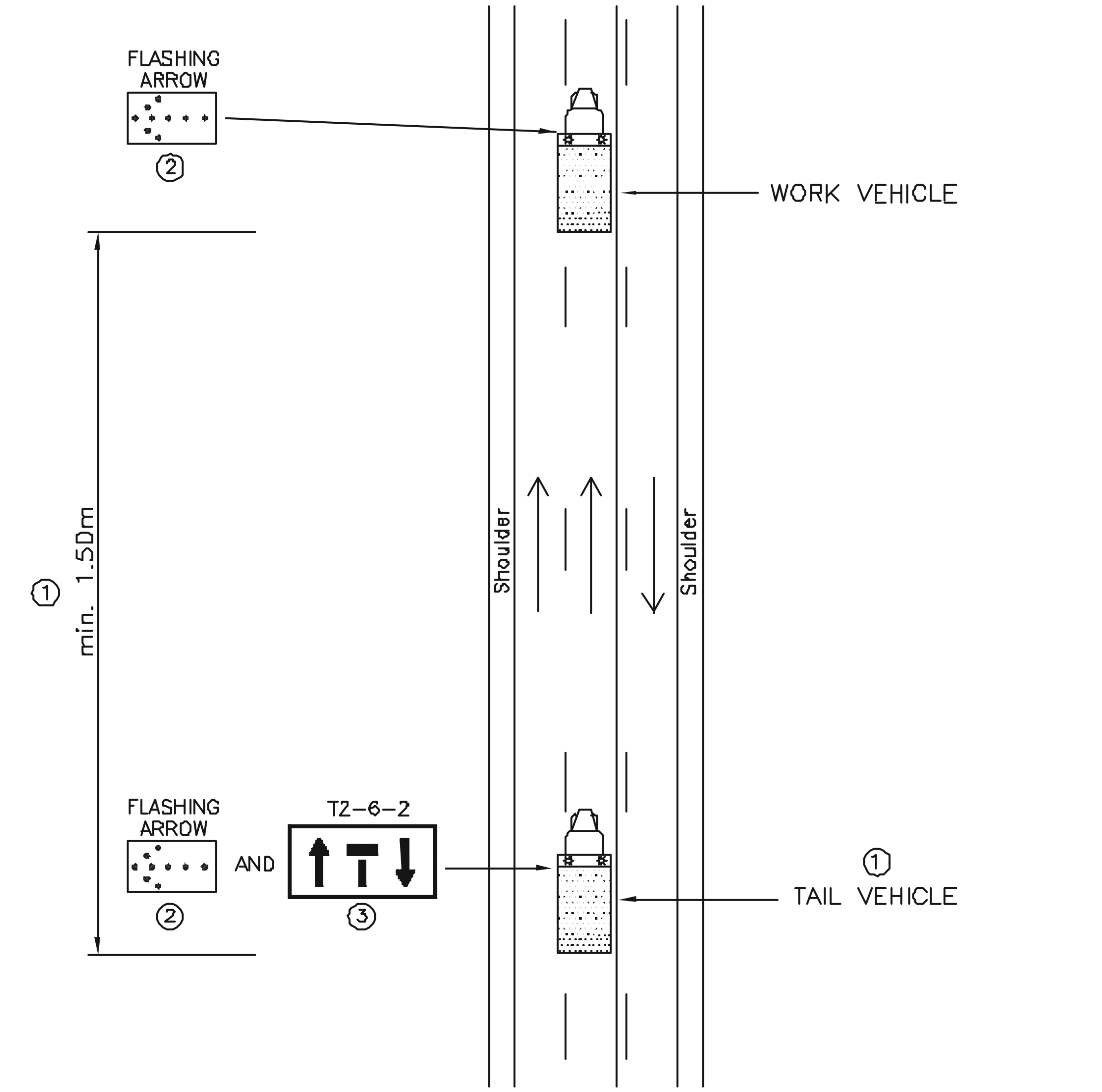
NOTE.

1. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
2. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.
3. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
2 LANE / DIVIDED
DEFLECTOGRAPH OR FWD TESTING IN LEFT LANE

T000448

TCP 448



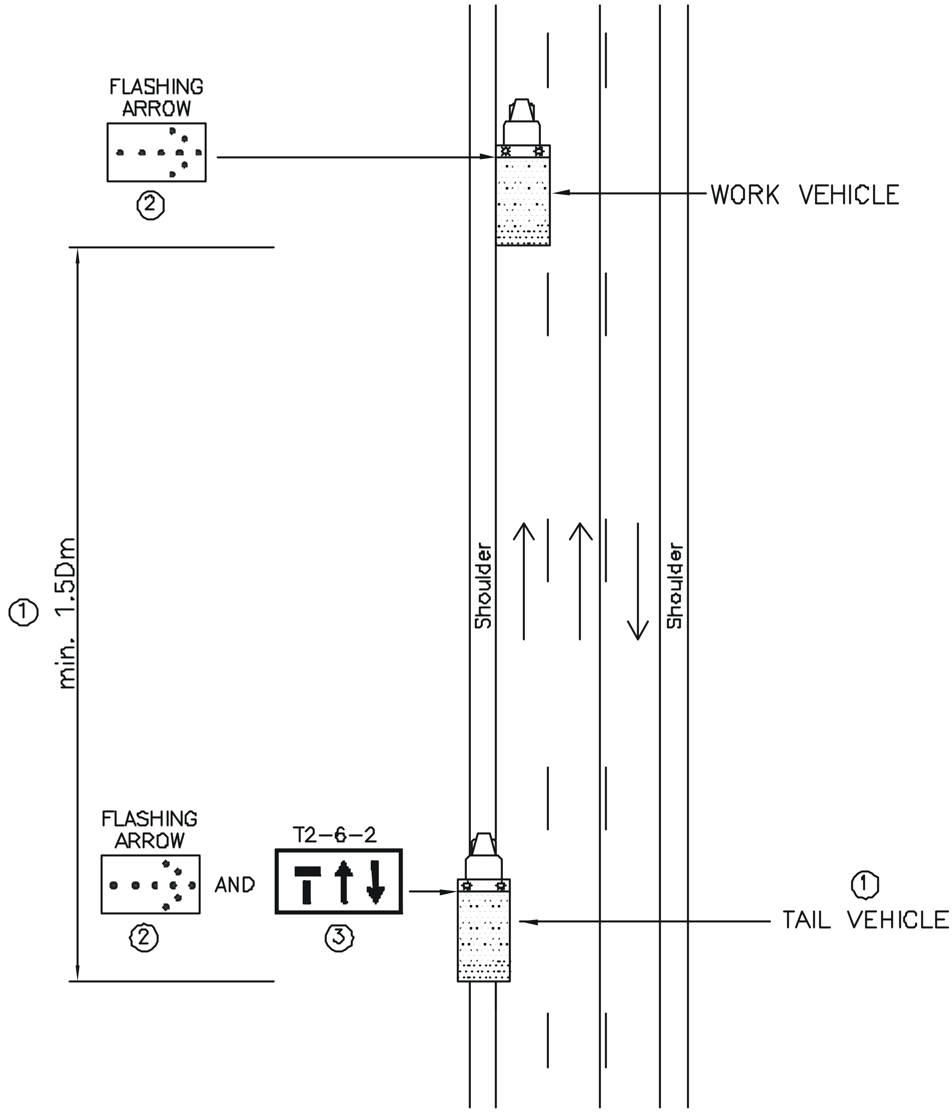
NOTES:

1. On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.
2. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.
3. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING IN OVERTAKING LANE

T000449

TCP 449



NOTES:

① On crests and curves, ensure that sight distance to Tail Vehicle is not less than Dm.

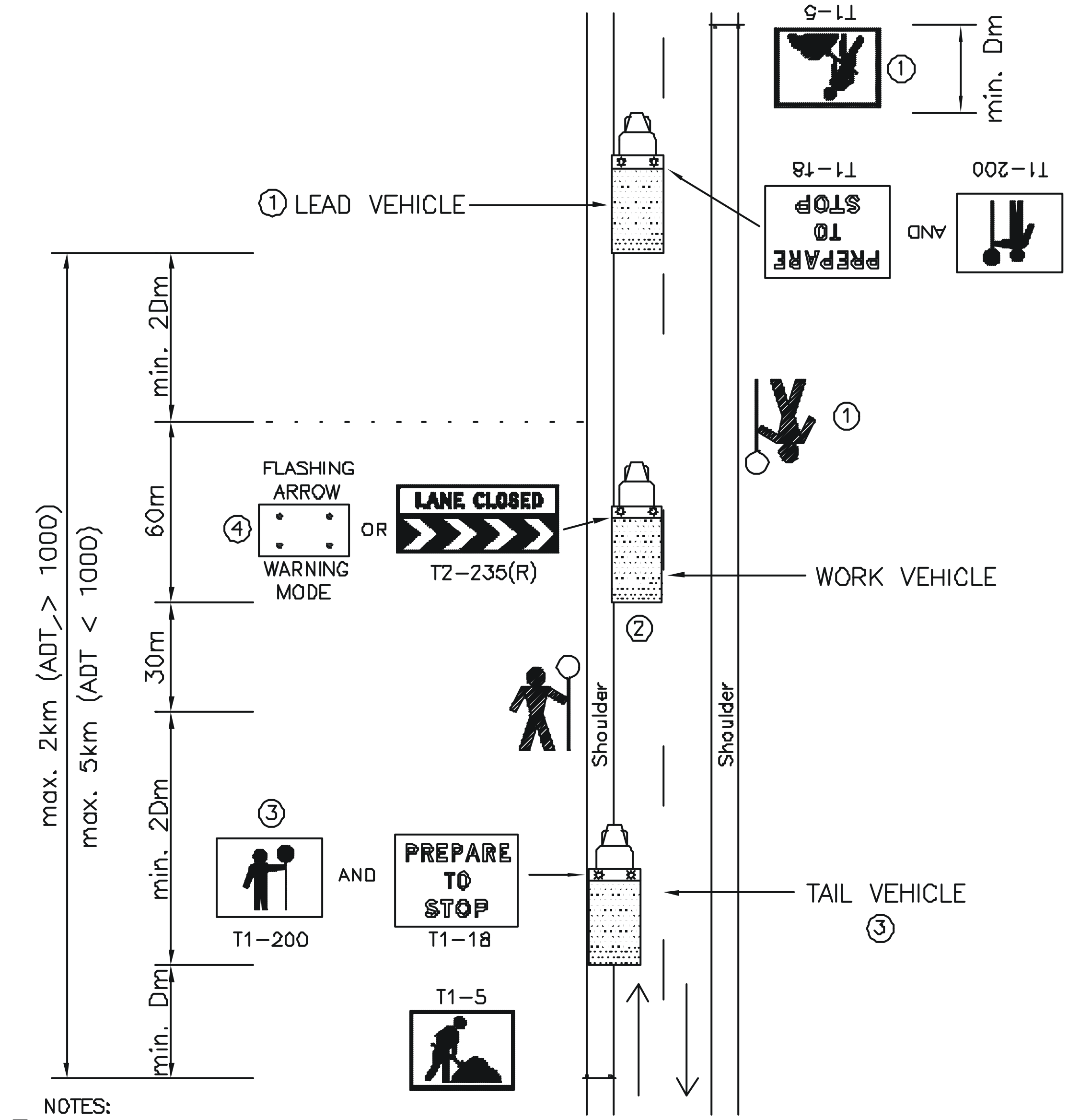
② Reference should be made to ***Traffic Control at Work Sites***, Section 3 2 2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.

③ Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
3 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING IN SLOW LANE

T000450

TCP 450



NOTES:

① Traffic Controller and T1–5 sign not required on unobstructed lane and Lead Vehicle not required where ADT is less than 1,500 vehicles per day provided that the sight distance between the The Traffic Controller in obstructed lane and traffic from the opposite direction is more than 300m (400m where travel speeds exceed 100km/h).

② Work to be carried out in the direction of traffic

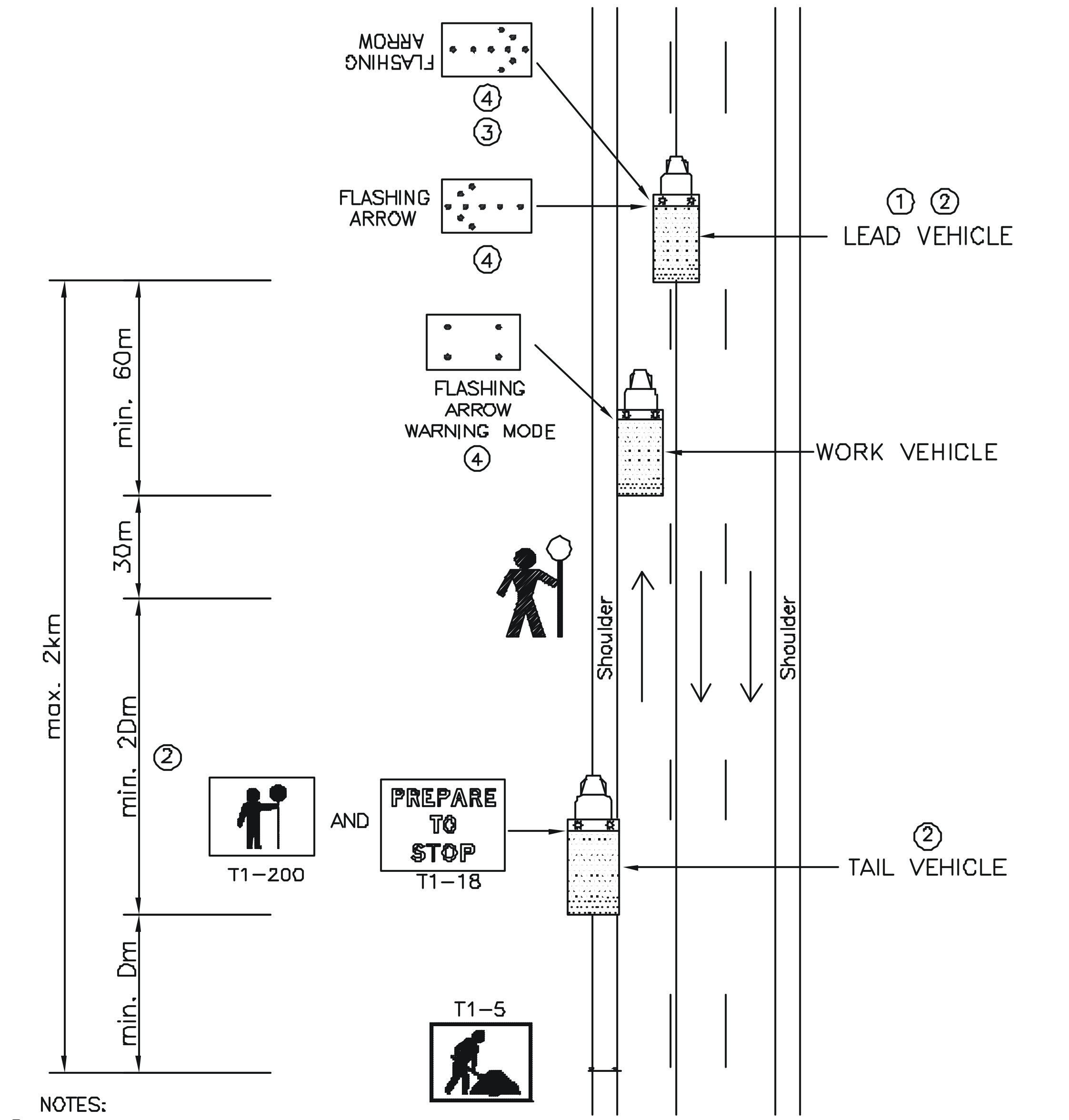
③ On crests and curves ensure that sight distance to Tail Vehicle is not less than Dm.

④ Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11 4.1. ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment.

MOBILE WORK
2 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING

T000451

TCP 451



NOTES:

① Lead Vehicle not required where ADT is less than 1,500 vehicles per day and sight distance from the opposite direction is more than 300m (400m where travel speeds exceed 100 km/h).

② On crests and curves, ensure that sight distances to Lead Vehicle and Tail Vehicle are not less than Dm.

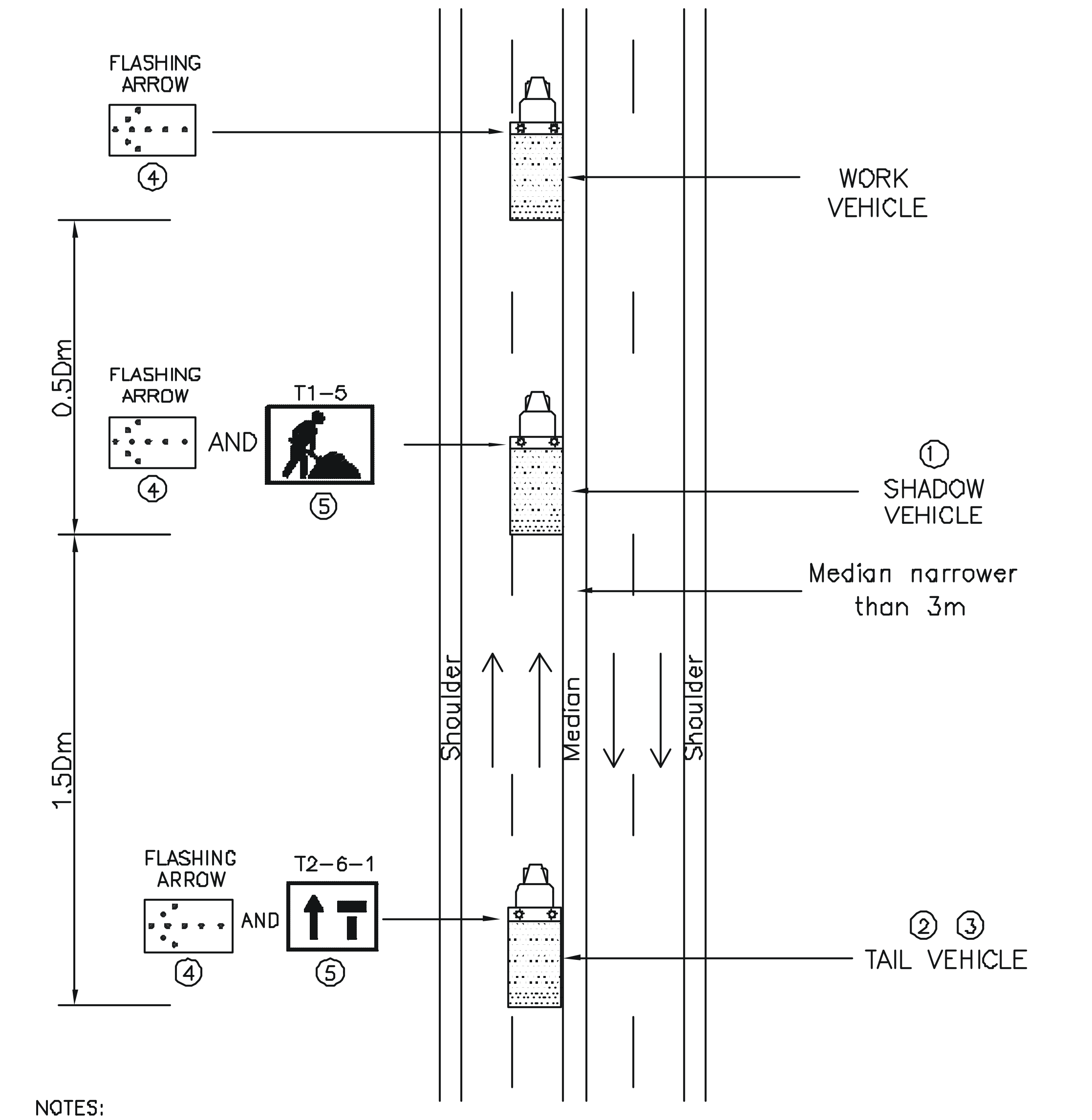
③ Use appropiate signs to direct traffic to the left or the right.

④ Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment

MOBILE WORK
3 LANE / 2 WAY
DEFLECTOGRAPH OR FWD TESTING IN SINGLE LANE

T000452

TCP 452



NOTES:

1. The Shadow Vehicle shall travel close to the lane line.
2. The Tail Vehicle shall travel close to the right edge line.
3. On crests and curves, ensure that sight distance to the Tail Vehicle is not less than Dm.
4. Reference should be made to ***Traffic Control at Work Sites***, Section 3.2.2, ***Sign Sizes*** and Section 11.4.1, ***Flashing arrow sign equipment*** in determining whether to use Type A, B or C equipment
5. Ensure that static signs, used with flashing arrow signs, are located on the vehicle so that they are readily visible but do not obscure the flashing arrow sign.

MOBILE WORK
4 LANE / 2 WAY
BENKELMAN BEAM TESTING IN RIGHT LANE

T000453

TCP 453

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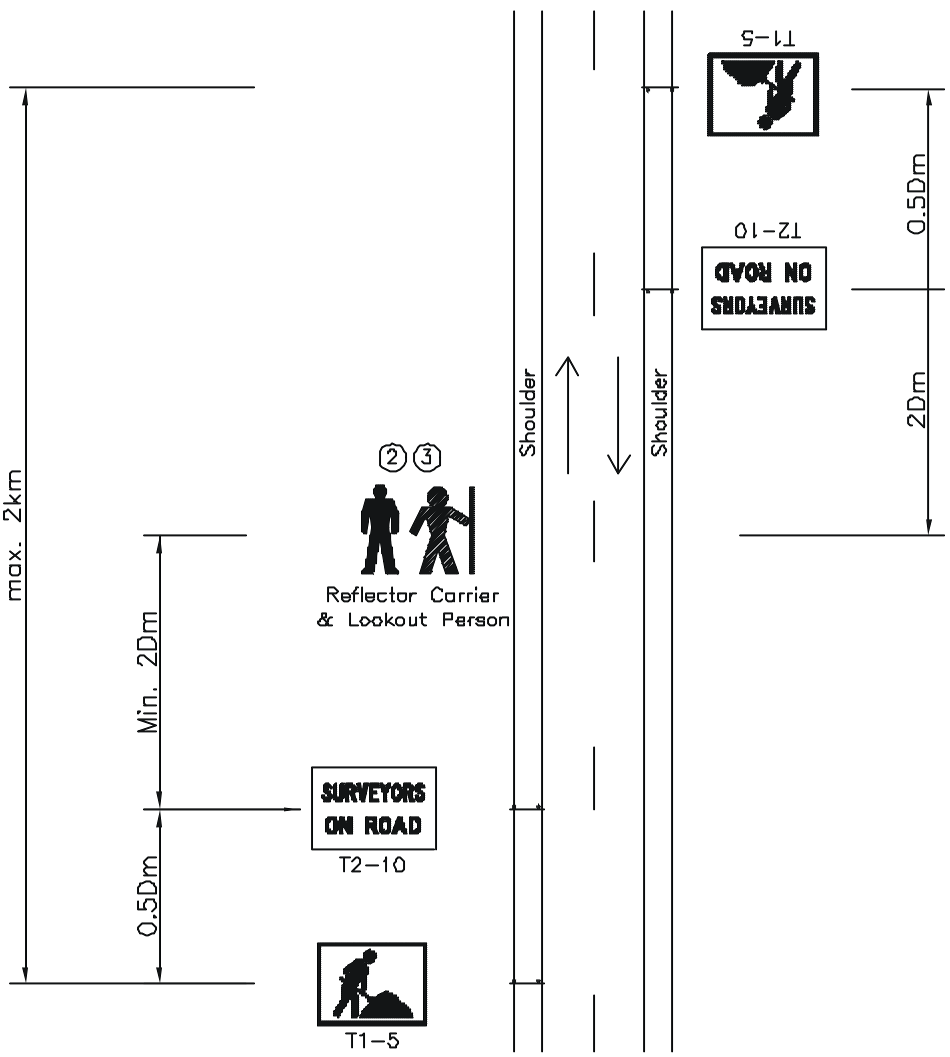

NOTES:

1. Survey instrument to be kept well clear of carriageway.
2. Lookout person must remain within sight and hearing distance, generally not more than 15m from the reflector carrier.
3. For shoulder surveying the lookout person is not required where vehicle movements are less than 1500vpd and sight distance is more than 300m from reflector carrier in both directions
4. For centreline or other on carriageway surveying, the additional requirements of Section 9.1.2, ***Planned work***, are to be observed with respect to minimum distances to approaching traffic.
5. Vehicle to be kept clear of the carriageway. Where this is not possible or desireable the flashing light on the vehicle must be operated.

INTERMITTENT WORK
2 WAY CARRIAGEWAY
SURVEYING SHOULDER ON BOTH SIDES (CLEAR OF TRAFFIC)
SURVEYING CENTRELINE OR ON CARRIAGEWAY

T000459

TCP 459

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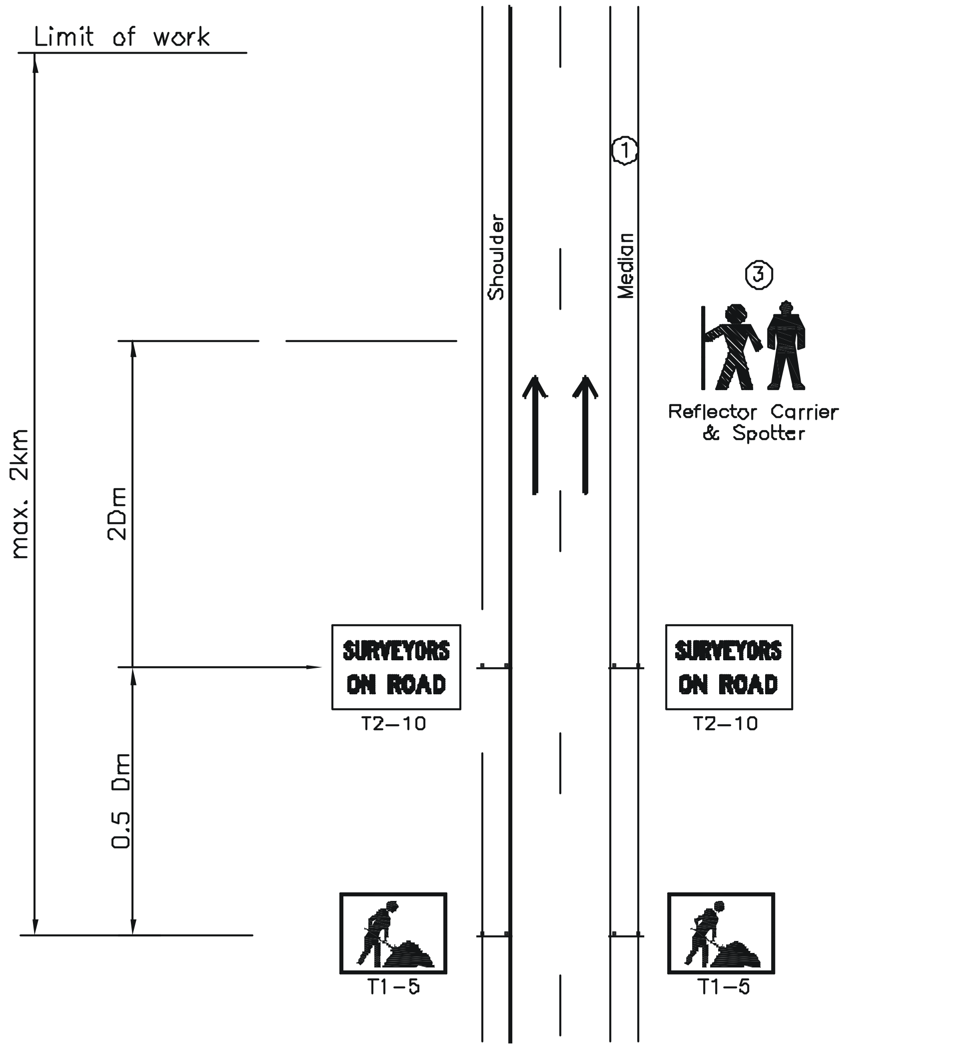


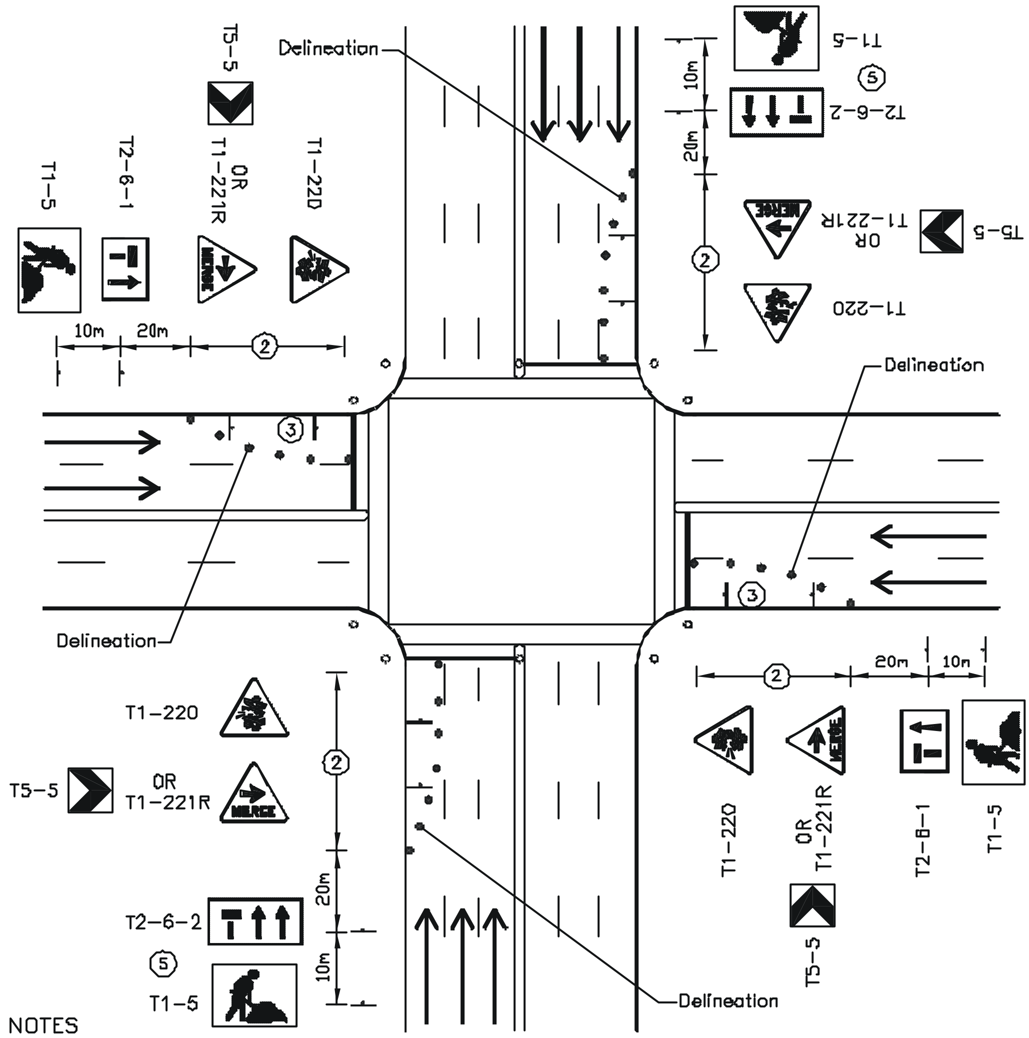
NOTES:

1. Do not use this TCP where median is narrower than 3m (painted) or 1m (raised) – a lane closure will be necessary when surveying a narrow median.
2. Survey instrument to be kept well clear of carriageway.
3. Spotter must remain within sight and hearing distance, generally not more than 15m from the reflector carrier.
4. Spotter not required where vehicle movements are less than 1,500 vpd and sight distance is more than 300m (400m where travel speeds exceed 100km/h) from reflector carrier in both directions.
5. Vehicles are to be kept clear of the carriageway. Where this is not possible or desireable the flashing light on the vehicle must be operated.
6. In urban situations the road shoulder carries at the lip and finishes at top of kerb.

INTERMITTENT WORK
ONE WAY CARRIAGE WAY
SURVEYING ON MEDIAN CLEAR OF TRAFFIC

T000463

TCP 463



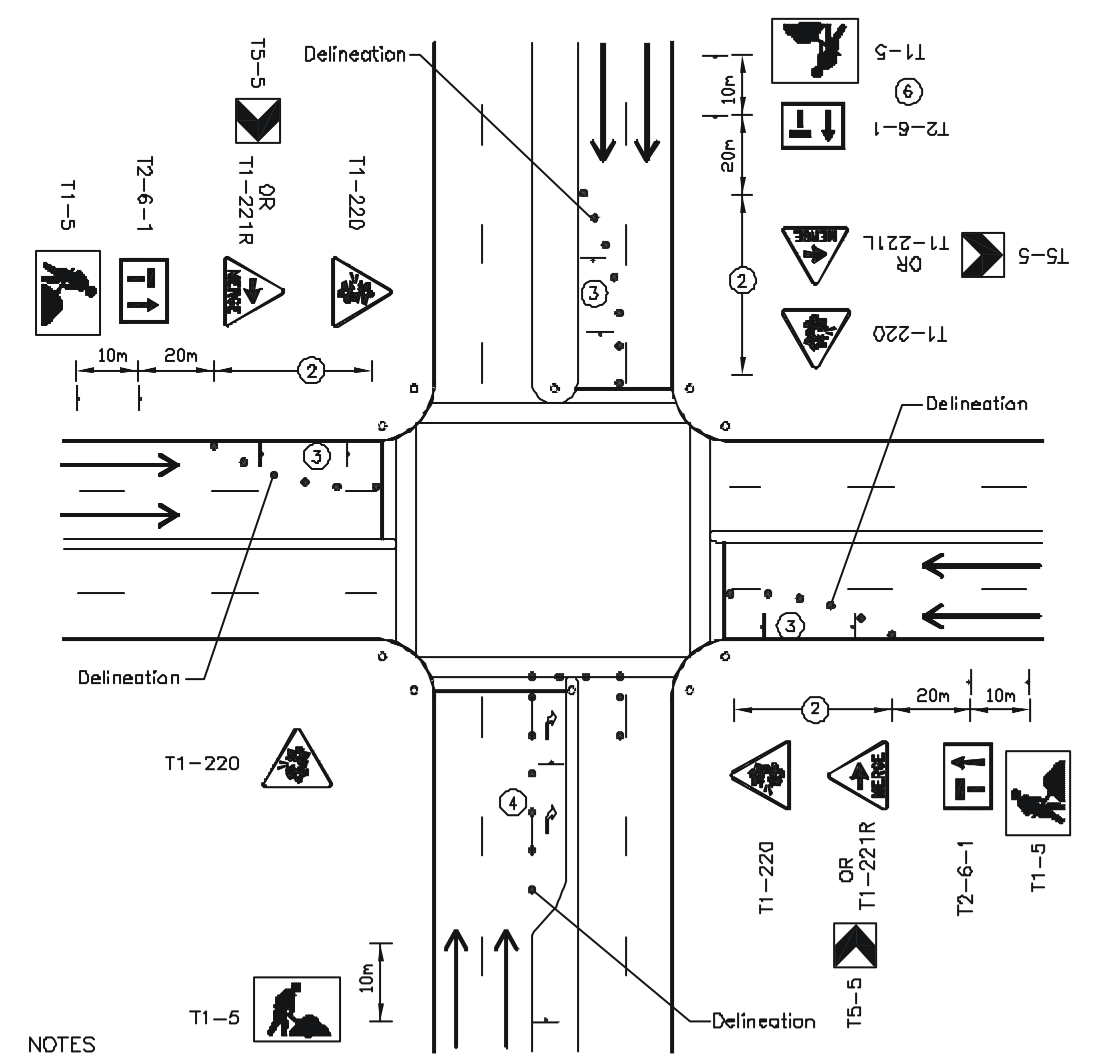
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Assumes no parking for >60m. If parked vehicles within this length then place cones along the centre lines.
4. Existing stop signs are in place on side street approaches.
5. Where there is sufficient width in the central median the T1-5 and T2-6-2 signs shall be duplicated on the median.

BLACKED OUT TRAFFIC SIGNALS – 4 WAY INTERSECTION
WORK ON FOOTPATH
(FOR SCHEDULED WORK >80 MIN)

TCP0802

TCP 802



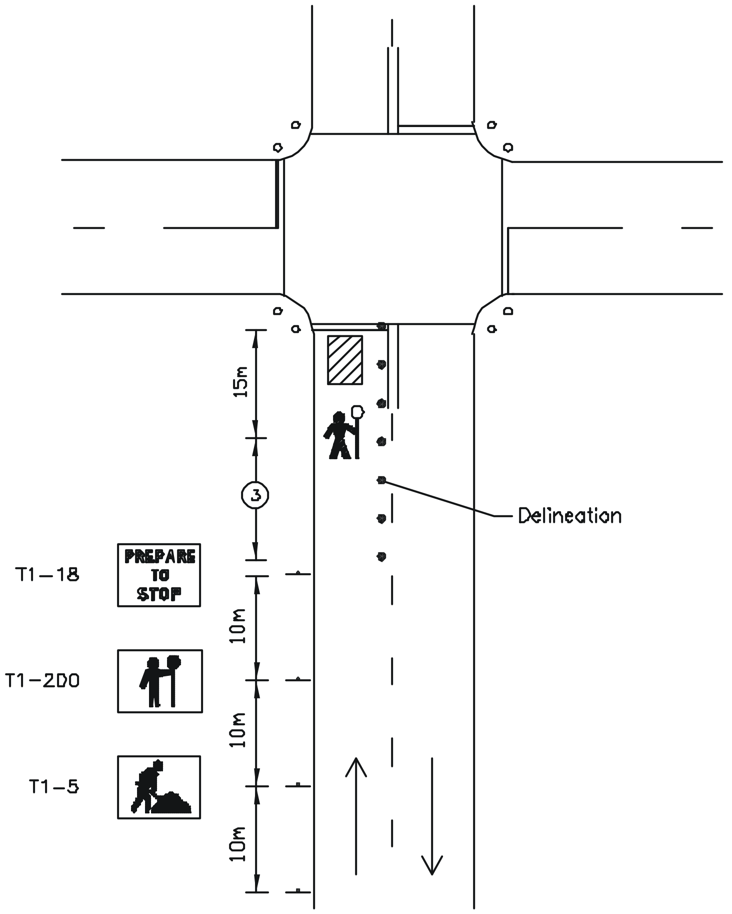
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Assumes no parking for >60m. If parked vehicles within this length then place cones along the centre lines.
4. If bay is too long care should be taken to ensure motorists are not entering the bay and having to swerve out again.
5. Existing stop signs are in place on side street approaches.
6. Where there is sufficient width in the central median the T1–5 and T2–6–1 signs shall be duplicated on the median.

BLACKED OUT TRAFFIC SIGNALS WITH RIGHT TURN BAY
WORK ON MEDIAN
(FOR SCHEDULED WORK >80 MIN)

T000803

TCP 803



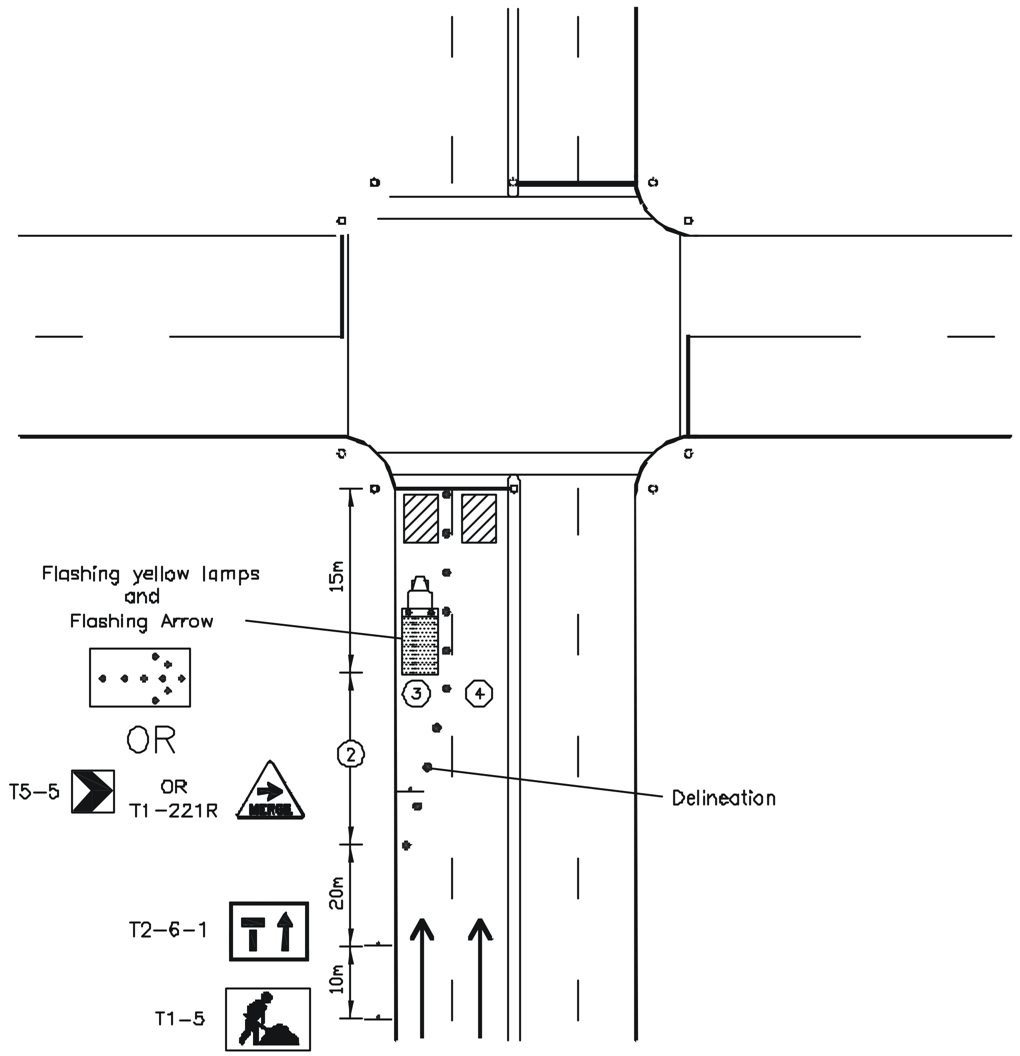
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Work is carried out when the traffic light is red for approaching traffic.
3. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
4. Traffic controller to monitor approaching vehicles and stop the first one at 15m from the stop line when traffic signal is red.
5. Work on site is not expected to exceed 60 minutes.
6. Traffic is allowed to go over the work site throughout this period.
7. Traffic controller to monitor queue length. If queue is long, allow vehicles through every cycle; else allow vehicles through every few cycles.

LOOP CUTTING – TWO LANE/TWO WAY INTERSECTION

T000804

TCP 804



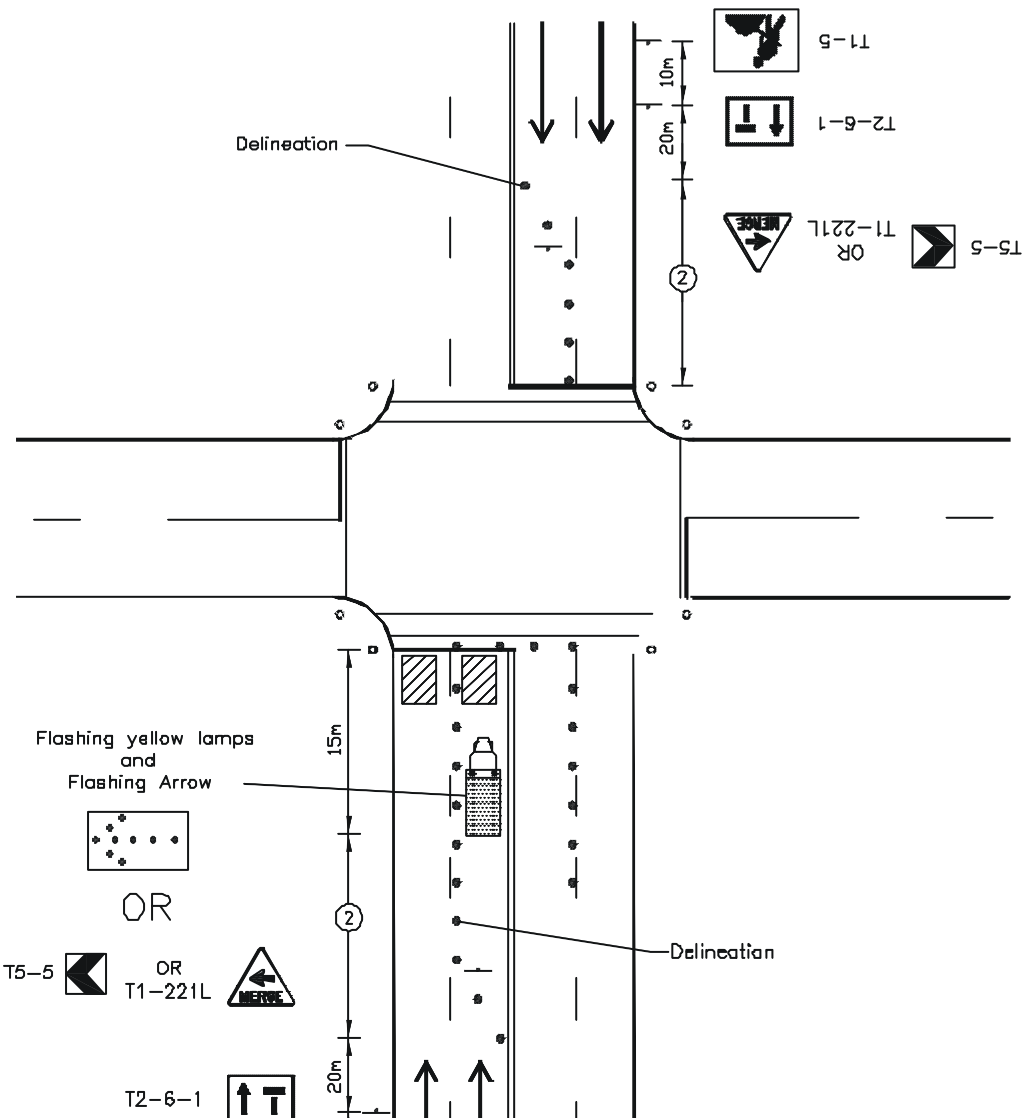
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3-5m spacing.
3. Vehicle parked to protect work area.
4. While loop cutting in median side lane, use mirror image traffic control. Also place cones on the median strip.

LOOP CUTTING - TWO APPROACH LANES

T000805

TCP 805



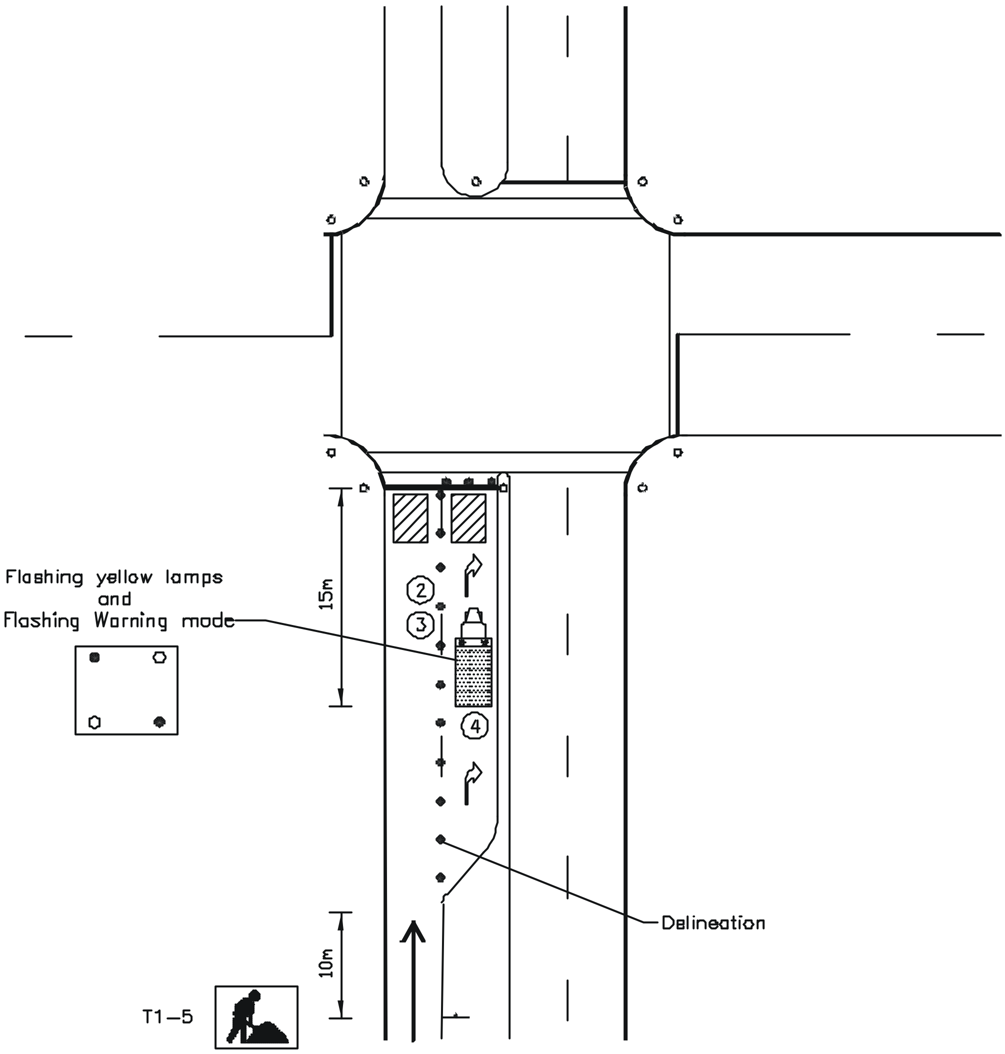
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Vehicle parked to protect work area.

LOOP CUTTING – TWO APPROACH LANES
(NO MEDIAN)

T000805A

TCP 805A



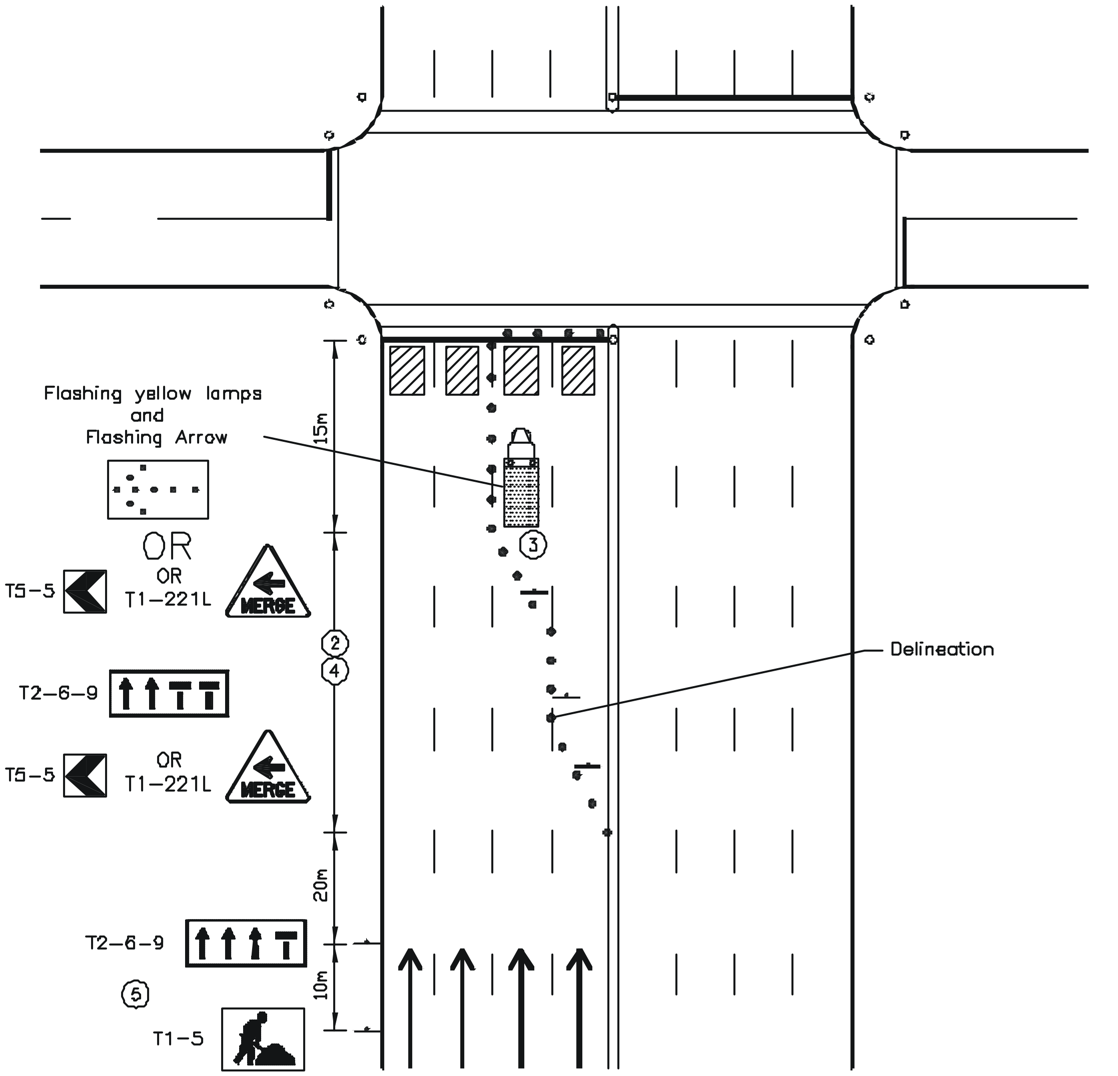
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Cones at 3–5m spacing.
3. If bay is too long care should be taken to ensure motorists are not entering the bay and having to swerve out again.
4. Vehicle parked to protect work area.
5. If medium width is <1.2m, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

LOOP CUTTING – RIGHT TURN BAY

T000806

TCP 806



NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of each tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h where practicable.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Vehicle parked to protect work area.
4. While loop cutting in kerb side lanes, use mirror image traffic control.
5. Where there is sufficient width on the central median the T1–5 and T2–6–9 signs shall be duplicated on the median.

LOOP CUTTING – FOUR APPROACH LANES

T000807

TCP 807

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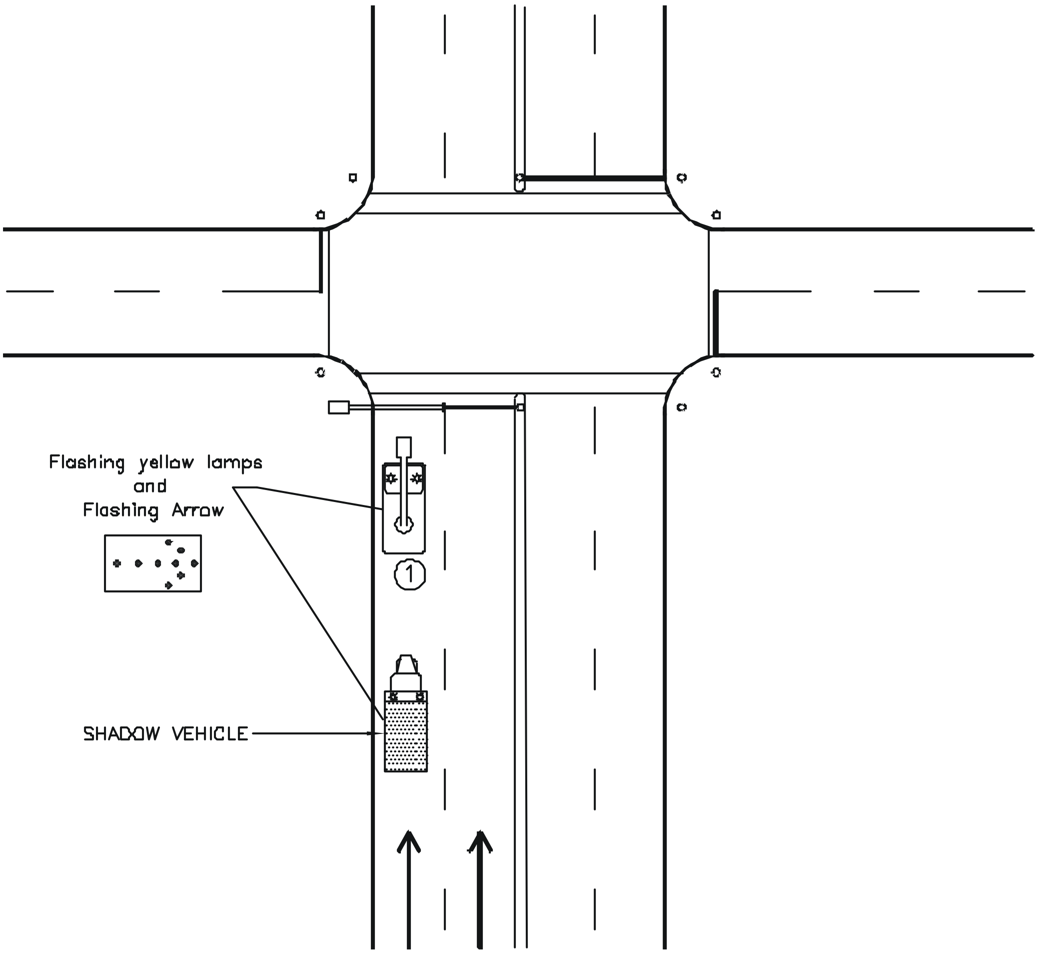


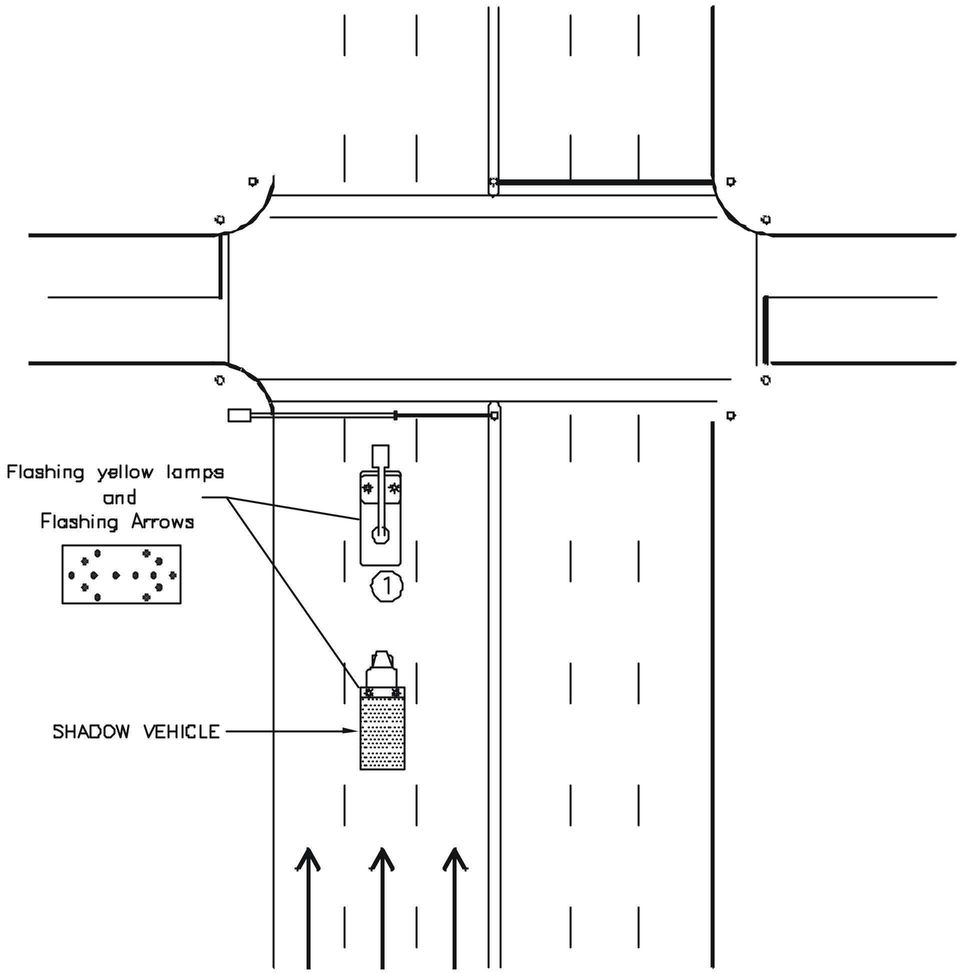
NOTES

(1) EPV and shadow vehcile fitted with flashing arrow and flashing yellow lamps.

EPV–KERBSIDE LANE–MAST ARM ON APPROACH
<80MIN WORK

T000809

TCP 809



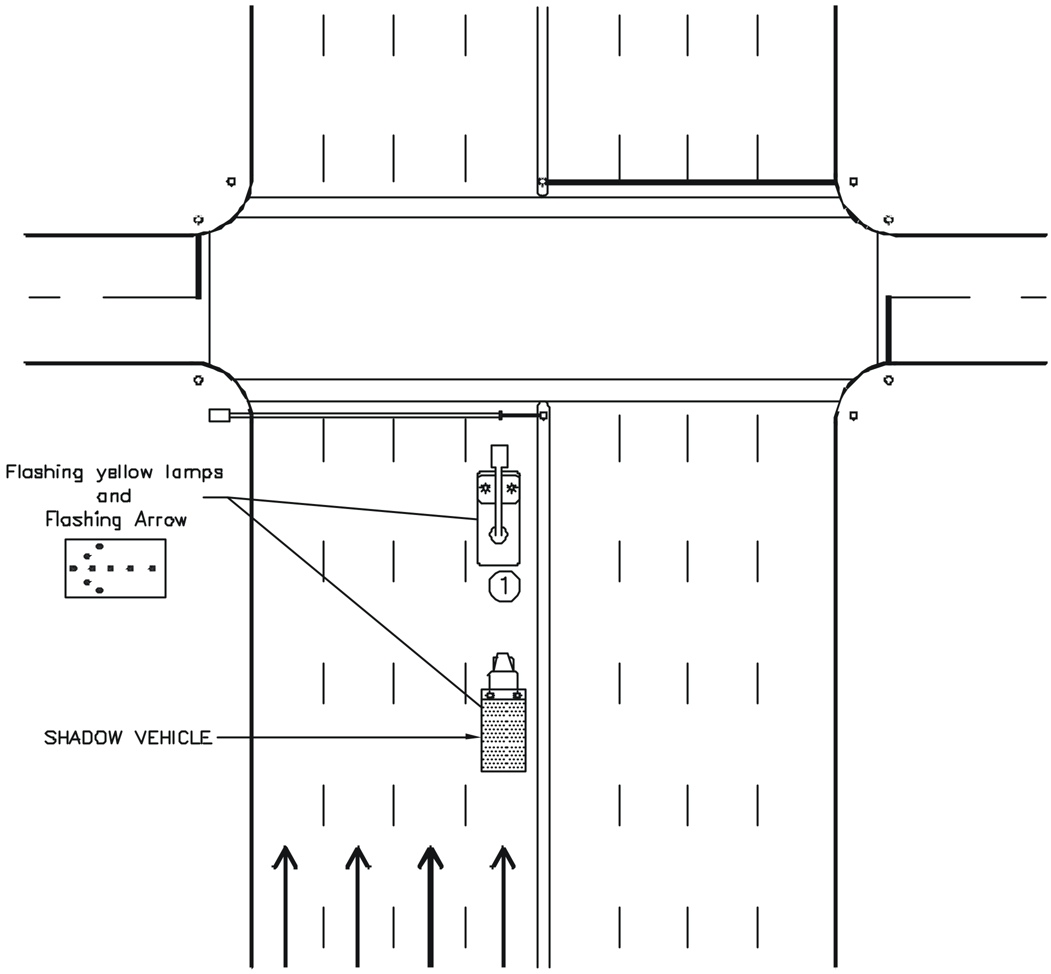
NOTES

(1) EPV and shadow vehcile fitted with flashing arrows and flashing yellow lamps.

EPV—CENTRE LANE—MAST ARM ON APPROACH
<80MIN WORK

T000810

TCP 810



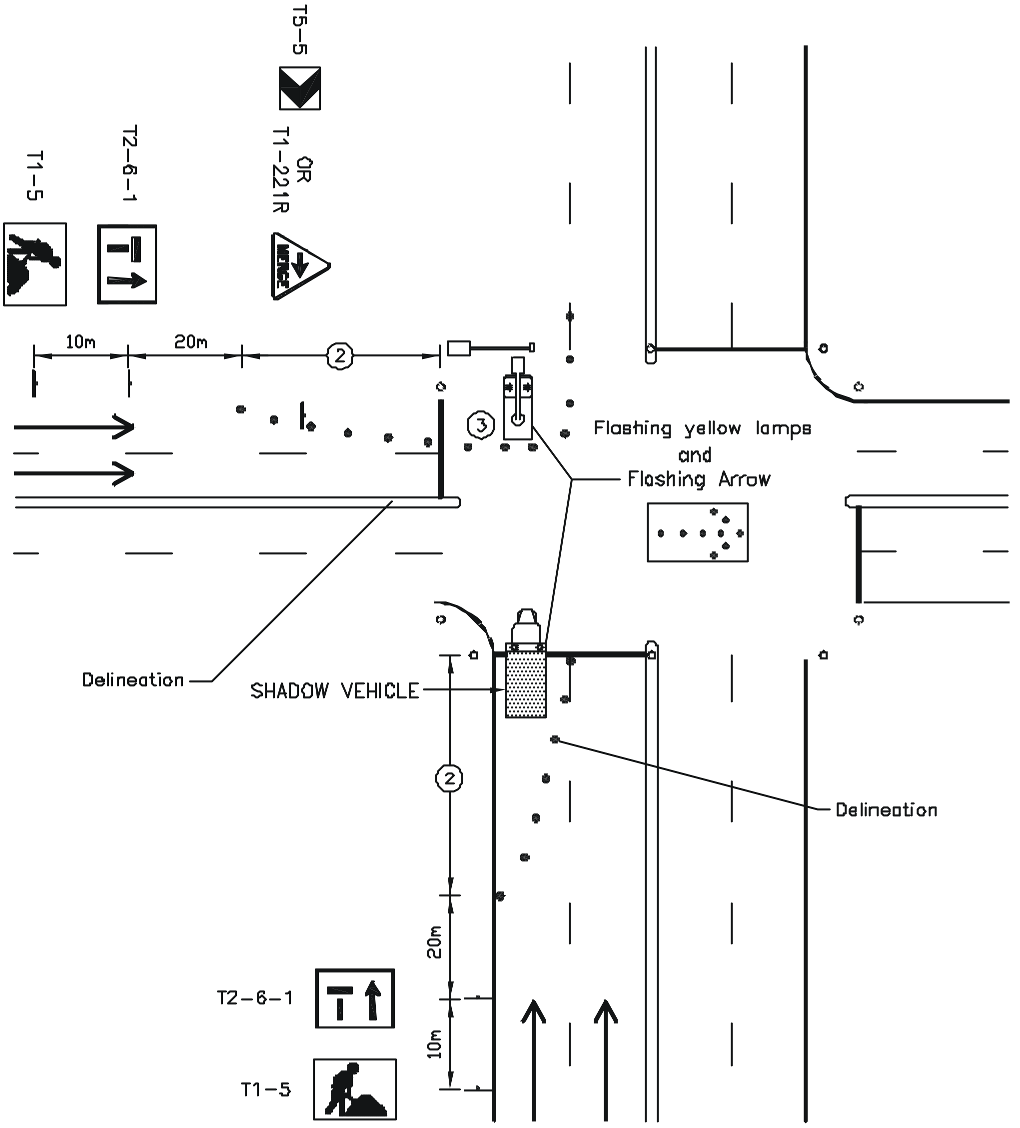
NOTES

1 EPV and shadow vehcile fitted with flashing arrow and flashing yellow lamps.

EPV–MULTI LANE–MAST ARM ON APPROACH
<80MIN WORK

T000811

TCP 811



NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. EPV and shadow vehicle fitted with flashing arrow and flashing yellow lamps.
4. Side street lane closure is only necessary when EPV obstructs part/whole of left lane.

EPV – MAST ARM ON DEPARTURE SIDE OR WORK ON TERTIARY POST WITH BLOCKED LANE (>80MIN)

T000812

TCP 812

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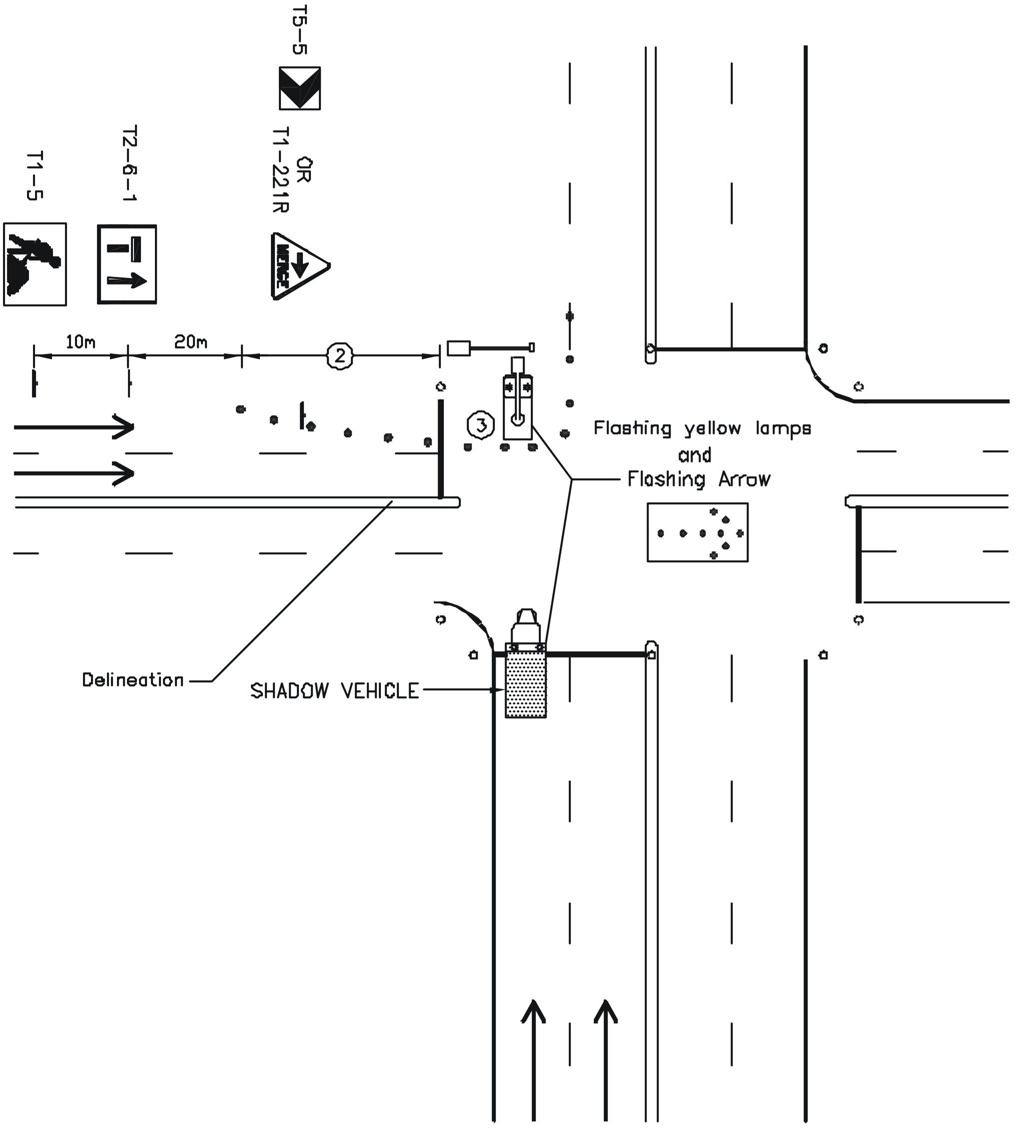


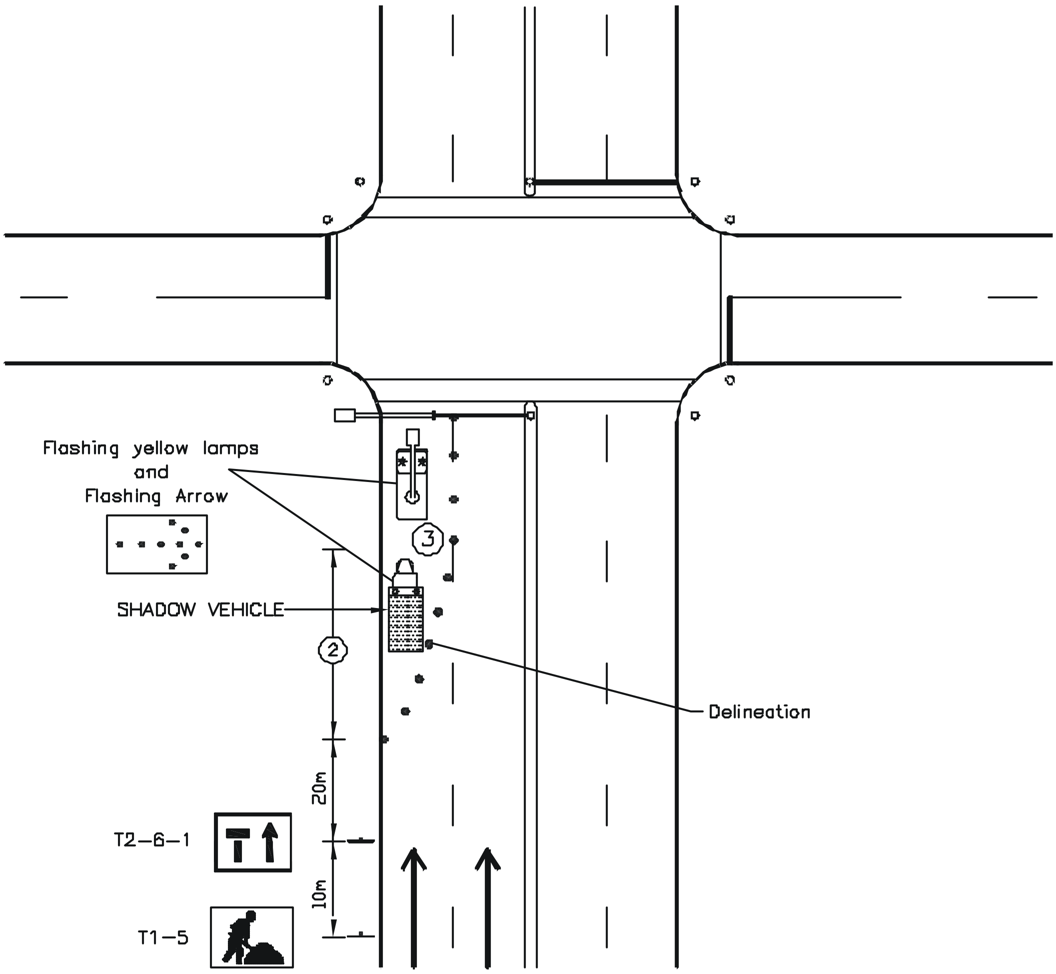
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. EPV and shadow vehicle fitted with flashing arrow and flashing yellow lamps.
4. Side street lane closure is only necessary when EPV obstructs part/whole of left lane.

EPV – MAST ARM ON DEPARTURE SIDE OR WORK ON TERTIARY POST
WITH BLOCKED LANE (<80MIN)

T000812A

TCP 812A



NOTES

(1) For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.

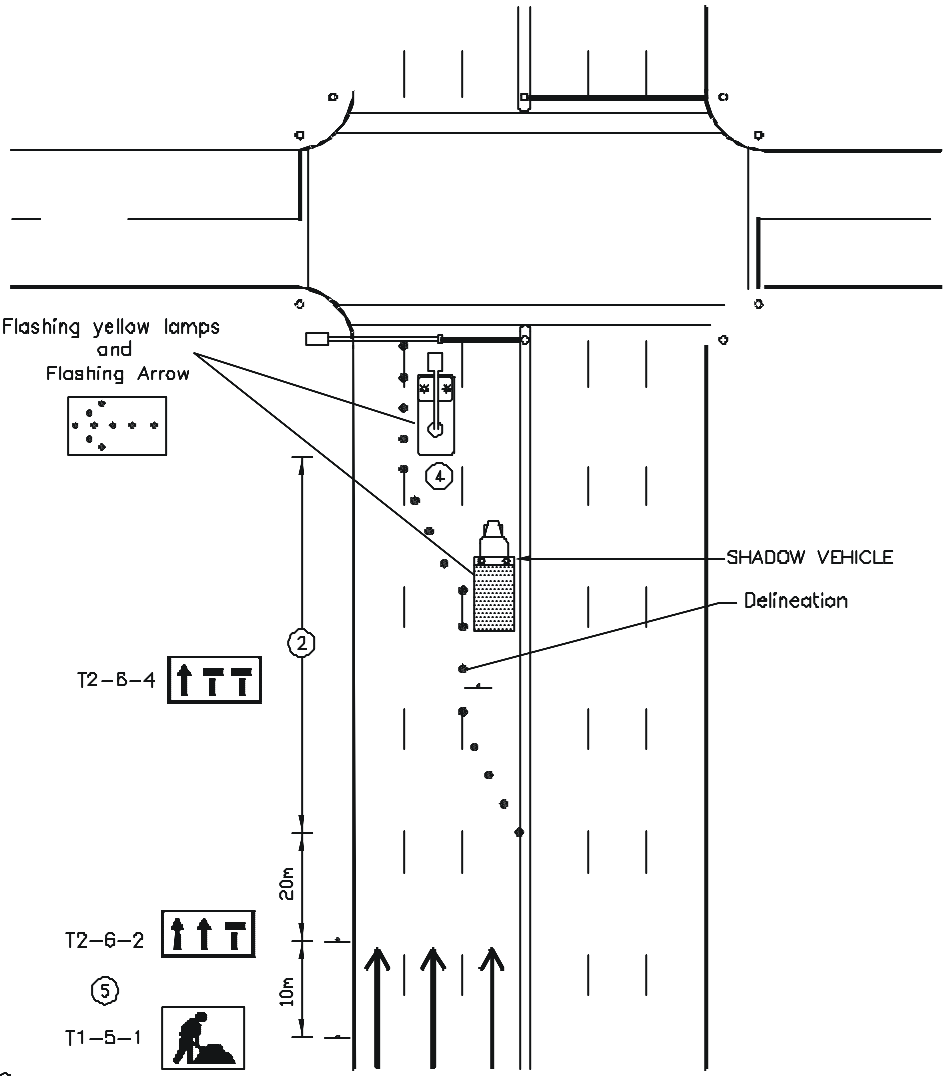
(2) Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.

(3) EPV and shadow vehicle fitted with flashing arrow and flashing yellow lamps.

EPV–KERBSIDE LANE–MAST ARM ON APPROACH
(FOR WORK >80 MIN)

T000813

TCP 813



NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site.
2. Length of each tapered or straight line of cones to be 30m for 60km/h zone and 50m per lane for >60km/h where practicable.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Close kerbside and centre lane if right turn traffic is predominant.
4. EPV and shadow vehicle fitted with flashing arrow.
5. Where there is sufficient width in the central median the T1-5-1 and T2-6-2 signs shall be duplicated on the median.

LOOP CUTTING / EPV (MAST ARM ON APPROACH) – CENTRE LANE
NO RIGHT TURN ALLOWED
(FOR WORK >80 MIN)

T000814

TCP 814

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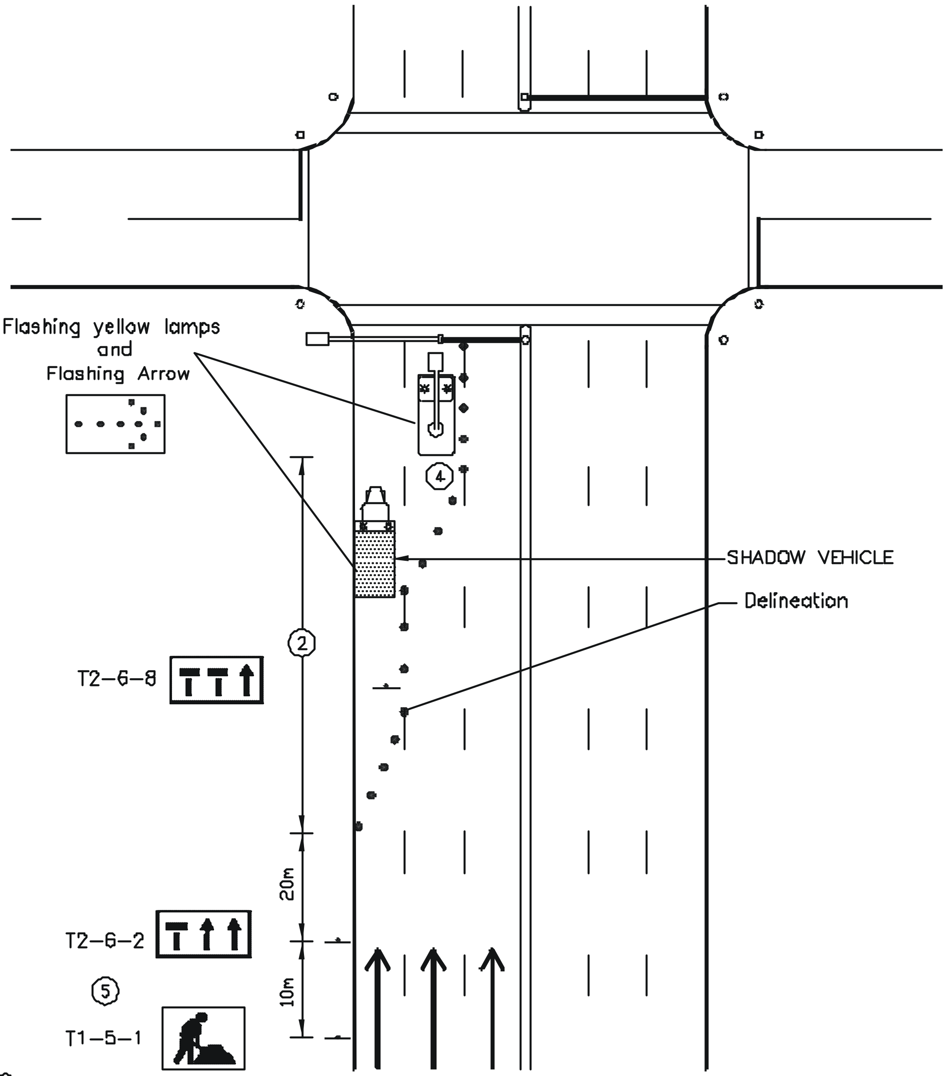


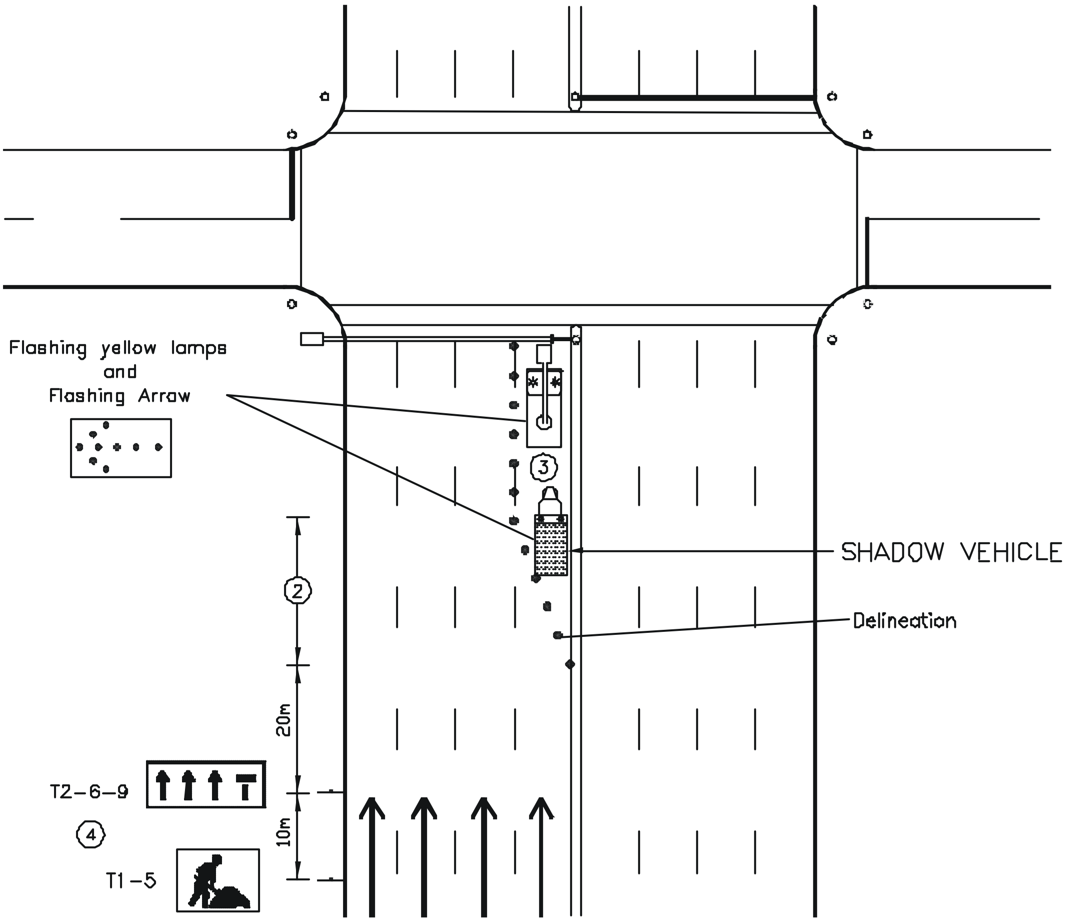
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site.
2. Length of each tapered or straight line of cones to be 30m for 60km/h zone and 50m per lane for >60km/h where practicable.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Close kerbside and centre lane if right turn traffic is predominant.
4. EPV and shadow vehicle fitted with flashing arrow.
5. Where there is sufficient width in the central median the T1–5–1 and T2–6–2 signs shall be duplicated on the median.

LOOP CUTTING / EPV (MAST ARM ON APPROACH) – CENTRE LANE
RIGHT TURN ALLOWED
(FOR WORK >80 MIN)

T000814A

TCP 814A



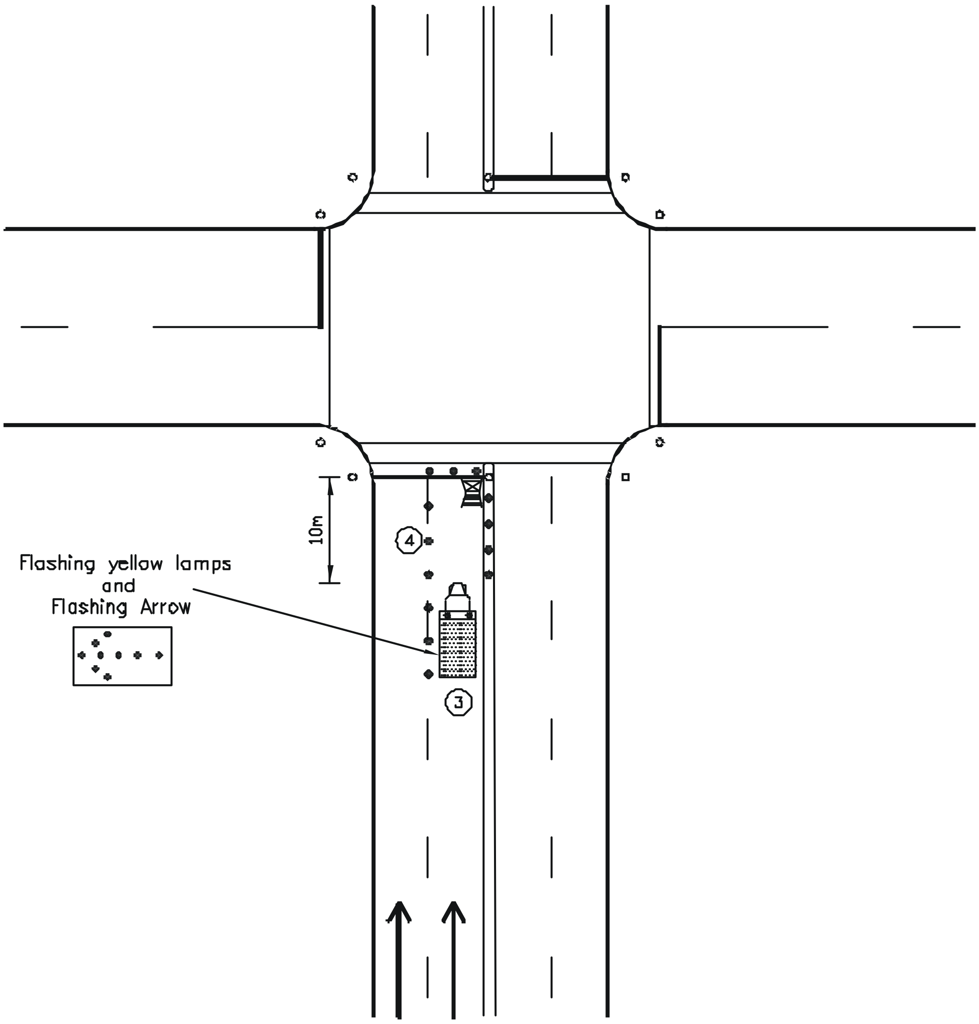
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 10 minutes.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h where practicable.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3-5m spacing.
3. EPV and shadow vehicle with flashing arrow and flashing yellow lamps.
4. Where there is sufficient width on the central median the T1-5 and T2-6-9 signs shall be duplicated on the median.
5. If medium width is <1.2m, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

EPV - MULTI LANES (WORK ON MEDIAN SIDE LANE) - MAST ARM ON APPROACH
(FOR WORK >80 MIN)

T000815

TCP 815



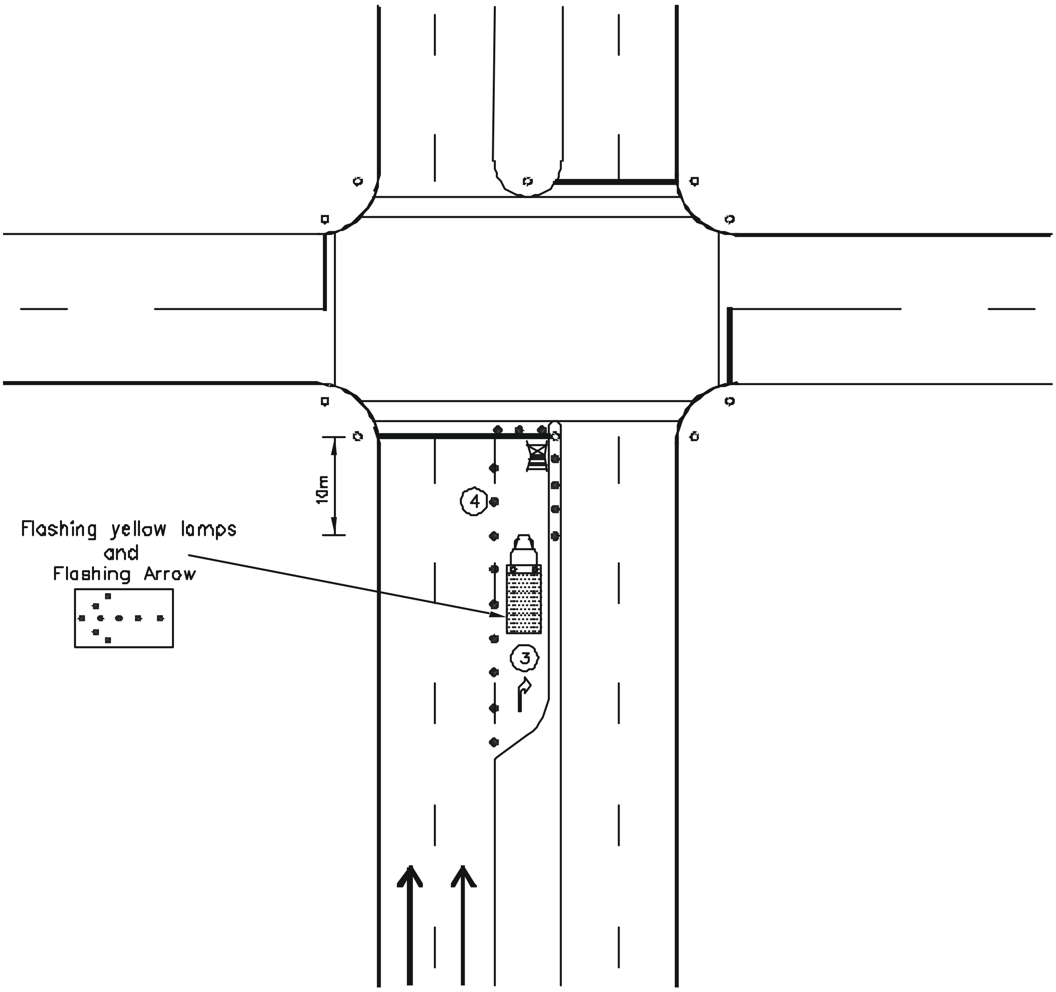
NOTES

1. For night time, use reflective cones.
2. 60km/h to 80km/h zone.
3. Vehicle parked to protect work area.
4. Cones at 3–5m spacing, up to the vehicle to delineate work zone.
5. If medium width is <1.2m, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

MEDIAN ISLAND – FOUR LANE/TWO WAY <80 MIN WORK

T000816

TCP 816



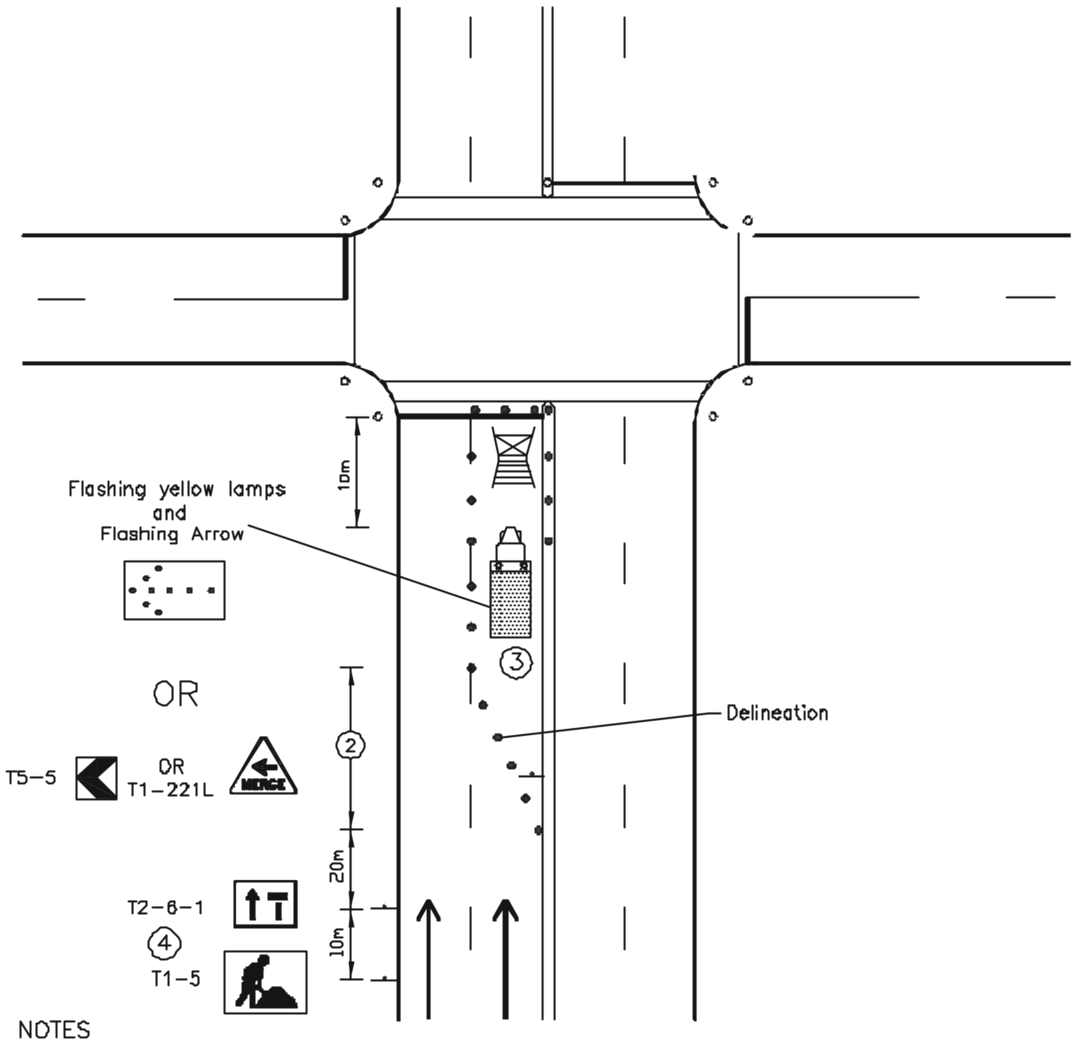
NOTES

1. For night time, use reflective cones.
2. 60km/h to 80km/h zone.
3. Vehicle parked to protect work area.
4. Cones at 3–5m spacing, up to the vehicle to delineate work zone.
5. If bay is too long care should be taken to ensure motorists are not entering the bay and having to swerve out again.
6. If medium width is <1.2m, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

MEDIAN ISLAND – TWO LANES WITH RIGHT TURN BAY <80 MIN WORK

T000817

TCP 817



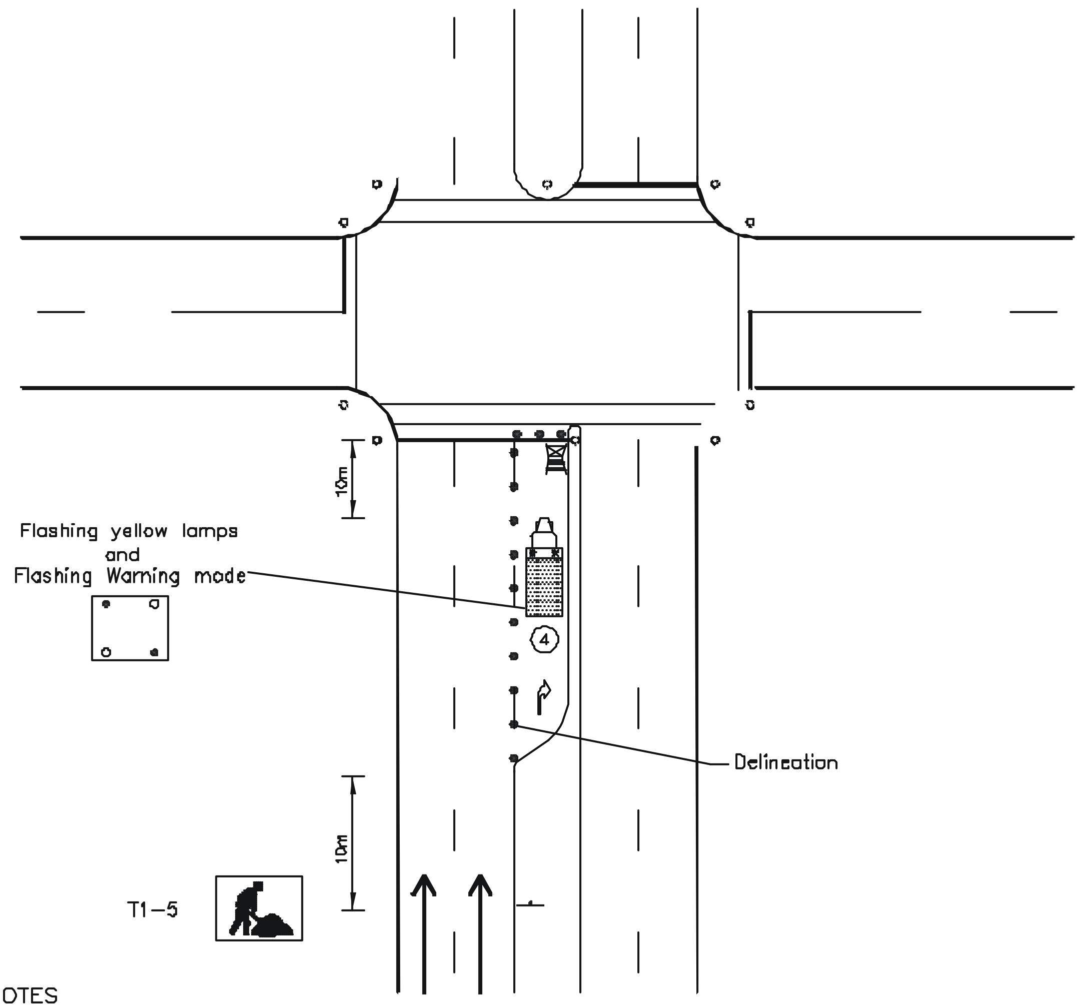
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3-5m spacing.
3. Vehicle parked to protect work area.
4. Where there is sufficient width in the central median the T1-5 and T2-6-1 signs shall be duplicated on the median.
5. If medium width is <1.2m, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

MEDIAN ISLAND – TWO LANES
(FOR WORK >80 MIN)

T000818

TCP 818



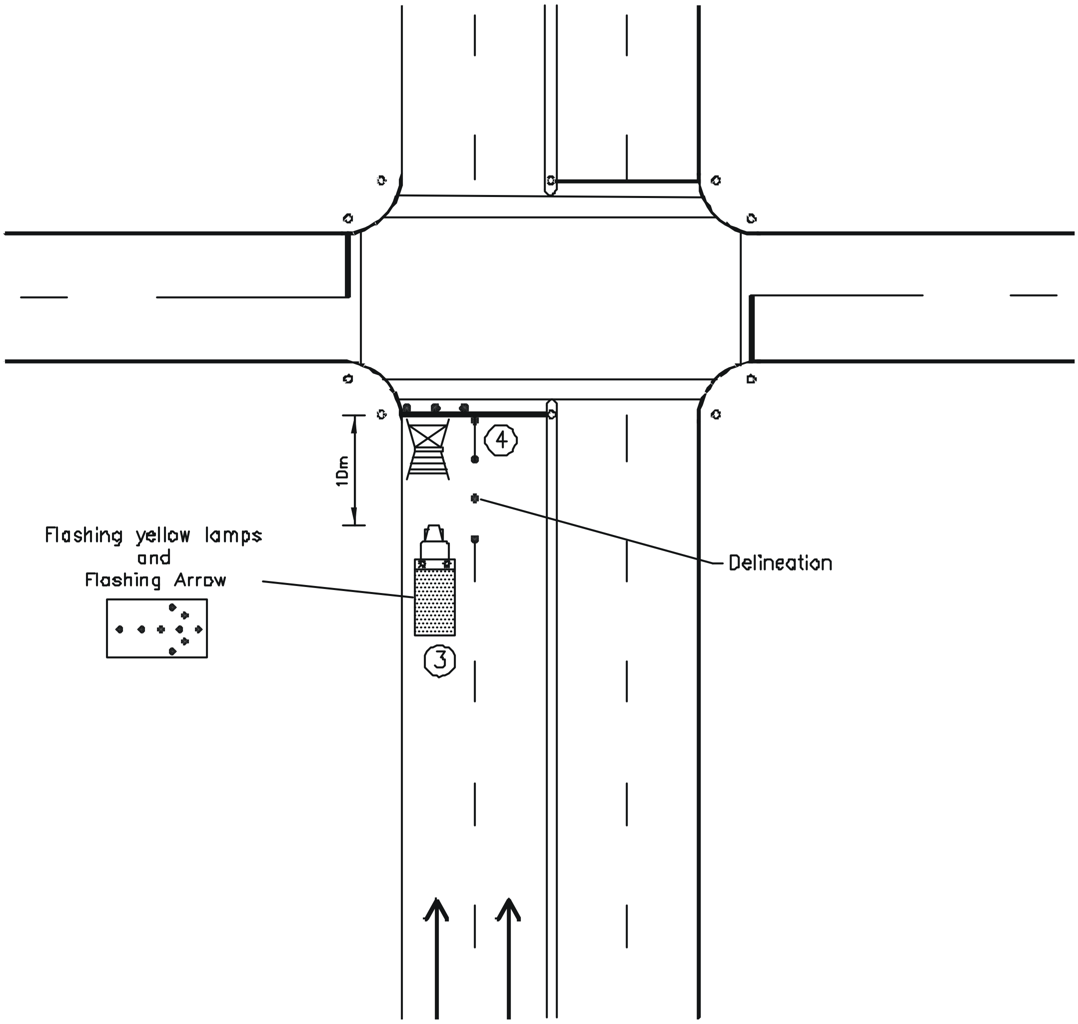
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. If bay is too long care should be taken to ensure motorists are not entering the bay and having to swerve out again.
4. Vehicle parked to protect work area.
5. If medium width is <1.2m, same treatment as TCP 805A should be used, i.e. closing off lane in opposite direction.

MEDIAN ISLAND – TWO LANES WITH RIGHT TURN BAY
(FOR WORK >80 MIN)

T000819

TCP 819



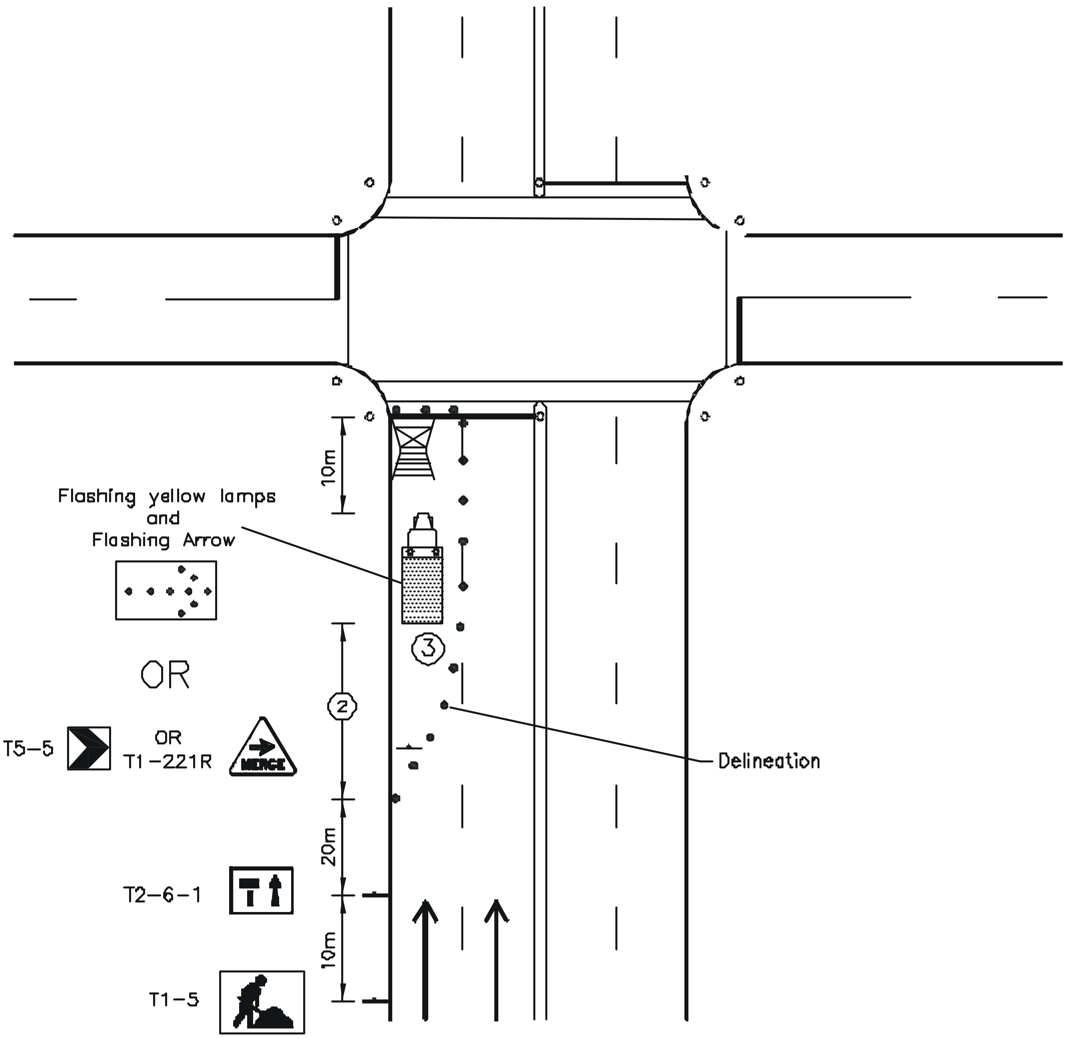
NOTES

1. For night time, use reflective cones.
2. 60km/h to 80km/h zone.
3. Vehicle parked to protect work area.
4. Cones at 3–5m spacing, up to the vehicle to delineate work zone.

FOOTWAY – PRIMARY POST <80 MIN WORK

T000820

TCP 820



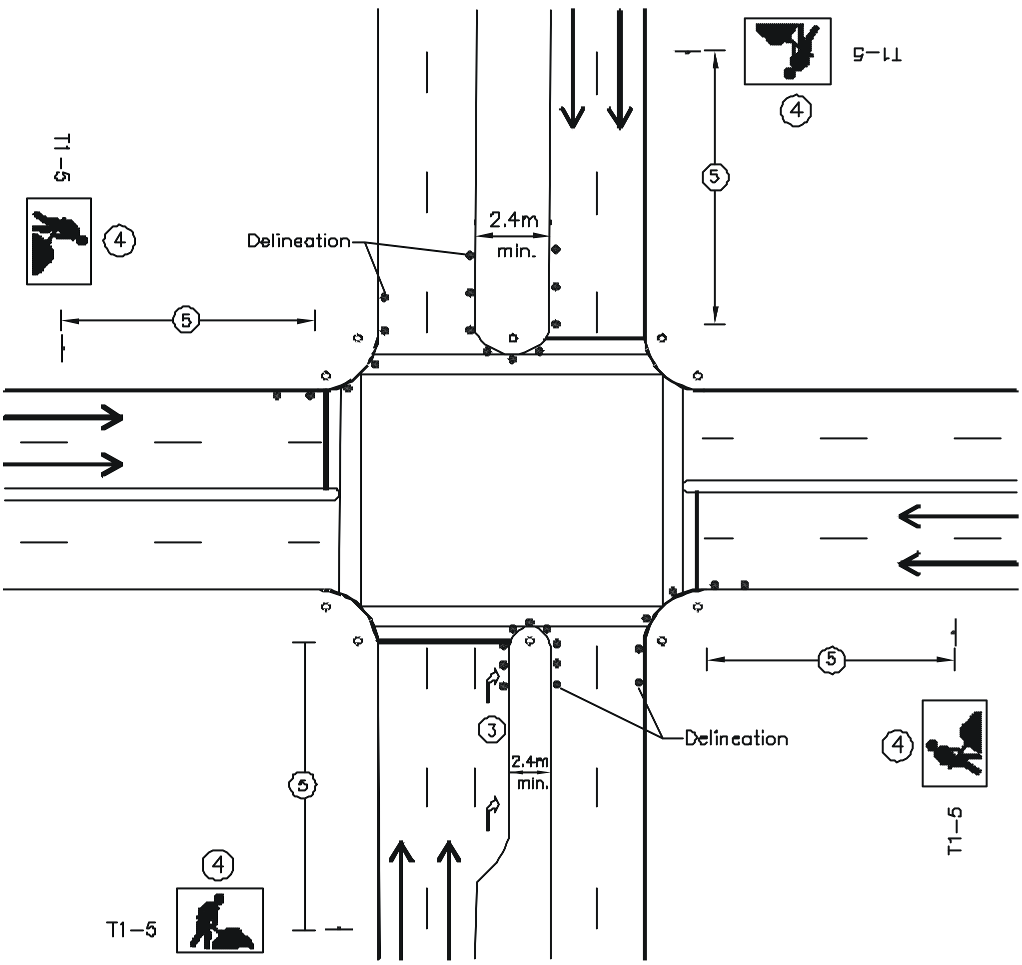
NOTES

1. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site.
2. Length of tapered or straight line of cones to be 30m for 60km/h zone and 50m for >60km/h zone.
   Length of cones may need to be increased to give adequate visibility over a crest or around a curve. Cones at 3–5m spacing.
3. Vehicle parked to protect work area.

FOOTWAY – PRIMARY POST
(FOR WORK >80 MIN)

T000821

TCP 821



NOTES

For Short Term Traffic Signal Maintenance (≤80 Minutes)

1. For night time, use reflective cones.
2. Minimum lane width 2.8m
3. Cones at 3m spacing along pavement edge where ladders are solely on footpath or median.

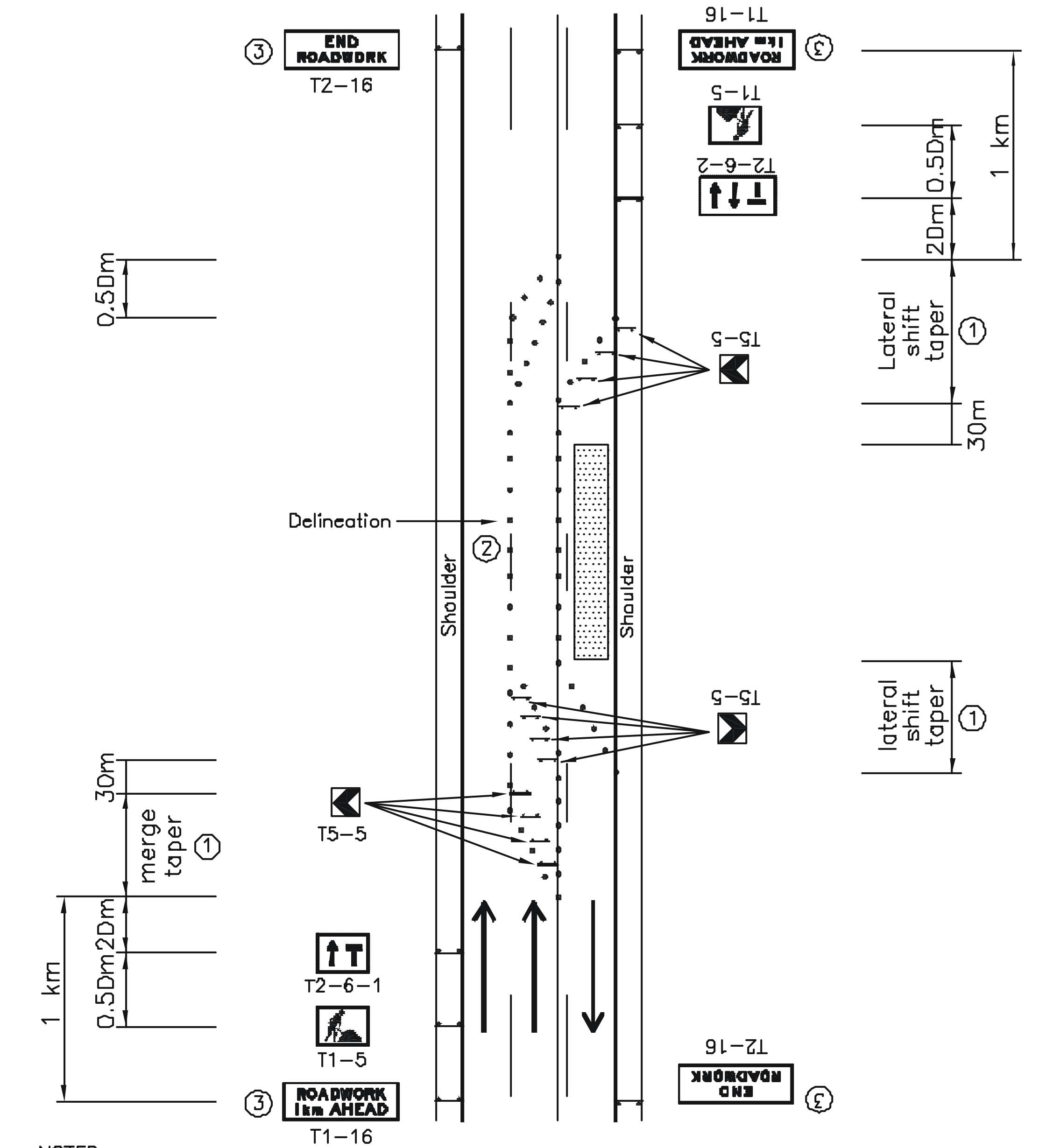
For Routine Maintenance (No Lane Blocked)

4. Workmen Ahead sign on all approaches to intersection.
5. Signs to be placed to a distance of 30m for 60km/h zone and 50m for >60km/h zone.
6. For night time, use night signs and reflective cones. Adequate lighting should be provided to illuminate the work site for durations longer than 80 minutes.

SHORT TERM TRAFFIC SIGNAL MAINTENANCE (DURATION ≤80 MIN)
OR ROUTINE MAINTENANCE (NO LANE BLOCKED)

T000822

TCP 822



NOTES:

For use where workers and plant remain in the closed lane.

① The length of merge and lateral shift tapers is to be determined from "Traffic Control at Work Sites" Table 5.2, recommended taper lengths.

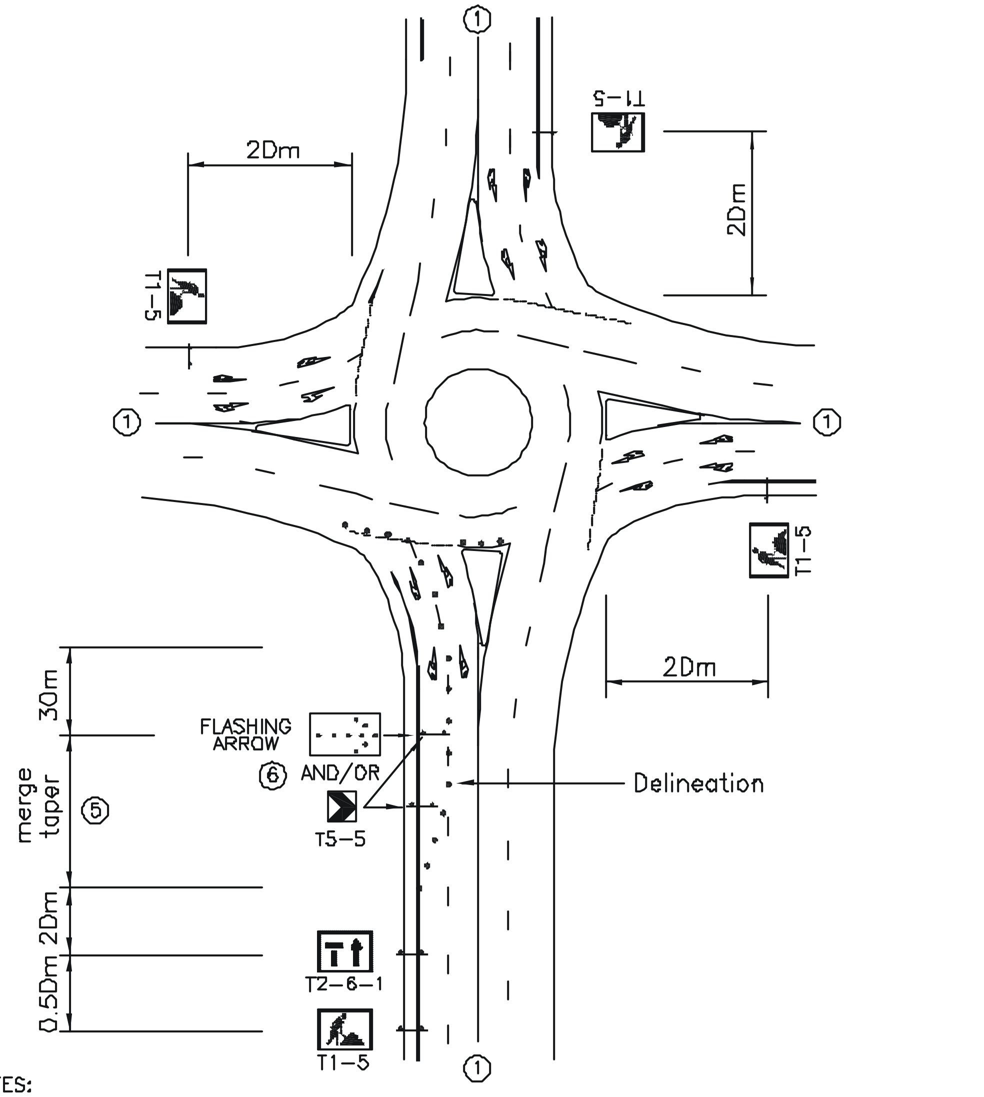
② Delineation must provide a clear separation between opposing traffic flows.

③ T1-16 and T2-16 signs are optional where ADT is less than 10,000 vehicles per day.

SHORT TERM WORK
3 LANE / 2 WAY

T000826

TCP 826



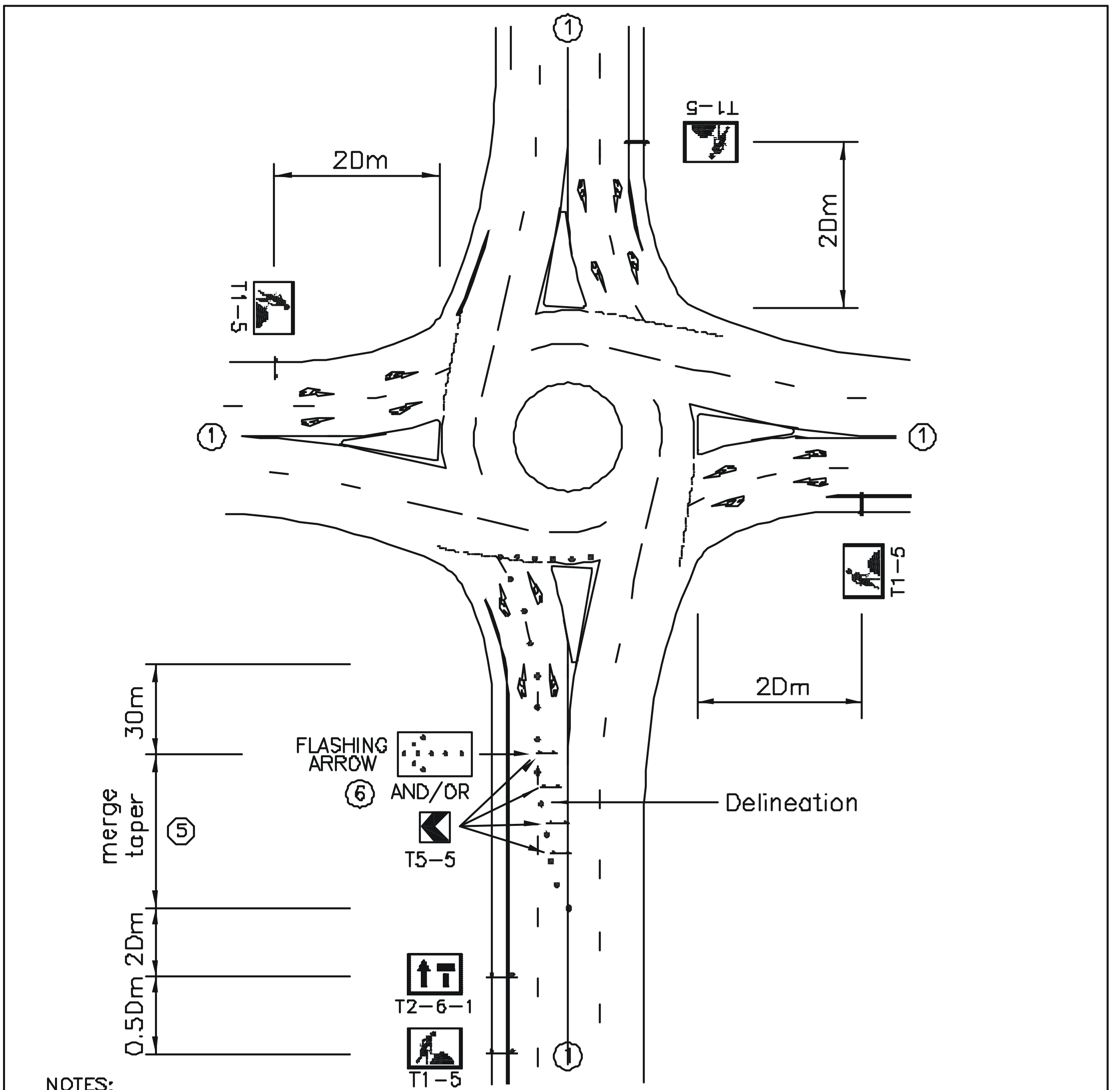
NOTES:

1. Install T1-1 and T2-16 signs on all approaches when the speed limit is equal to or exceeds 80km/h and the ADT is greater than 10,000 vehicles per day.
2. The traffic control signs and devices may also be installed on all the approaches of the roundabout to enable the closure of the kerb lane.
3. Means of access for local traffic and pedestrians across the Work Area should be provided.
4. This TCP has been developed assuming there are no parked vehicles. Therefore, this TCP should be modified if parked vehicles affect the location of the traffic control signs and devices.
5. The length of merge tapers is to be determined from Traffic Control at Work Sites, Table 5.2, recommended taper lengths.
6. See Section 5.2.3, ***Requirements for specific signs,*** 8th dot point.

SHORT TERM WORK AT ROUNDABOUTS
4 LANE / 2 WAY
WORKING IN THE KERB SIDE LANE

T000827

TCP 827



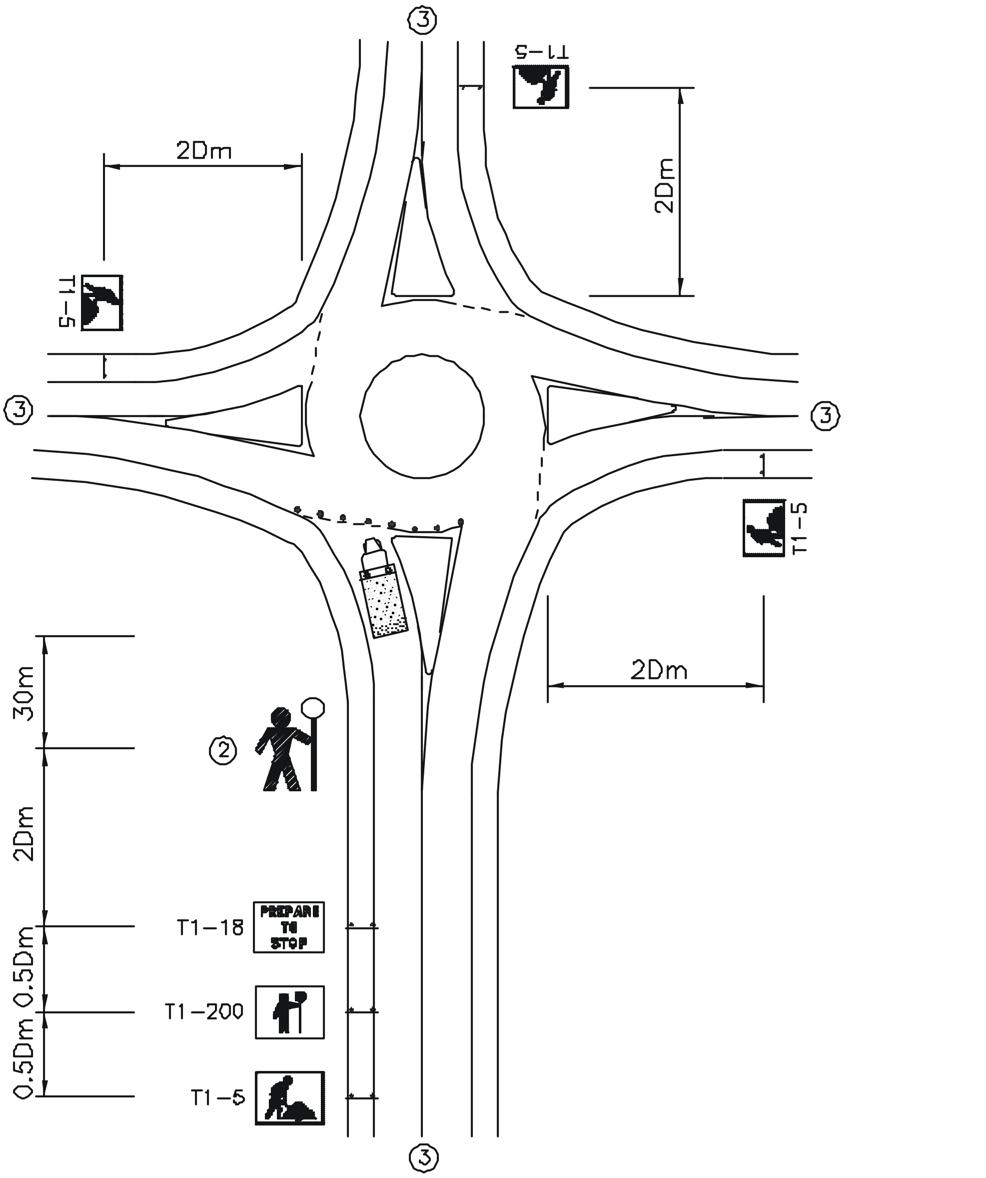
NOTES:

1. Install T1-1 and T2-16 signs on all approaches when the speed limit is equal to or exceeds 80km/h and the ADT is greater than 10,000 vehicles per day.
2. The traffic control signs and devices may also be installed on all the approaches of the roundabout to enable the closure of the median lane.
3. Means of access for local traffic and pedestrians across the Work Area should be provided.
4. This TCP has been developed assuming there are no parked vehicles. Therefore, this TCP should be modified if parked vehicles affect the location of the traffic control signs and devices.
5. The length of merge tapers is to be determined from Traffic Control at Work Sites, Table 5.2, recommended taper lengths.
6. See Section 5.2.3, ***Requirements for specific signs***, 8th dot point.

SHORT TERM WORK AT ROUNDABOUTS
4 LANE / 2 WAY
WORKING IN THE MEDIAN LANE

T000828

TCP 828



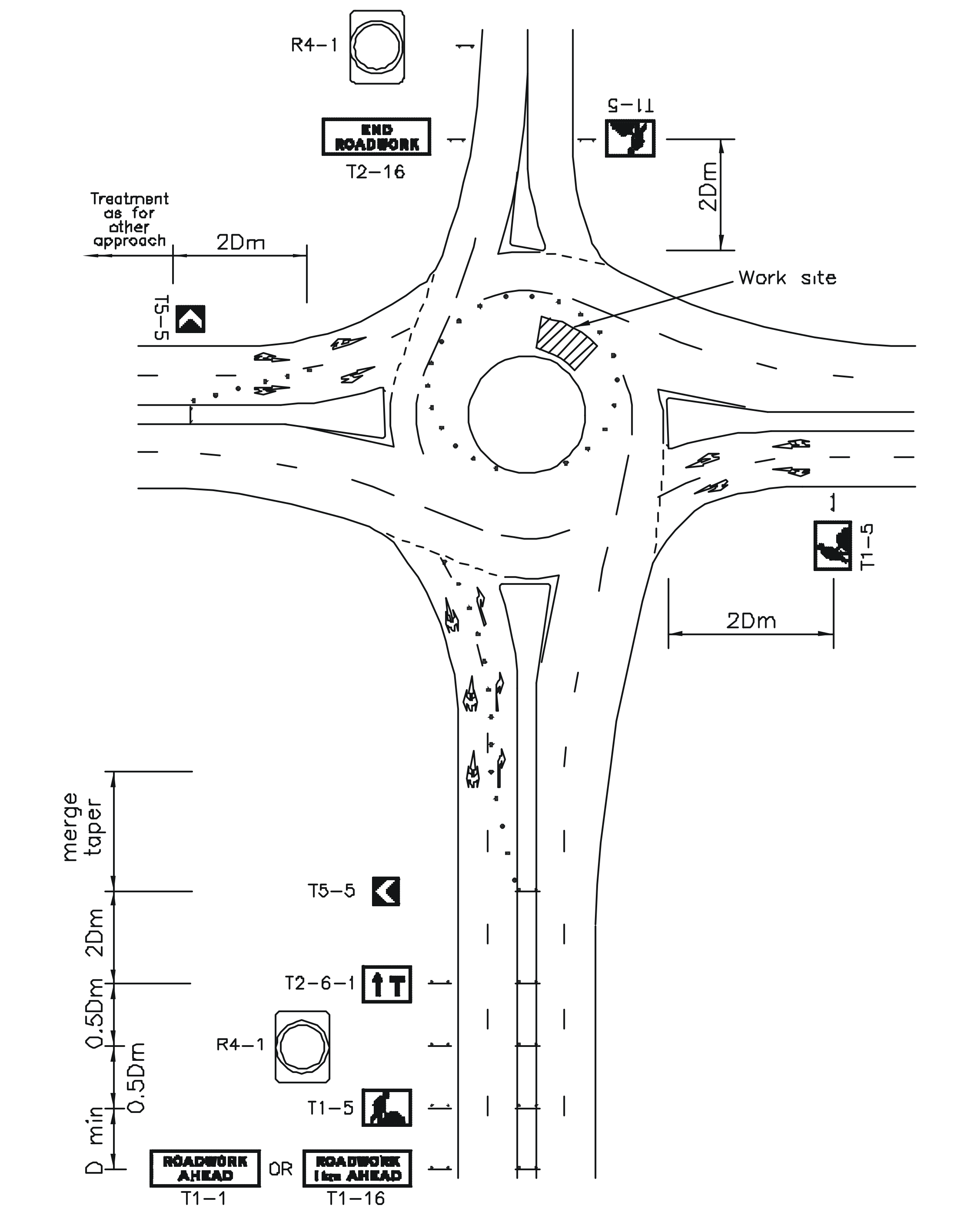
NOTES:

1. While setting up, park the Work Vehicle away from the roundabout and allow traffic to proceed.
2. Traffic controller to stop traffic for the duration of work and then direct traffic through the Work Area, once it has been cleared of personnel and the Work Vehicle.
3. Install T1-1 and T2-16 signs on all approaches when the speed limit is equal to or exceeds 80km/h and the ADT is greater than 10,000 vehicles per day.
4. Means of access for pedestrians across the Work Area should be provided.
5. This TCP has been developed assuming there are no parked vehicles. Therefore, this TCP should be modified if parked vehicles affect the location of the traffic control signs and devices.

SHORT TERM WORK AT ROUNDABOUTS (STOP TRAFFIC UP TO 10 MINUTES)
2 LANE / 2 WAY
WORKING ON SINGLE LANE

T000829

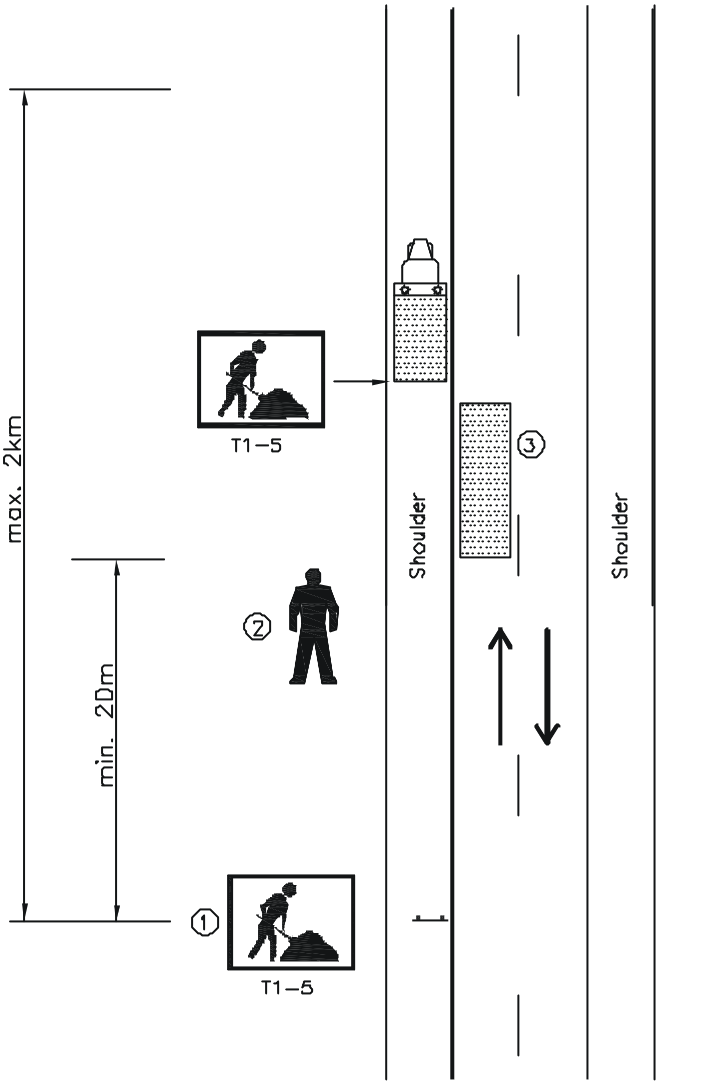
TCP 829



SHORT TERM WORKS
LANE CLOSURE
MULTILANE ROUNDABOUT

T000830

TCP 830



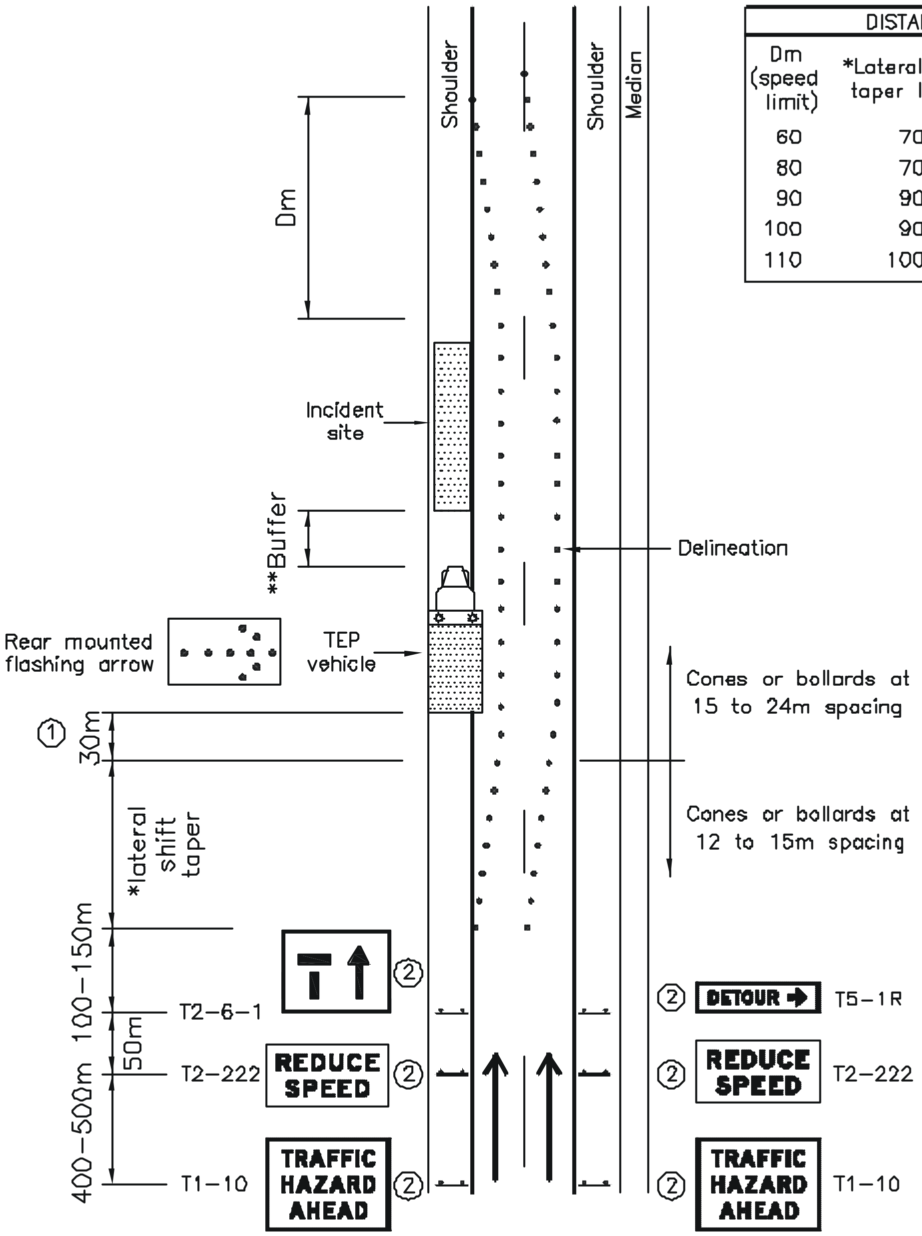
NOTE:

1. T1–5 sign to be used where work is repeated at a number of locations within a designated length of up to 2km. May be used with T1–28 "NEXT 2KM" sign as required.
2. Spotter to be positioned within sight and hearing of workers (generally within 2 metres). Sight distance of spotter to approaching traffic to be in accordance with ***Traffic Control at Work Sites***, Table 9.1, Safe traffic gaps for intermittent work.
3. Work to be undertaken only in direction of travel.

INTERMITTENT WORK
2 LANE / 2 WAY

T000831

TCP 831



DISTANCES		
Dm (speed limit)	*Lateral shift taper length	**Buffer
60	70m	30m
80	70m	40m
90	90m	50m
100	90m	50m
110	100m	60m

NOTES:

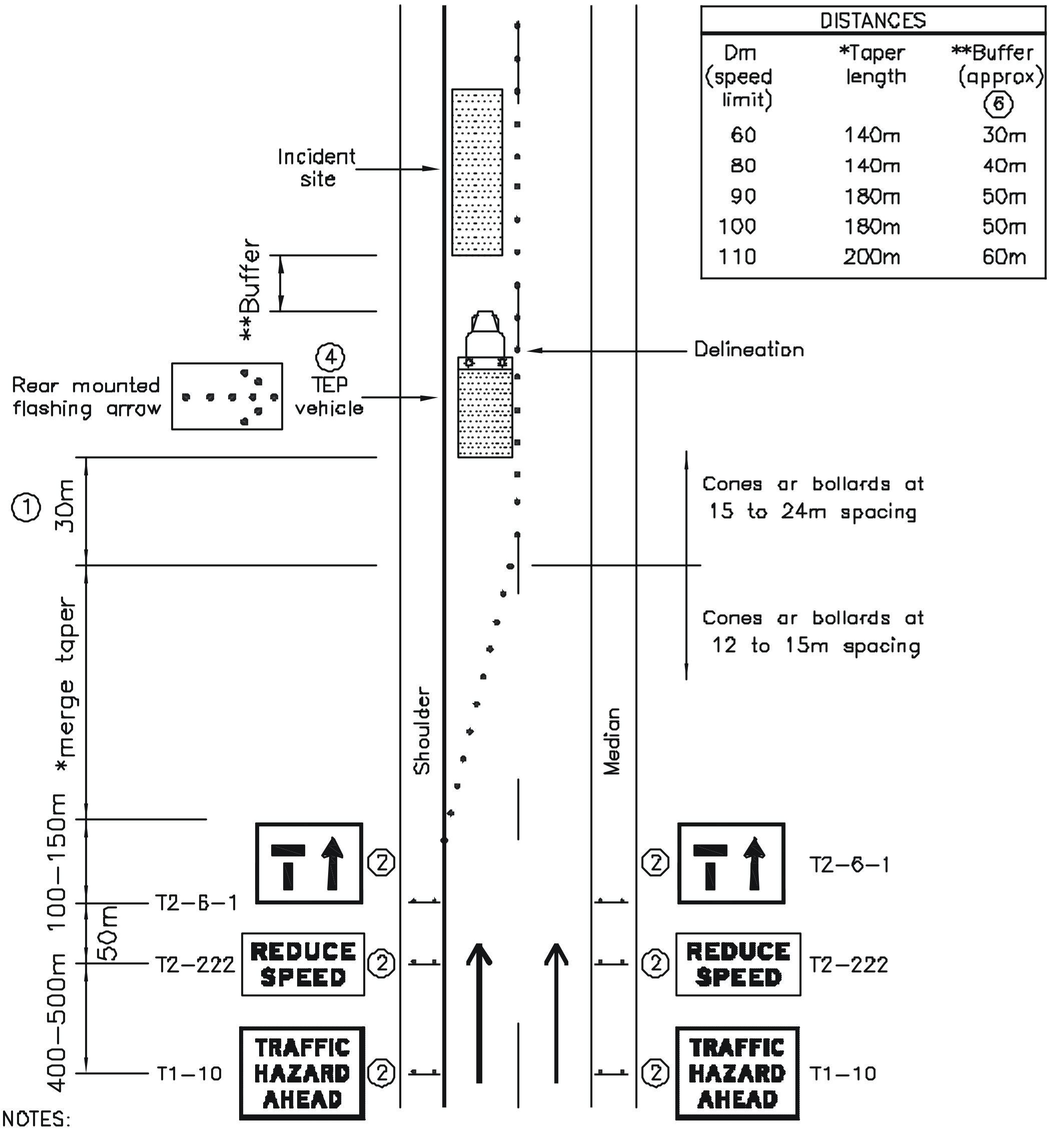
(1) Make this longer if the incident is around a curve.

(2) Adapt the distances to these advance warning signs to best fit the road layout, traffic conditions, intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes.

EMERGENCY INCIDENTS
2 LANE / 1 WAY (DIVIDED CARRIAGEWAYS)
INCIDENT IN SHOULDER – DIVERT BOTH LANES
(If median shoulder of sufficient width is present)

T00843

TCP 843



DISTANCES		
Dm (speed limit)	*Taper length	**Buffer (approx) 6
60	140m	30m
80	140m	40m
90	180m	50m
100	180m	50m
110	200m	60m

NOTES:

1. Make this longer if the incident is around a curve.
2. Adapt the distances to these advance warning signs to best fit the road layout, traffic conditions, intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes and traffic is free flowing.
3. Vary these signs according to the number of lanes.
4. TEP vehicle to shadow incident site by 1.0m on the right.
5. Control traffic using a STOP/SLOW bat in right lane to rovide safe crossing to set up Advance Warning Signs.
6. Use **Buffer (see table) to provide safe work area and allow access for emergency or service vehicles.

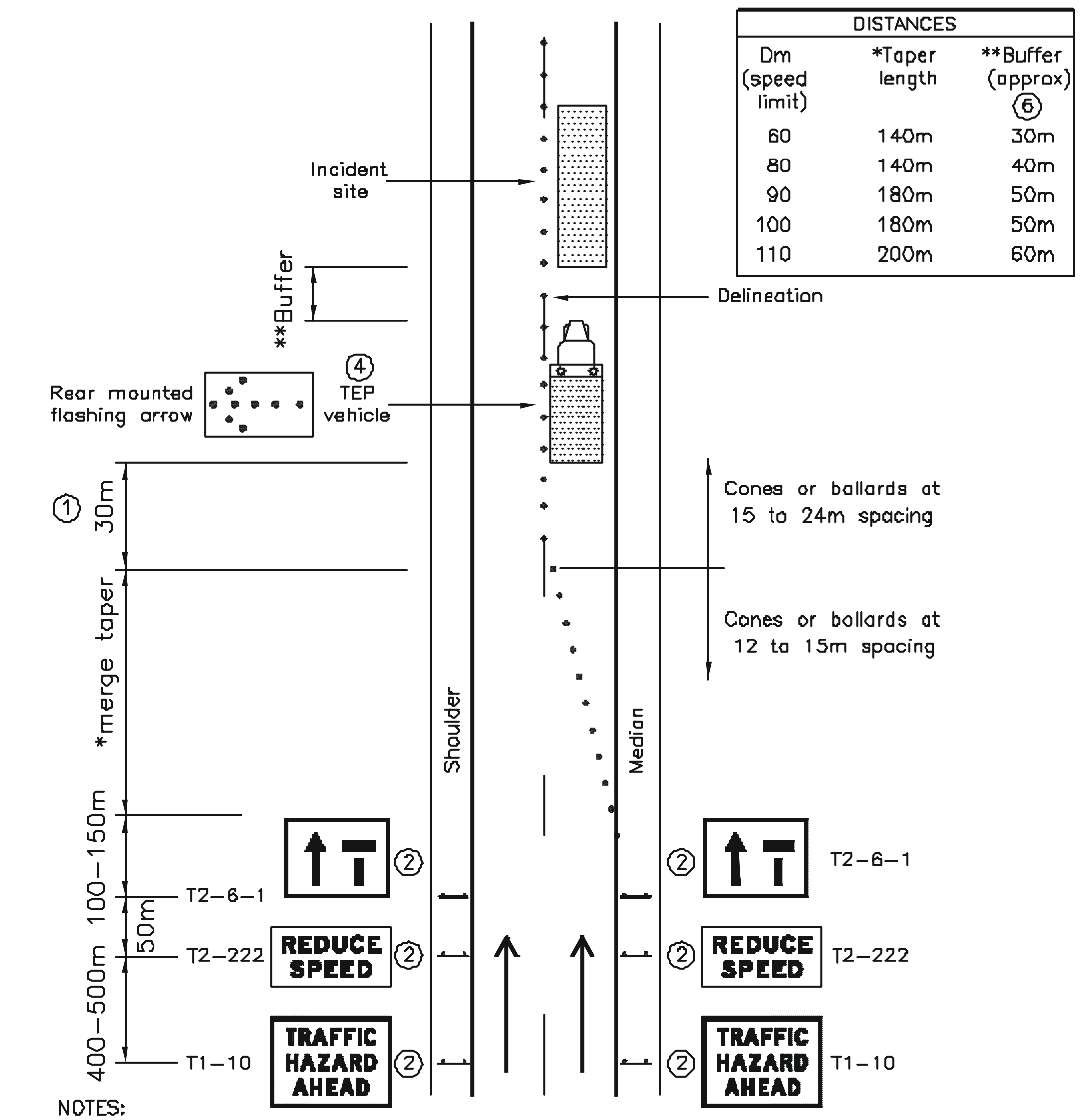
EMERGENCY INCIDENTS

2, 3 or 4 LANES / 1 WAY (DIVIDED CARRIAGEWAYS)

INCIDENT IN LEFT LANE

T00844

TCP 844



DISTANCES		
Dm (speed limit)	*Taper length	**Buffer (approx) 6
60	140m	30m
80	140m	40m
90	180m	50m
100	180m	50m
110	200m	60m

NOTES:

1. Make this longer if the incident is around a curve.
2. Adapt the distances to these advance warning signs to best fit the road layout, traffic conditions, intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes and the traffic is free flowing.
3. Vary these signs according to the number of lanes.
4. TEP vehicle to shadow incident site by 1.0m on the right.
5. Control traffic using a STOP/SLOW bat in right lane to rovide safe crossing to set up Advance Warning Signs.
6. Use **Buffer (see table) to provide safe work area and allow access for emergency or service vehicles.

EMERGENCY INCIDENTS

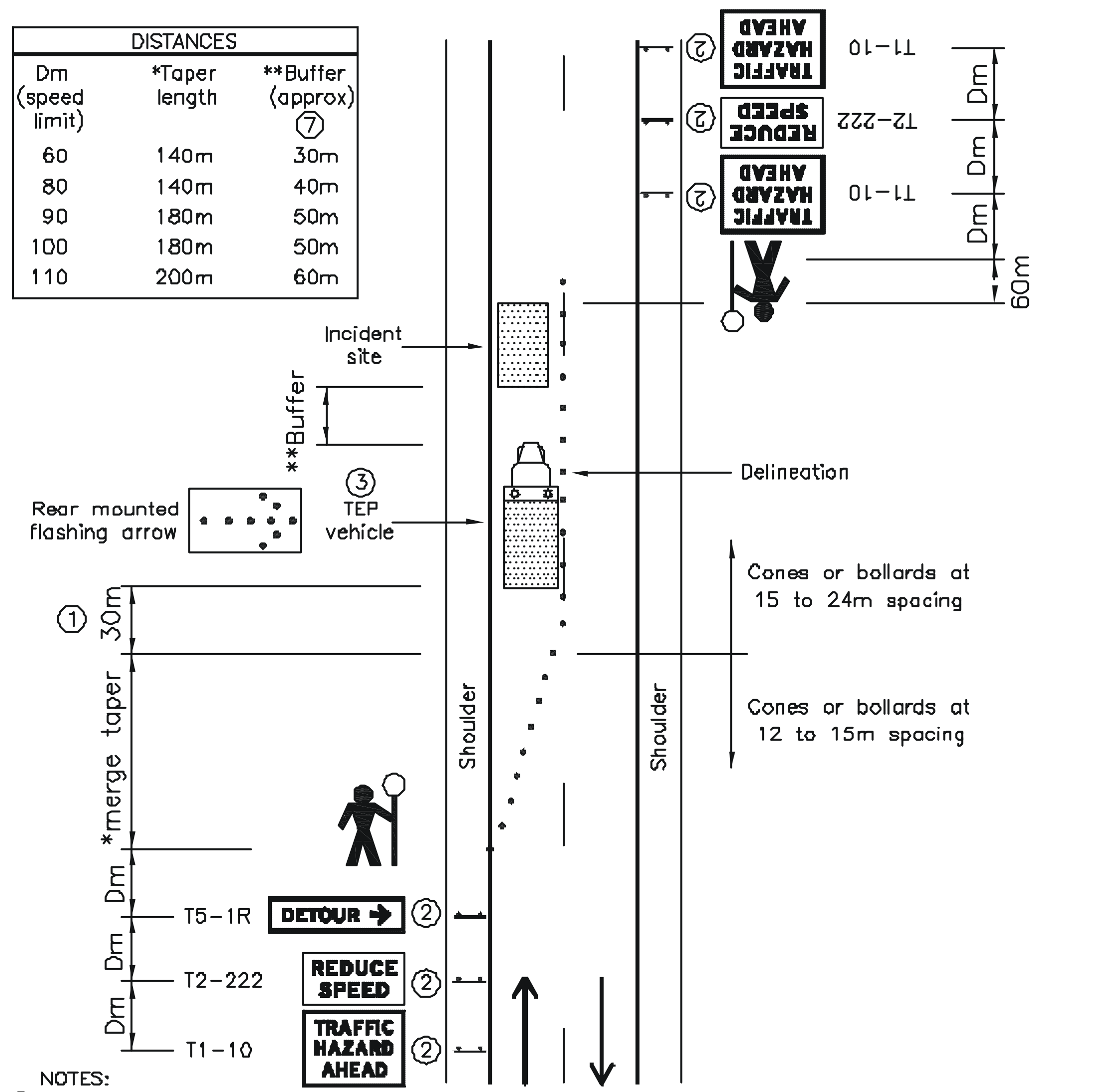
2, 3 or 4 LANES / 1 WAY (DIVIDED CARRIAGEWAYS)

INCIDENT IN MEDIAN LANE

T00845

TCP 845

DISTANCES		
Dm (speed limit)	*Taper length	**Buffer (approx) 7
60	140m	30m
80	140m	40m
90	180m	50m
100	180m	50m
110	200m	60m



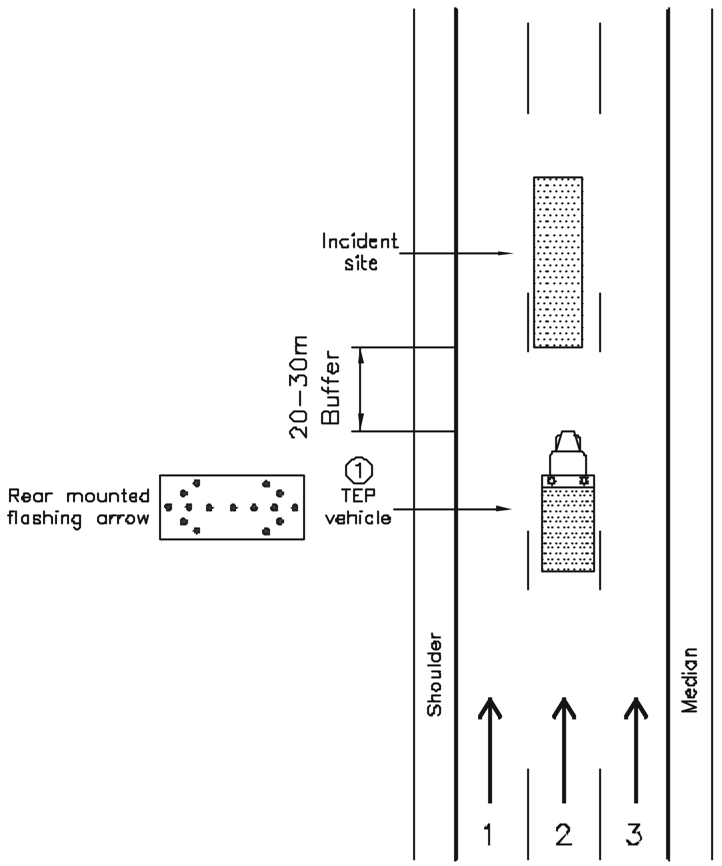
NOTES:

1. Make this longer if the incident is around a curve.
2. Adapt the distances to these Advance Warning Signs to best fit the road layout, traffic conditions intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes and traffic is free flowing.
3. TEP vehicle to approach the Incident Site with caution and with hazard warning lights, vehicle mounted rotating beacon lights on and right arrow of the flashing sign activated. Park behind the Incident Site so that the TEP vehicle shadows the Incident Site by 1.0m if suitable and leaving 20–30 metres buffer, as shown.
4. If the traffic conditions are dangerous call for a 2nd TEP vehicle, police or Traffic Comander.
5. TEP passenger to leave vehicle when safe to do so and to carefully assess the situation by talking to the driver of any vehicle or inspecting the roadway.
6. Control traffic using a STOP/SLOW bat to provide safe crossing to set up Advance Warning Signs.
7. Use **Buffer (see table) to provide safe work area and allow access for emergency or service vehicles.

EMERGENCY INCIDENTS
2 LANES / 2 WAY (UNDIVIDED CARRIAGEWAYS)
INCIDENT BLOCKING ONE DIRECTION

T00846

TCP 846



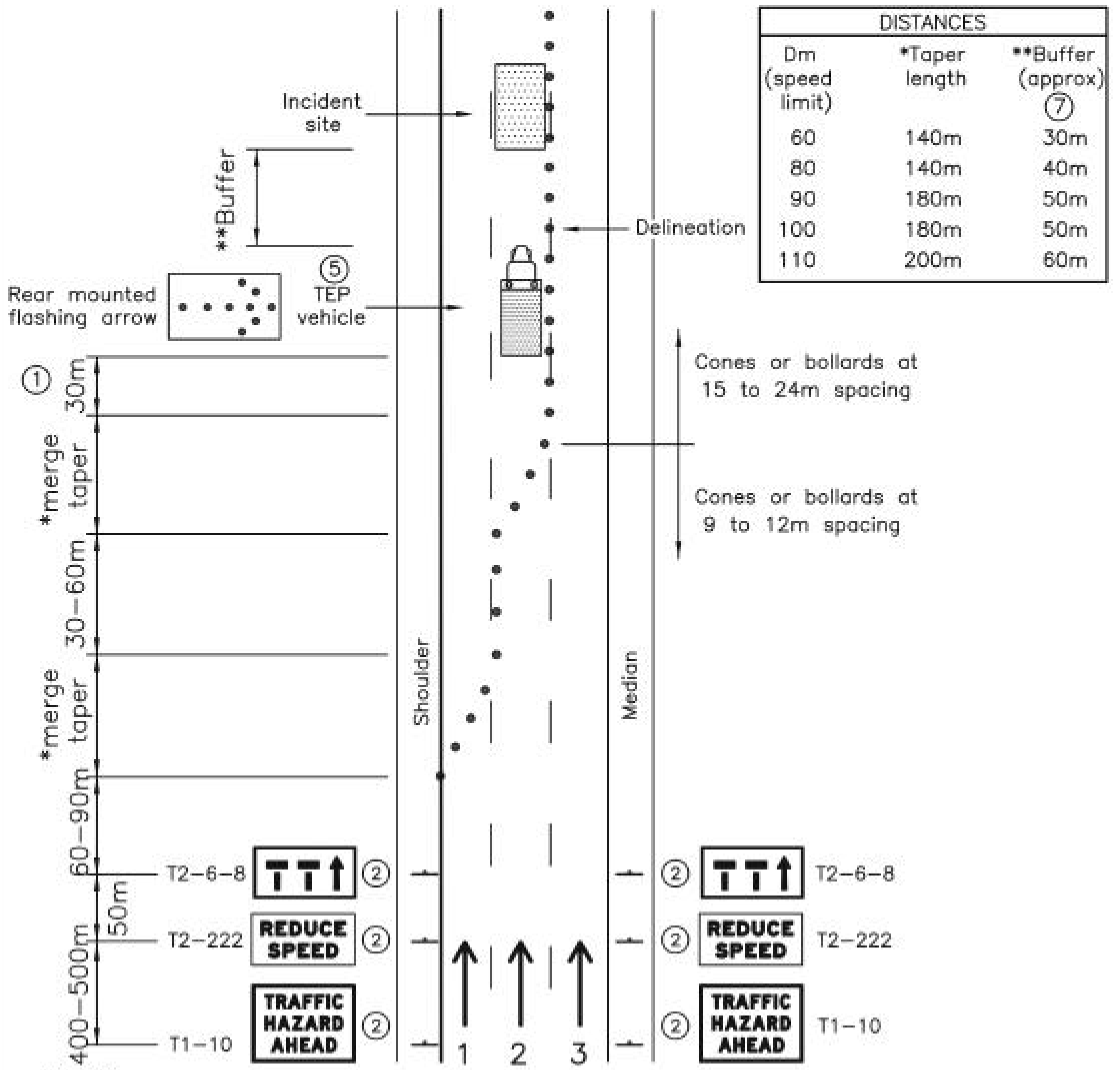
NOTES:

1. TEP vehicle to approach the Incident Site with caution and with hazard warning lights, vehicle mounted rotating beacon lights on and both left and right arrow of the flashing sign activated. Park behind the Incident Site so that the TEP vehicle shadows the Incident Site by 1.0m if suitable and leaving 20–30 metres buffer, as shown.
2. Call for assistance from a 2nd TEP vehicle, police or Traffic Comander.
3. TEP passenger to leave vehicle when safe to do so and to carefully assess the situation by talking to the driver of any vehicle or inspecting the roadway.
4. If the traffic conditions are too dangerous, wait for a 2nd TEP vehicle to arrive and start laying cones in Lane 1 or 3 as appropriate.
5. QUICK RESPONSE
If the incident has been caused by the breakdown of a light vehicle which can be pushed safely, the TEP passenger closes Lane 1 by directing traffic to stop and then places a barrier in Lane 1 and a barrier in Lane 2. The left arrow of the flashing arrow sign is extinguished, leaving only the right arrow activated. The TEP driver then pushes the vehicle involved in the incident on to the shoulder so as not to obstruct Lane 1.
OTHER RESPONSE
More assistance may be required in the case of an immoveable vehicle or spillage. If that assistance is not readily available and assessment of the situation requires closing Lanes 1 & 2, then refer to TCP3122b. If the situation requires closing Lanes 2 & 3 then refer to TCP3122c.

EMERGENCY INCIDENTS
3 OR 4 LANES / 1 WAY (DIVIDED CARRIAGEWAYS)
INCIDENT IN CENTRE LANE – INITIAL RESPONSE

T00847

TCP 847



DISTANCES		
Dm (speed limit)	*Taper length	**Buffer (approx) 7
60	140m	30m
80	140m	40m
90	180m	50m
100	180m	50m
110	200m	60m

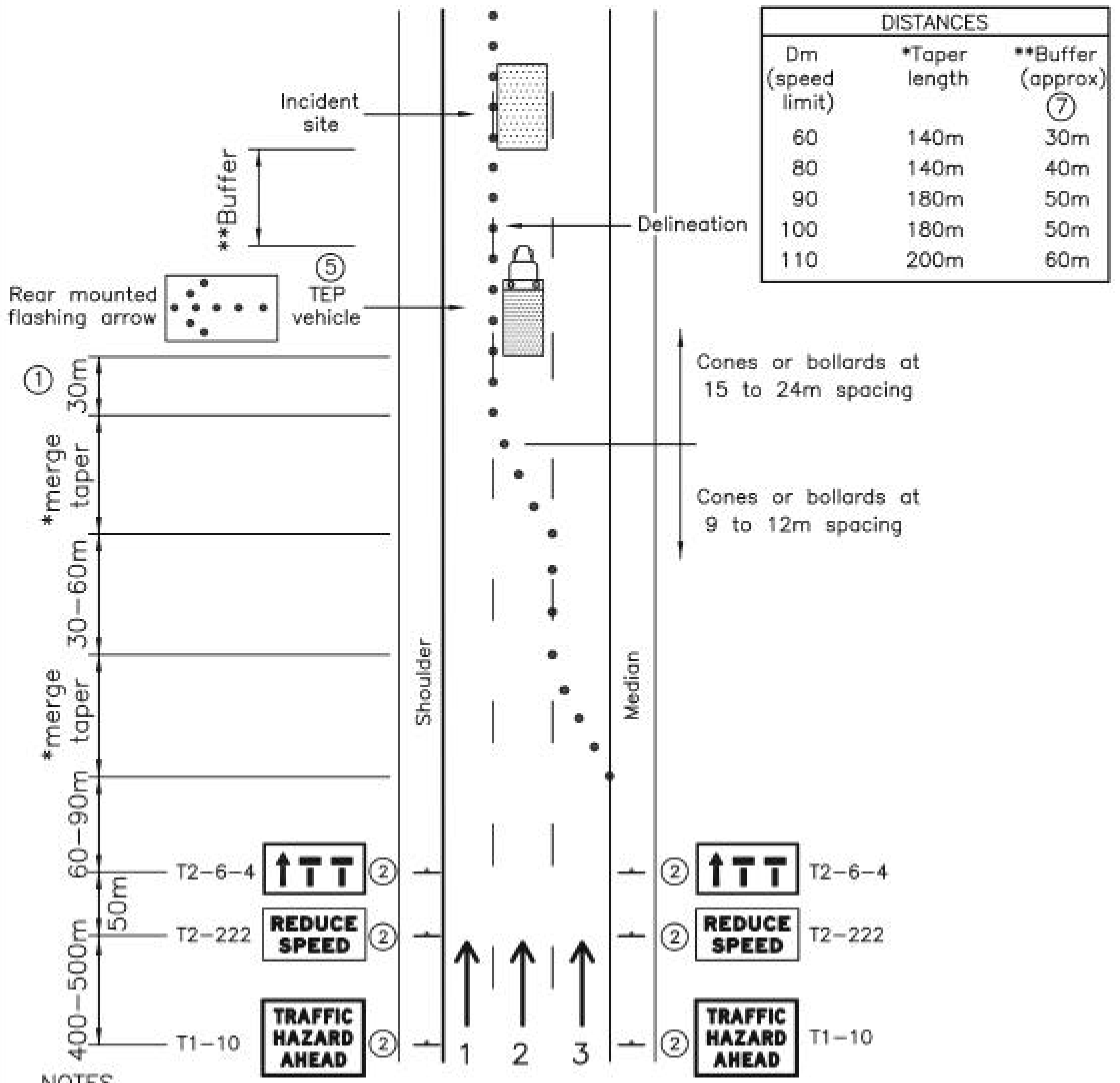
NOTES

1. Make this longer if the incident is around a curve.
2. Adapt the distances to these Advance Warning Signs to best fit the road layout, traffic conditions intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes and traffic is free flowing.
3. Your actions will depend on the traffic conditions as you arrive to the incident (congested and slow moving or free flowing and fast moving)
4. Call for assistance from a 2nd TEP vehicle, police or Traffic Comander.
5. If the conditions are too dangerous call and wait for a 2nd vehicle to arrive in Lane 1 and start laying delineators or, if the traffic in Lane 1 may be safely stopped, then indicate to driver from the shoulder area and lay cones. Reposition the TEP vehicle to shadow the Incident Site with an overlap of 1.0m, if appropriate.
6. Control traffic using a STOP/SLOW bat to provide safe crossing to set up Advance Warning Signs.
7. Use **Buffer (see table) to provide safe work area and allow access for emergency or service vehicles.

EMERGENCY INCIDENTS
3 LANES / 1 WAY (DIVIDED CARRIAGEWAY)
INCIDENT IN CENTRE LANE – CLOSE LANES 1 & 2

T00847-1

TCP 847-1



DISTANCES		
Dm (speed limit)	*Taper length	**Buffer (approx) 7
60	140m	30m
80	140m	40m
90	180m	50m
100	180m	50m
110	200m	60m

NOTES

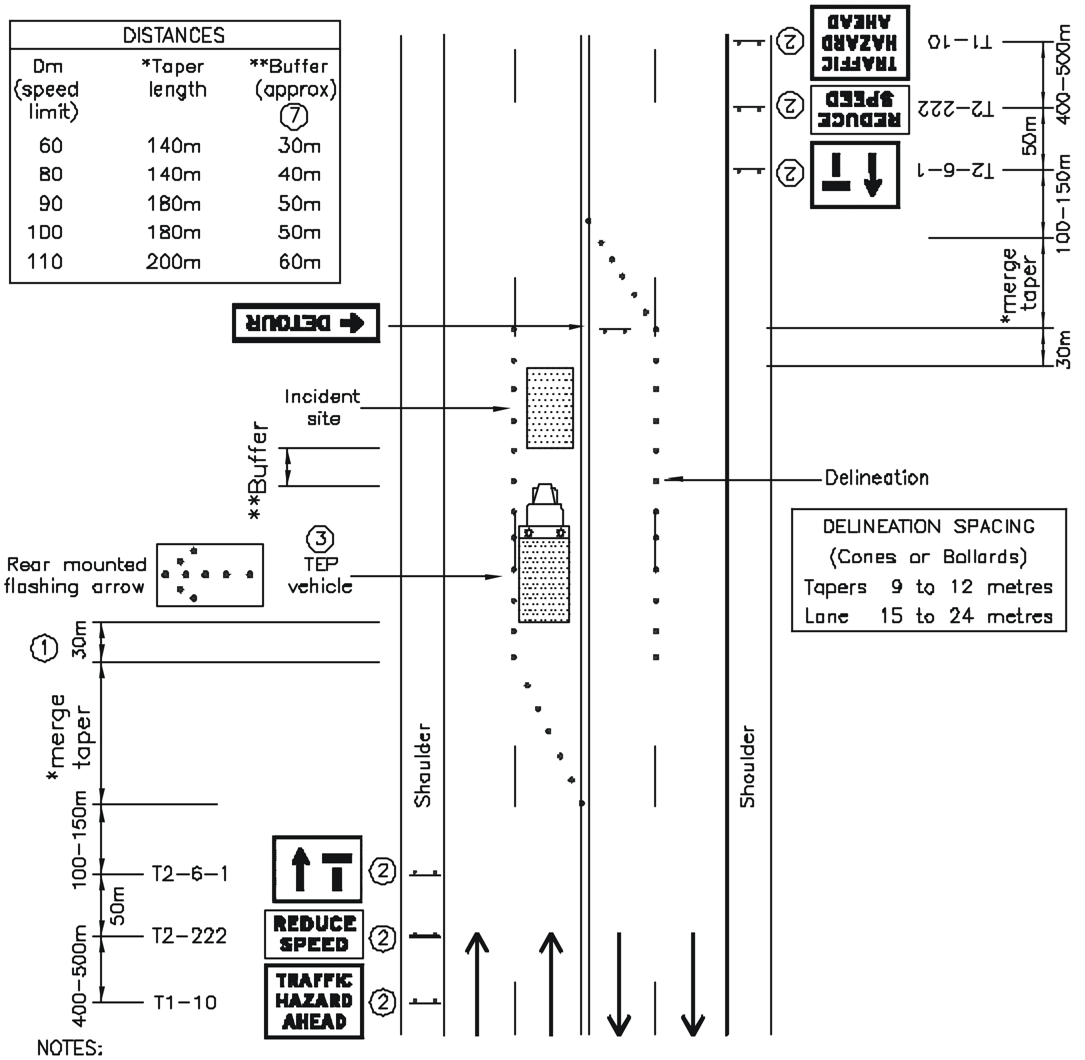
1. Make this longer if the incident is around a curve.
2. Adapt the distances to these Advance Warning Signs to best fit the road layout, traffic conditions intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes and traffic is free flowing.
3. Your actions will depend on the traffic conditions as you arrive to the incident (congested and slow moving or free flowing and fast moving)
4. Call for assistance from a 2nd TEP vehicle, police or Traffic Comander.
5. If the conditions are too dangerous call and wait for a 2nd vehicle to arrive in Lane 3 and start laying delineators or, if the traffic in Lane 3 may be safely stopped, then indicate to driver from the shoulder area and lay cones. Reposition the TEP vehicle to shadow the Incident Site with an overlap of 1.0m, if appropriate.
6. Control traffic using a STOP/SLOW bat to provide safe crossing to set up Advance Warning Signs.
7. Use **Buffer (see table) to provide safe work area and allow access for emergency or service vehicles.

EMERGENCY INCIDENTS
3 LANES / 1 WAY (DIVIDED CARRIAGEWAY)
INCIDENT IN CENTRE LANE – CLOSE LANES 2 & 3

T00847–2

TCP 847-2

DISTANCES		
Dm (speed limit)	*Taper length	**Buffer (approx) 7
60	140m	30m
80	140m	40m
90	180m	50m
100	180m	50m
110	200m	60m



NOTES:

1. Make this longer if the incident is around a curve.
2. Adapt the distances to these Advance Warning Signs to best fit the road layout, traffic conditions intersections, etc for visibility and readability, especially if the incident will last longer than 15 minutes and traffic is free flowing.
3. TEP vehicle to approach the Incident Site with caution and with hazard warning lights, vehicle mounted rotating beacon lights on and left arrow of the flashing sign activated. Park behind the Incident Site so that the TEP vehicle shadows the Incident Site by 1.0m if suitable and leaving 20-30 metres buffer, as shown.
4. If the traffic conditions are dangerous call for a 2nd TEP vehicle, police or Traffic Comander.
5. TEP passenger to leave vehicle when safe to do so and to carefully assess the situation by talking to the driver of any vehicle or inspecting the roadway.
6. Control traffic using a STOP/SLOW bat to provide safe crossing to set up Advance Warning Signs.
7. Use **Buffer (see table) to provide safe work area and allow access for emergency or service vehicles.
8. Vary this sign according to number of lanes.

EMERGENCY INCIDENTS

4 LANES / 2 WAY (UNDIVIDED CARRIAGEWAYS)

INCIDENT IN LANE 2 – AFFECTING BOTH C'WAY FLOWS

T00848

TCP 848

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Appendix E Audit and checklist forms

This Appendix contains examples of audit and checklist forms to be used at traffic control sites. The forms may be modified to suit local requirements provided that the basic information is retained.

AUDIT CHECKLIST

Date..Time..Auditor..

RTA Office/Contractor...Site Supervisor...

Location..TCP No...............................

Type of work...

Duration of work..

Road configuration..

Rate in the following manner:

✓ Acceptable ✗ Not Acceptable N/A Not Applicable

No	Conditions	TCAWSM Section	Rating
1	**TCP**		
1.1	Is an approved TCP on site ?	4.3.1 & 4.3.2	
1.2	Is the TCP relevant for the works in progress ?	4.3.2	
1.3	Is the TCP correctly implemented (i.e. all signs and devices in place and at correct spacing) ?	4.3.2	
2	**Roadwork Speed Limits**		
2.1	Is a roadwork speed limit in place ?	8.2	
2.2	Is the limit the correct one ?	8.2.3	
2.3	Are all signs installed and at the correct spacings ?	8.2.4	
2.4	Is the speed limit authorised ?	8.2.5	

COMMENTS

3	**Traffic Controllers**		
3.1	Are Traffic Controllers being used ?	8.1	
3.2	Have their Traffic Control Certificates been sighted ?	8.1.1a	
3.3	Are they wearing high visibility clothing ?	8.1.1b	
	Are they correctly authorised ?	8.1.1b	
	Are they positioned to be visible to approaching traffic ?	8.1.1d	
4	**Portable Traffic Signals (PTS)**		
4.1	Are portable traffic signals being used ?	10	
4.2	Is the approach speed limit 80 km/h or less ?	10.7.2	
4.3	Is minimum sight distance provided ?	10.7.3	
4.4	Have the signals been approved for use ?	T 10.7	
4.5	Are the signal Type Approved ?	10.5	
5	**Flashing Arrow Sign (FAS)**		
5.1	Is a flashing arrow sign being used ?	11	
5.2	Is it the correct Type ?	3.2.2	
5.3	Is it located correctly ?	11.4.4	
5.4	Is it Type Approved ?	11.2	
6	**Variable Message Sign (VMS)**		
6.1	Is a variable message sign being used ?	3.2.8	
6.2	Is the message relevant ?	3.2.8	
6.3	Is the sign located in a safe position ?		
7	**Safety Barriers**		
7.1	Are safety barriers installed correctly ?	9.6	
7.2	Have the correct barriers been installed ?	9.6 & 3.3.7	

COMMENTS

8	**Signs and Devices**		
8.1	Are signs and devices in good condition ?	4.3.2	
8.2	Are the signs clearly visible and not affected by other signs. Plant items, vegetation, shade, light glare etc ?	3.1.1	
8.3	Are the correct sign sizes being used ?	3.2.2	
8.4	Are signs duplicated ?	3.2.4	
8.5	Are signs erected at the correct height and position ?	3.2.7	
8.6	Are the signs erected to give the correct sight distance ?		
8.7	Are there any contradictory or superfluous signs, devices or markings ?	4.3.2	
8.8	Have the needs of pedestrians been provided for ?	9.3	
8.9	Have the needs of cyclists been provided for ?	9.4	
8.10	Are all property accesses to the site controlled ?	9.7	
8.11	Are all cones and bollards installed at the correct spacing ?	5.2.2	
8.12	Has the potential for end of queue accidents been considered and action taken ?	3.5.7	

COMMENTS

RECOMMENDATIONS/CORRECTIVE ACTION

Auditor...**Site Supervisor**..

DAILY CHECKLIST – TRAFFIC CONTROL AT SHORT TERM WORK SITES

SITE SUPERVISOR:___________________________**DATE:**______________

REPORTING OFFICE/COMPANY:_______________________________

SITE:	1		2		3		4	
TCP No:								
INSPECTION:	Pre–Start	Pre–Close	Pre–Start	Pre–Close	Pre–Close	Pre–Start	Pre–Close	Pre–Start
TIME: (24 hrs)								
All signs used during the work are to be recorded below, using the following codes: *Y – signs and devices are in place during pre–start check and between shifts.* *N – signs and devices are no longer required at pre–close down check.* *X – signs and devices are damaged, vandalised or missing.*								
Signs and devices:								
Traffic Signals – time operational	To		To		To		To	
Appr No								
Temp Speed – time operational	To		To		To		To	
Appr No								
Speed (km/h)								
Supervisor's Initials:								

SITE 1

SITE 2

SITE 3

SITE 4

WEEKLY CHECKLIST – TRAFFIC CONTROL AT LONG TERM WORK SITES

NATURE OF WORK____________________________**TCP No**__________

LOCATION____

REPORTING OFFICE/COMPANY__________________________________

DATE								
INSPECTION	Pre– Start	Pre– Close	Pre– Start	Pre– Close	Pre– Close	Pre– Start	Pre– Close	Pre– Start
TIME: (24 hrs)								
All signs used during the work are to be recorded below, using the following codes: *Y – signs and devices are in place during pre–start check and between shifts.* *N – signs and devices are no longer required at pre–close down check.* *X – signs and devices are damaged, vandalised or missing.*								
Signs and devices								
Traffic Signals – time operational	To		To		To		To	
Appr No								
Temp Speed – time operational	To		To		To		To	
Appr No								
Speed (km/h)								
Supervisor's Initials:								

COMMENTS:

END ROADWORK

For further enquiries:

www.rta.nsw.gov.au/trafficinformation/guidelines

technical_directions_publication@rta.nsw.gov.au

RTA/Pub. 03.290

Roads and Traffic Authority

Sept 2003